COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 1LI	ARCHITECTURAL BASIC DESIGN	0	0	14	6

OBJECTIVES:

- To understand the elements and principles of Basic Design as the building blocks of Creative design through exercises that will develop originality, expression, skill and creative thinking.
- To involve students in a number of exercises to understand the grammar of Design and Visual composition.
- To enable the understanding of 3D Composition by involving students in a number of exercises which will help generation of a form from a two dimensional / abstract idea.
- To understand architecture as a craft, of making and of putting together.
- To sensitize students to materials both planar and plastics and Processes involved in working with them.
- To draw inspiration and clues from nature.
- To introduce Drawing as an analytical tool.
- To introduce students to History of Design and craft.

UNIT I INTRODUCTION TO BASIC DESIGN 1 9

Introduction to architectural design –

- Line
- Direction
- Shape
- Size
- Texture
- Value colour.

UNIT II WORKSHOP

Using of carpentry, masonry model making, space frame models, such as match sticks, straw, steel wire etc.

TOTAL: 75 PERIODS

Text Book:

1. Francis DK Ching – "Form space and order"

2. VS. Prammar – "Design fundamentals in architecture"

References:

1. Edward D. Mills – "Planning the Architects handbook, London 1985"

2. Paul Laseau , Graphic thinking for Architects and Designers, John Wiley & Sons, New York , 2

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Identify the basic design elements and principles and applying the same in designing
CO2	Develop the skills of art appreciation and sense of aesthetics by studying, correlating the basic design principles and works of master architects.
CO3	Developing the skills of expressing the ideas visually through sketching, renderings using different media.
CO4	An ability to engage and combine the elements of design in spontaneous as well as intentional ways in order to create desired qualities and effects.
CO5	An understanding of the qualities of different elements as well as their composite fusions.
C06	An ability to engage and combine the elements of design in spontaneous as well as intentional ways in order to create desired qualities and effects

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				L		M		L			L	
	CO2	H											M
	CO3		M		L			H		H			
	CO4					L	M		L		M		
	CO5		M									L	
	C06							H					L
3	Category	Professional Core (PC)											
4	Approval	26th Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 101	THEORY OF ARCHITECTURE – I	3	0	0	3

OBJECTIVES:

- To understand that architecture is a dynamic interface between man and his environment: through its constituent aspects and elements.
- To understand the various principles of architectural design, with which the above objective is attained.
- To understand that architecture is communicative medium involving aspects of expression and experience.
- To understand the various possibilities of approaching architectural design, through examples from historical and contemporary examples.

UNIT I INTRODUCTION **9**

APPLICATION OF COLOUR IN ARCHITECTURE

Effect of Colour in architecture – Colour symbolism.

UNIT II

ORGANISATION OF FORMS AND SPACES

a) Spatial Relationship

i) Space within space

ii) Interlocking Spaces

iii) Adjacent spaces

iv) Space linked by a common space.

b) Spatial Organization – influencing factors and their types

i) Centralized

ii) Linear

iii) Radial

iv) Clustered

v) Grid

c) Articulation of forms and spaces types

i) Edges and Corners

ii) Surface.

UNIT III

Factors influencing the character and style of buildings. Study of examples from Buddhist, Hindu and Islamic Architecture in India – Greek, Roman, Gothic, Renaissance, Modem and Post Modern Movement.

UNIT IV

PRINCIPLES OF COMPOSITION

Unity, Harmony and specific qualities of design to include Dominance, Punctuating Effect, Dramatic Effect, Fluidity, Climax, Accentuation and Contrast with building examples.

UNIT V

CIRCULATION

Function of building circulation components of building circulation – The building approach, the building entrance, Configuration of the Path, path space relationship, from of circulation space with examples.

Simple circulation diagram for buildings.

TOTAL: 45 PERIODS

Text Book:

1. Sir-Bannister Fletcher – "A History of Architecture", Butterworths, London, 1987.

2. Francis D.K. Ching, Architecture – "Forms, Space and Order", Van Nostrand Publications, New York, 1979.

3. Paul Alan Johnson - The Theory of Architecture - Concepts and Themes - Van Vostrand Reinhold Co – 1994

4. V.S. Pramar, Design Fundamental in Architecture - Somaiya Publications Pvt. Ltd. New Delhi,1973

References:

1. Ernest Burden – "Elements of Architectural Design" – A Visual resource, Van Nostrand Reinhold, 1994.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	To know the difference between architecture and engineering.
CO2	Understand the primary elements and forms in architecture, their role and impact on architecture and the development of new forms by applying the same techniques.
CO3	Understand about the elements and fundamentals Techniques of space making of space making.
CO4	An exposure to the principles of architecture and applications of the same in buildings.
CO5	A thorough understanding on the definition of architecture; elements of architectures of form.
C06	An understanding the meaning of character and style of buildings with examples.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		M	H					H	H		H
	CO2		H		M	H			M		L	H	
	CO3	H				L				M			H
	CO4		L							M		M	
	CO5	H	M	M	M				M		H		H
	C06			M			L						
3	Category	Professional Core (PC)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 102	HISTORY OF ARCHITECTURE – I	3	0	0	3

OBJECTIVES:

- To inform about the development of architecture in the Ancient Western World and the cultural and contextual determinants that produced that
- To understand architecture as evolving within specific cultural contexts including aspects of politics, society, religion and climate.
- To gain knowledge of the development of architectural form with reference to Technology, Style and Character in the prehistoric world, Ancient Egypt, West Asia, Greece , Rome, Medieval times and Renaissance period.

UNIT I

PREHIST AND EGYPT 9

Old stone age – the agricultural revolution – the new stone age – development of shelter – nature of art and architecture – out line of architectural character pyramid of Cheops – temple of Ammoon etc.,

UNIT II

WEST ASIA 8

Sumerian, Babylonian and Persian cultures – architectural characters – Ziggurats – Palace of Sargoan – Palace at Persepolis

UNIT III

GREECE 10

Evolution of city states – arts culture development – classical periods – architectural characters – orders in architecture examples Parthenon of Athens, Erecthion, Theatre etc.,

UNIT IV

ROME 6

Republican States – factors influencing architecture – out line of architectural character – examples.

UNIT V

EARLY CHRISTIAN AND BYZANTINE 12

British and spread of Christianity – church forms – out line of architectural character and various examples.

TOTAL: 45 PERIODS

Text Book:

1. Sir Banister Fletcher "A History of Architecture"

References:

1. Spiro Kostof – "A History of Architecture"
2. Pier Liugi Nervi – "History of World Architecture New York 1972"

COURSE OUTCOMES (COs)	
The student will be able	
CO 1	***Understand*** the origin of architecture in prehistoric age in western world.
CO 2	***Understand*** the origin of architecture in prehistoric age in western world.
CO 3	Know the importance of the history, relate to design thinking, cultural aspiration, social needs, and the evolution of the built environment
CO 4	Interpret the characteristics of designing of temples and tombs by Egyptian, Babylonian, and Mesopotamian, Greek, Rome and Byzantine builders.
CO 5	Compare spatial and stylistic qualities associated with church architecture
C06	An Understanding of architecture as an outcome of various social, political and economic upheavals, and as a response to the cultural and context.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		M			M	H	H		H
	CO2	L		M	M						L	H	L
	CO3		L			L			M				H
	CO4									M		M	H
	CO5		M	M	M				M		H	W	
	C06				M				L				
3	Category	Professional Core(PC)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 103	MECHANICS OF STRUCTURES I	3	0	0	3

OBJECTIVES:

- To enable a student to understand the effect of action of forces on a body and the concept of equilibrium of the body through exercises.
- To determine the internal forces induced in truss members due to external loads by working out
- problems.
- To calculate the sectional properties (centroid, moment of inertia, section modulus and radius of gyration) for various sections by working out problems.
- To study the stress – strain behaviours of steel and concrete due to axial loads and to determine the stresses and strains developed in solids due to external action through select problems.
- To derive the relationship between elastic constants and solving problems.

UNIT I **9**

FORCES AND STRUCTURAL SYSTEMS

Types of force systems – Resultant of parallel forces – principle of moments –principle of equilibrium – simple problems.

UNIT II **8**

ANALYSIS OF PLANE TRUSSES

Introduction to determinate and indeterminate Plane trusses – Analysis of simple supported and cantilevered trusses by method of joints and method of sections.

UNIT III **10**

PROPERTIES OF SECTION

Centroid – Moment of Inertia – Section modulus – Radius of gyration – Theorem of perpendicular axis – Theorem of parallel axis.

UNIT IV **6**

ELASTIC PROPERTIES OF SOLIDS

Stress strain diagram for mild steel, High tensile steel and concrete – concept of axial and volumetric stresses and strains.

UNIT V **12**

ELASTIC CONSTANTS

Elastic constants – Relation between elastic constants – Application to problem

Text Book:

1. P.C. Punmia, "Strength of Materials and Theory of Structures", Vol 1, Laxmi Publications, Delhi 1994.

2. S. Ramamurtham, "Strength of Materials", Dhanpatrai & Sons, Delhi 1990.

References:

1. W.a. Nash, "Strength of Materials" – Schaums Series – McGraw Hill Book Company, 1989.

2. R.K. Bansal – "Engineering Mechanics and Strength of Materials" – Lakshmi Publications, Delhi 1990.

3. R.K. Rajput – "Strength of Materials', S. Chand & Company Ltd., New Delhi 1996.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Apply the concepts of action of forces on a body and should be able to apply the equilibrium concepts.
- Analyze any type of determinate trusses with different end conditions.
- To solve the sectional properties for any geometrical shapes.
- The concepts of elastic constants and its applications for various types of problems with a thorough understanding of stresses and strain.

TEXTBOOKS:

1. R.K.Bansal – A text book on Engineering Mechanics, Laxmi Publications, Delhi, 2005.

2. R.K.Bansal – A textbook on Strength of Materials, Lakshmi Publications, Delhi 2007.

REFERENCES:

1. P.C.Punmia, Strength of Materials and Theory of Structures; Vol. I, Lakmi Publications, Delhi 1994.

2. S. Ramamrutham, Strength of Materials – Dhanpatrai & Sons, Delhi, 1990.

3. W.A.Nash, Strength of Materials – Schaums Series – McGraw Hill Book Company, 1989.

4. R.K. Rajput – Strength of Materials, S. Chand & Company Ltd. New Delhi 1996.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Relate*** with basic engineering mechanics concepts required for analyzing static structures. To calculate resultant of parallel forces
CO2	***Solve*** the problems of Free body Diagram & principle of equilibrium
CO3	***Identify*** and model various types of loading and support conditions that act on structural
CO4	***Analyze*** any type of determinate trusses with different end conditions.
CO5	***Demonstrate*** the relations for centroid and Center of Gravity and ***Analyze*** the moment of
C06	***Apply*** the knowledge of stress and strain in the design of structural elements.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		M			M	H	H		H
	CO2	L	H		M		M		M		L	H	L
	CO3					L						M	
	CO4	H	L			L		L		M		M	H
	CO5	H	M	M	M				M		H		H
	C06			h								l	
3	Category	Building sciences and Applied Engineering (BS & AE)											
4	Approval	30th Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BMA 102	MATHEMATICS	3	0	0	3

OBJECTIVES:

- Identifying practical problems to obtain solutions involving trigonometric and exponential functions.
- Studying the properties of lines and planes in space, along with sphere and providing a tool too.
- Understand 3D material.
- Understand functions of more than one variable, along with differentiation under integral sign.
- Solving differential equation of certain type and analyzing data collection and interpretation of results using statistical tools.

UNIT I **9**

PLANE AND LINES

Direction rations and cosines of a line – equations of a plane and intersecting planes – symmetric form of a straight line – angle between lines and planes – coplanar lines – skew lines – shortest distance.

UNIT II **8**

CURVED SURFACES 8

Equations of Sphere – section by a plane – tangent plane – standard equations of cone, cylinder and conoid – Properties.

UNIT III **10**

MATRICES

Characteristic equation, values and eigen vectors of a real matrix cayley – Trigonom Theorem without proof, reduction of a real symmetric matrix to diagonal from.

UNIT IV **6**

INTEGRATION

Integration of rational, trigonometric and irrational functions, properties of definite integrals, reduction formulae for trigonometric functions.

UNIT V **12**

ORDINARY DIFFERENTIAL EQUATIONS AND FUNCTIONS OF TWO VARIABLES

Linear second order and higher order different equations with constant co effienients. Differential equations with variable coefficients of Euler type. Partial differentiation, total derivative, approximations, Taylor's theorem with remainder Maxima and Minima envelope.

TOTAL: 45 PERIODS

Text Book:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publications, Delhi

2. P. Kandhaswamy, K. Thilagavathi, "Engineering Mathematics" Vol – I & II, S. Chandhan Publishers – 1998.

2. Narayan S. Manickavachagam Pillai T.K. Ramanaiah G – "Advanced Mathematics for Engineering Students" – Vol I & II S. Viswanathan Printers – 1993.

References :

1. V.Ramamurthy – Engineering Mathametics – Vol I & II, Amudha publications

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Find*** area and volumes of simple, complex and irregular geometries using various rules.
CO2	***Apply*** Trignometry on architectural elements
CO3	***Demonstrate*** the appropriate role of the mathematical concepts learnt.
CO4	***Analyze*** Tally charts, Tables and graphs and statistical diagrams using for various types of data.
CO5	***Explain*** about various architectural proportioning systems and calculating the same.
C06	Understanding of the appropriate role of the mathematical concepts learnt

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	M			M	H	H		H
	CO2			M				M			L	H	L
	CO3		L			L						M	
	CO4	H				L	H			M			
	CO5			M	M				M		H	W	H
	C06		l					h					
3	Category	Basic Sciences (BS)											
4	Approval	31St Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BEN 102	ENGLISH	3	0	0	3

OBJECTIVES: The English Language Course for students of architecture would,

- Enhance their communication skills in English by developing their listening, speaking, reading and writing skills.
- Develop their speaking skills with specific reference to prospective/actual clients, suppliers, business partners and colleagues.
- Enhance their reading particularly, rules and regulations, catalogues, architecture journals and textbooks.
- Develop their writing skills especially writing emails, proposals and reports.

UNIT I **9**

LISTENING

Importance of listening, how listening plays a vital role listening comprehension - listening to audio cassettes – listening to interviews & group discussion and debate.

UNIT II **8**

SPEAKING

Defining things – Describing objects using adjectives – comparing – pronunciation practice –world stress – discourse markets – intonation – role play.

UNIT III **10**

READING

Detailed reading – interpreting tables, flow charts, tree diagram, pie diagram – understanding discourse coherence – guessing the meaning and training sentences (technical as well as general meaning) – vocabulary analysis.

UNIT IV **6**

WRITING

Sentence Patterns – SVO, SVOC, SVOCA…., recommendations and suggestions – preparing checklists, preparing an agenda to organize any program – formal and informal letters – preparing resume paragraph writing – note making and precise writing.

UNIT V **12**

LANGUAGES FOCUS

Parts of speech, prefixes & suffixes, degrees of comparison, prepositions, types of verbs, punctuation, error detection & correction synonyms and antonyms.

TOTAL: 45 PERIODS

Text Book:

1. "English for Engineers and technologist" Vil. I Orient Longman Ltd.

References:

1. Narayanasami, "Strength your writing"-Orient Longman revised edition.
2. Picket and laster, "Technical Writing" – New York Haper and Row publication.
3. Swan, Michel, "Basic English" – OUP
4. Technical communication – Principles – Meenakshi Raman & Sangeetha Sharma, Oxford University

COURSE OUTCOMES (COs)	
The student will be able	
CO1	*Identify* different strategies of reading and writing skills.
CO2	*Revise* the library skills in their learning process.
CO3	*Apply* different techniques to various types of material such as a novel, newspaper, poem, drama and other reading papers.
CO4	*Use* visual aids to support verbal matters into language discourse.
CO5	*Prepares* to face the written exam with confidence and without any fear or tension.
C06	Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, and argue using appropriate communicative strategies.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H			M			M		H		H
	CO2			M	M	H					L	H	L
	CO3		L			L	L			M			
	CO4		L			L		H		M		M	
	CO5		M	M	M				M		H	W	H
	C06	L					M						
3	Category	Professional Ability Enhancement Courses (PAEC)											
4	Approval	30th Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 1L2	ARCHITECTURAL GRAPHICS & ART STUDIO	0	0	6	3

OBJECTIVES:

- To understand drawing as a medium to visualize and communicate design ideas.
- To understand the concepts of Architectural Drawing with the introduction of drafting fundamentals.
- To understand the language of Architectural representations through Architectural Drawing systems and to introduce the basics of measured drawing.

UNIT I **9**

GEOMETRICAL DRAWING: INTRODUCTION

Introduction to fundamentals of drawing/ drafting: Construction of lines, line value, line types, lettering, dimensioning, representation, format for presentation, etc.; Construction of angles, use of scales; Construction of circles, tangents, curves and conic sections.

Fundamentals of art – Elements and principles of drawing – Types of drawing – Visual effects of drawing – Scale drawing – Composition – Approach to sketching – Study of light, shade and shadow.

Exercise involving Indoor and outdoor sketching – Spot sketching - Drawing from imagination –

Study of 3 D effects through light and shade from nature – Tools and materials – Illustration – Study of human being and mobiles.

UNIT II **8**

GEOMETRICAL DRAWING: PLANE & SOLID GEOMETRY

Construction and development of planar surface – square, rectangle, polygon etc Introduction of multi-view projection – projection of points, lines and planes.

Multi- view projection of solids – cube, prism, pyramids, cones, cylinders etc.; Sections of solids, true shape of solids.

UNIT III **10**

GEOMETRICAL DRAWING: AXONOMETRICPROJECTION & MEASURED DRAWING

Isometric, plan oblique and elevation oblique projection of planes, solids and combination of solid etc.

Introduction to fundamentals of measured drawing, line value, lettering, drawing representation, format for presentation methods and technique of measuring buildings and their details. Measured drawing of simple objects like furniture, detailing in terms of construction, ornamentation, measured drawing of building

components like column, door, window, cornice, etc

UNIT IV **6**

PAINTING I & II

Introduction of painting – Colour – Properties of colour – Colour schemes – Types of colours - Application and visual effects of colour. Exercise involving Study of colour – Properties of paper, brush and other tools – Basic washes – 3D effects from still-life, nature and built environment using mono chromatic and multi colour.

Indoor and outdoor painting – Rendering techniques Exercise involving Water colour – Water soluble colour pencil – Tempra – Acarali – Water soluble oil colour – Oil colour – Pen and ink –

Brush – Air brush – Mixed mediums – Study of multi colour and 3D effects from nature and built environment.

UNIT V SCULPTURE **6**

Introduction of sculpture –Sculpture using various materials such as clay, plaster of Paris, paper mache, and wire.

UNIT VI APPLIED ART **6**

Graphic representations – Visual composition and Abstraction- Exercises involving Logo design, collage, calligraphy and printing.

OUTCOMES

- An understanding on the concepts of architectural drawing as well as representation skills are imparted.
- An understanding on the building representation in 2D and 3D among students in addition to preparation of measured drawing.
- The students are exposed to various mediums and techniques.
- Bold enough to handle to the colours for the presentation sheets.
- The students are mastery in sketching and expression through forms.
- The skill and knowledge gained through the subject is most useful to their profession

TOTAL: 45 PERIODS

TEXTBOOKS:

1. IH. Morris, Geometrical Drawing for Art Students - Orient Longman, Madras, 2004.

2. Francis D. K. Ching, Architectural Graphics, John – Wiley and Sons, 2009.

3. Fraser Reekie, Reekie's Architectural Drawing, Edward Arnold, 1995

4. Webb, Frank, "The Artist guide to Composition", David & Charles, U.K., 1994.

5. Drawing a Creative Process", Ching Francis, Van Nostrand Reinhold, New York, 1990.

6. Alan Swann, Graphic Design School, Harper Collins,1991.

REFERENCES:

1. C.Leslie Martin, Architectural Graphics, The Macmillan Company, New York, 1978.

2. Moivahuntly, "The artist drawing book", David & Charles, U.K., 1994.

3. Arundell (Jan) Exploring sculpture, Mills and Boon, London/Charles, T. Brand Ford Company, U.S.A.

4. The art of drawing trees, heads, colours, mixing, drawing, landscape and painting,water colour, oil colour, etc. – The Grumbacher Library Books, New York –1996.

5. Caldwell Peter, "Pen and Ink Sketching", B.T. Bats ford Ltd., London, 1995.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Demonstrate*** the usage of various drafting tools in the process of preparing drawings.
CO2	***Assess*** 3D objects and represent them in drawings.
CO3	***Construct*** lines, Planar and solid geometry of simple and complex objects in reduced scales.
CO4	***Compare*** the various types of projections
CO5	***Construct*** Orthographic projections, Axonometric and Isometric views of three dimensional objects in reduced scales.
C06	An understanding on the concepts of architectural drawing as well as representation skills are imparted

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			L									
	CO2	H			H			M			L		
	CO3					M							L
	CO4		M	L	H		L					L	
	CO5									M			
	C06		M										
3	Category	Professional Core (PC)											
4	Approval	22nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 2 LI	ARCHITECTURAL DESIGN – II	0	0	11	6

UNIT I

DESIGN STUDIO

The problems involve simple space organization starting with single space single use – small span Horizontal movement – single bay – passive energy type spaces. The study of space standards and an anthropometrics related to each problem is stressed upon. Anthropometry as related to physically handicapped and elderly persons is required to be studies.

Examples and exercises include

a) Toilet for a physically handicapped person, Hostel Room, Bedroom, Kitchen.

b) Shop, Workshop, Pavilions, Snack bar.

c) Residence, Petrol bunk, fire station, police station, cottage for an elderly couple.

UNIT II WORKSHOP

Elementary models including wall surfaces floral designs, ceilings, glass areas; law water, bodies etc., Block models of small campuses using wood, the ramacol mount broad, soap, soap, corkboard, etc., Detailed model of a small building like branch bank, small residence, bus shelter, snack bar, including landscape details.

TOTAL: 180 PERIODS

References:

Design Studio

1. "E and O.E Planning", L life Book Ltd., London, 1973

2. De. Chiara and Callender, "Timer – saver standards for building types" McGrawHill Co., New York, 1973.

3. Sid Delk Mar Leach, "Techniques of Interior Design Rendering and Presentation", McGraw Hill Co., New York, 1973.

Workshop II

1. Wenninger (Magrus. J) "Sperical Models", Cambridge University Press, 1979.

2. Arundell (Jan), "Exploring Sculpture", Mills and Boom, London/Charles T. Brandford Company, USSA, 1972.

3. John W. Mills, "The Technique of Sculpture", B.T. Batsford Ltd., New York Reinhold Publishing Corpn., London, 1966.

4. Jannsen Constructional Drawing and Architectural models, KariKramer Verlag, Stuttgart

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Demonstrate the knowledge on arriving spatial requirements for various human activities
CO2	Demonstrate the knowledge on anthropometry and ergonomics in architectural design.
CO3	Interpret the case study examples to develop knowledge on architectural design.
CO4	Design of single spaces with the understanding of structural, utility, aesthetics and material considerations.
CO5	Develop a neat presentation drawings scale models using various media
C06	Learn to reciprocate and sensitize the design/concept to the environment and the design skill of the project

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			H	M			M	H	H		H
	CO2	L		M		H			M		L	H	L
	CO3					L				M		M	
	CO4		L			L				M			
	CO5	H	M	M	M				M		H		H
	C06					L						M	
3	Category	Professional Core(PC)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 201	THEORY OF ARCHITECTURE – II	3	0	0	3

OBJECTIVES:

- To introduce the large scale changes from 1960s as context for new thought in architecture.
- To give exposure to the critiques of modern architecture.
- To study in detail the different post modern directions in architecture.
- To give an outline of architectural approaches across the world from late 20^{th} century.
- To give an understanding of the trajectory of post independence architecture of India till the present.

UNIT I **9**

INTRODUCTION

Developments during the industrial area, the great inventions and the reason for the birth of modern architecture.

UNIT II **8**

USE OF NEW MATERIALS

Extensive use of steel, glass and concrete – the great or the international exhibitions and their influence on architecture. The characteristic feature of modern architecture.

UNIT III **10**

CONTEMPORARY ARCHITECTS

The various moments, thoughts and philosophies of the 19th and 20th centuries to include Art Nouveau, Brutalism, Chicago school, constructivism, expressionism, Bauhaus, Functionalism, futurism, Neoclassicism, Organic architecture, Modular Co-ordination.

UNIT IV **12**

CONTEMPORARY ARCHITECTS

The three generations of architects : first generation to include L. Sullivan, F.L. Wright, Le Corbusier, Mies Van Der Rohe, Eric Mendelson. Walter Gropius, Richard Neutra. Second generation to include, Erro Sarrinen, Kenzo Tange, Louis Kahn, Minoru Yamasaki, Hugh Stubbins, Paul Rudolph, Skidmore Owings and Merrill.

UNIT V **6**

LATER TREND

Developments of prefabrication techniques, futuristic thoughts of Buck Minister Fuller.

TOTAL: 45 PERIODS

References:

1. Peter Collins, “Changing ideals in Modern Architecture”, Faber and Faber, London, 1985.
2. Bill Rise Bero, “Modern Architecture and Design”.
3. Kenneth Frampton, “Modern Architecture – A critical history” – Oxford University Press, 1980.
4. William J. Christ “Modern architecture since 1900”, Paidon Press Ltd., Oxford, 1982.

COURSE OUTCOMES (COs)	
The student will be able	
CO	Understand the impact of literature in architecture on philosophical development of
CO	Understand concepts, material and construct the alternative architectural methods
CO	Exposed to the master architects works and trace the development of evolution of their
CO 4	Understand the spatial organization and spatial qualities of different typologies of buildings
CO	Knowledge of the contemporary design process and apply the same in the architectural
C0	Understanding the conceptualization of architectural design with respect to program,

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/PO	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				H	L	M		M		H	L	
	CO2				H	L	M		M		H		
	CO3				H	L	M		M		H		
	CO4				H		M						
	CO5				H		M						
	C06				H		M					L	
3	Categor	Professional Core(PC)											
4	Approva	37TH Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/ S	C
BAR 202	HISTORY OF ARCHITECTURE – II	3	0	0	3

OBJECTIVES:

- To give an overall understanding of the architecture in India up to the colonial period as parallel and sequential productions rising from the cumulative effect of forces operating and intersecting in the Indian subcontinent.
- To inform about specific and prominent modes of architecture in terms of evolution,
- Togive exposure to works that are architecturally exemplary and/or representative.
- To appreciate architecture as a giver of particular or universal meaning.

UNIT I **9**

ANCINET INDIA

Indus valley civilization – Culture and pattern of settlement. Impact of Aryan Culture – Vedic Village and the rudimentary forms of bamboo and wood wooden construction under the Mauryan Rule.

UNIT II **8**

BUDDHIST ARCHITECTURE

Hinayana and Mahayana Buddhism – Interaction of Hellenic & Indian ideas in Northern India – Architectural Production During Ashoka's Rule – Ashokan Pillar, Sarnath, Rock cut caves at Barabar, Sanchi Stupa, Salient features of a Chaitya hall and Vihara, Rock cut architecture in the Western and Eastern Ghats – Karli, Viharas at Nasik, Rani Gumpha, Udaigiri, Takti Bhai, Gandhara.

UNIT III **10**

HINDU ARCHITECTURE

Evolution of Hindu Temple – Early shrines of the Gupta and Chalukya periods – Tigawa Temple, Ladh Khan and Durga Temple, Aihole, Papanatha and Virupaksha Temples, Pattadakal.

UNIT IV **12**

DRAVIDIAN ARCHITECTURE

Dravidian culture – Rock cut products under Pallavas – Shore Temple, Mahabalipuram – Dravidian Order – Brihadeeswara Temple, Tanjore – Evolution and Form of Gopuram – Complexity in temple plan due to complexity in Ritual – Minakshi Temple, Madurai.

UNIT V **6**

INDO ARYAN STYLE

Salient Features of an Indo Aryan Temple – Lingaraja Temple, Bhuvaneswar – Sun Temple, Konarak, Kunds and Vavs – Sabali Kund – Adalaj – Surya Kund, Modhera.

TOTAL: 45 PERIODS

Test Book:

1. Percy Brown, "Indian Architecture (Buddhist and Hindu period)", Taraporevalla and sons, Bombay, 1983.

2. Satish Grover, "The Architecture of India (Buddhist and Hindu period)", Vikas Publishing Housing.

References:

1. Christoper Tadgelli, The History of Architecture in India From the Dawn of civilization to the end of Raj, Longman Group, U.K. Ltd., London, 1990.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Understand*** the origin of various civilization and Architecture in India at different points of time
CO2	***Understanding*** the architectural responses with respect to materials, technology, style and character in the Buddhist, Hindu and Dravidian Architecture
CO3	***Understand*** the emergence of Islamic Architecture, form and function of different structures and the underlying geometry and concepts of decoration and colour.
CO4	***Gain Knowledge*** on the history related to design thinking, cultural aspiration, social needs, and the evolution of the built environment
CO5	An understanding of the diversity of architecture in India and sensitivity towards its syncretic aspects
C06	Ability to appreciate particular cultural, symbolic, spatial and material qualities in architecture and cities as givers of meaning and continuity.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	M			M	H	H		H
	CO2				M						L	H	
	CO3									M		M	
	CO4		L			L						M	
	CO5	H	M		M				M		H	W	H
	C06												
3	Category	Professional Core (PC)											
4	Approval	31St Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 203	MECHANICS OF STRUCTURES II	3	0	0	3

OBJECTIVES:

To enable understanding of the basic concepts of shear force and bending moment acting on beams subjected to different loading conditions.

- To give knowledge about how to determine stresses in beams and strength ofsections.
- To give knowledge about how to calculate deflection of beams.
- To enable study of theory of columns.
- To give an understanding of the concept of indeterminate structure and its analysis.

UNIT I **9**

SHEAR FORCE AND BENDING MOMENT

Concept of sharing forces and Bending Moments – shear force and bending Moment diagrams for cantilver and simply supported beams subjected to point load, uniformly distributed loads and their combinations.

UNIT II **8**

STRESSES IN BEAMS

Theory of simple blending stresses in beams, share stresses in beams – examples on simple sections. Stress distribution diagrams.

UNIT III **10**

DEFLECTION OF BEAMS

Slope and deflection at a section – Double Integration and Macaulay's method for simply supported and cantilever beams.

UNIT IV **12**

THEORY OF COLUMNS

Short and long columns – Euler's method and its limitation. Derivations of Euler's formula (for different end conditions) – Rankine's formula for columns, examples, effect of eccentric loading.

UNIT V **6**

INTRODUCTION INDETERMINATE STRUCTURES

Concept in Analysis of continuous beams, fixed, beams, cantilevers, and partial frames (No problems)

TOTAL: 45 PERIODS

Text Books:

1. M.M. Ratwani, & V.N. Vazirani, "Analysis of Structures, Vol. I" Khanna Publishers – Delhi, 1987.

2. A.R. Jain and B.K. Jain, "Theory and Analysis of Structures, Vol I" Nemchand and Bros, Roorkeee, 1987.

3. B.C. Punmia, 'Strength of Materials and Theory of Structures" Vol I Laxmi publications New Delhi, 1994.

4. R.K. Rajput "Strength of Materials", S. Chand & Company Ltd., New Delhi 1996.

References:

1. Timoshenko, S.P. and D.H. Young, "Elements of Strength of Materials" Fifth Editions, East West Press, 1983.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Identify*** various types of loading and support conditions that act on structural systems and Understand the basic principles used in the analysis of structural members.
CO2	***Apply*** the concepts for finding the shear forces and moments for various structural members.
CO3	***Apply*** the concepts for finding the shear forces and moments for various structural members.
CO4	***Analyze*** the long and short columns and determine the design loads.
CO5	***Analyze*** indeterminate beams like continuous beams and fixed beams
C06	***Analyze*** and solve the problems in practical installations of the structural members

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M	H	M			M	H	H		H
	CO2			M							L		L
	CO3		L							M			
	CO4	H								M			
	CO5	H		M	M						H		
	C06					l		H					
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BMA 204	PERSONALITY DEVELOPMENT, SOFT SKILLS ENHANCEMENT	3	0	0	3

OBJECTIVES

The objective of the training programme is bring about personality development with regard to the different behavioral dimensions that have far reaching significance in the direction of organizational effectiveness.

Unit 1 **9**

Leadership Introduction to Leadership, Leadership Power, Leadership Styles, Leadership in Administration.

Unit 2 **8**

Interpersonal skills – Conversation, Feedback, Feed forward

Interpersonal skills – Delegation, Humor, Trust, Expectations, Values, Status,

Unit 3 **5**

Communication Introduction to Communication, Flow of Communication, Listening, Barriers of Communication, How to overcome barriers of communication.

Unit 4 **6**

Stress Introduction to Stress, Causes of Stress, Impact Management Stress, Managing Stress

Unit 5 **6**

Group Dynamics Importance of groups in organization, and Team Interactions in group, Group Building Decision Taking, Team Building, Interaction with the Team, How to build a good team?

Unit 6 5

Time Time as a Resource, Identify Important Time Management Wasters, Individual Time Management Styles, Techniques for better Time Management.

Unit 7 **5**

Motivation Introduction to Motivation, Relevance and types of Motivation, Motivating the subordinates, Analysis of Motivation

TOTAL: 45 PERIODS

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Students gets the ability to apply visual and verbal communication skills at various stages of architectural design and project delivery process.
CO2	Students gains self-confidence to get into the global world.
CO3	*Apply* different techniques to various types of material such as a novel, newspaper, poem, drama and other reading papers.
CO4	*Use* visual aids to support verbal matters into language discourse.
CO5	*Prepares* to face the written exam with confidence and without any fear or tension.
C06	Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, and argue using appropriate communicative strategies.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	M			M	H	H		H
	CO2			M	M						L	H	L
	CO3									M			
	CO4	H	L							M		M	H
	CO5								M		H		H
	C06												
3	Category	Professional Ability Enhancement Courses (PAEC)											
4	Approval	22nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 205	ARCHITECTURAL GRAPHICS – II	3	0	0	3

UNIT I **15**

PERSPECTIVE

Characteristic of Perspective Drawings, Perspective Systems and methods. Two point perspective of simple objects, outdoor and indoor view of building etc.

UNIT II **15**

ONE POINT AND TWO POINT PERSPECTIVE

One and two point perspective of interiors, Perspective theory and practice.

UNIT III **15**

SCIOGRAPHY

Principles of shade and shadows – of lines and Circles, shadows of Architectural elements, etc., Shadows of circular solids, shadows on buildings.

TOTAL:45 PERIODS

Text Book:

I Perspective:

1. Robert W. Gill, "Basic Perspective", Thames and Hudson, London, 1974.
2. Interiors: "Perspective in Architectural Design Graphic" – SMA Publishing Co., Ltd., Japan, 1967.

II Sciography :

1. C. Leslie Martin, "Architectural Graphics", The Macmillan Company, New York, 1964.
2. Francis Ching, "Architectural Graphics", Van Nostrand and Reinhold Company, New York, 1975.
3. Ernest Norling, "Perspective Drawing", Walter Foster Art Books, California, 1986.
4. Bernard Alkins – 147, "Architectural Rendering", Walter Foster Art Books, 1986.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Demonstrate*** the usage of various drafting tools in the process of preparing drawings.
CO2	***Assess*** 3D objects and represent them in drawings.
CO3	***Measure*** and prepare scaled measured drawings of various objects and existing buildings/
CO4	***Create*** One-point and Two-point perspective views of objects, interior and exterior of buildings from given plans and elevations.
CO5	***Analyze*** and ***draft*** the formation of shade and shadows of basic geometric shapes, forms and
C06	Ability to construct the 3d views and perspective drawings of the buildings.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		H	M			M	H	H		H
	CO2	L	H	M	M	H					L	H	L
	CO3		L			L				M		M	H
	CO4		L			L			M	M			H
	CO5	H	M	M	M				M		H	W	H
	C06					L		H					
3	Category	Professional Core(PC)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 206	MATERIALS AND CONSTRUCTION I	0	0	6	3

1 INTRODUCTION 15

Functional requirements of a building and its components - Drawings of foundations, plinth superstructure, roofings. Soils - Formation - grainsize distribution - soil classification systems. Lime - fat/hydraulic limes - Their uses and properties - Manufacturing process -Mortar, functions - requirements - mix proportions.

2 RURAL - MATERIAL AND CONSTRUCTION 20

Mud as a building material - Soil stabilisation, soil blocks-Drawings of foundations - types, S.S. Block - S.S.Castinsitu walls - flooring - roofing - plastering. Bamboo, casuarina coconut, palam, hay coir,jute-properties-uses-fire retardent treatment insection proofing. Types of foundations - walls - simple rooftrusses, floors for rural structures.

3 STONE 25

Classification of rocks - Building stones - their uses - physical properties - brief study of tests for stone - deterioration - preservation of stone - various stone finishes - cutting and polishing of granites. Drawings of foundations - types of masonry - random rubble/Ashlar, etc.-cavity walls - flooring copings, sills, lintels,corbels, arches.

4 BRICKS AND CLAY PRODUCTS 15

Bricks - brief study on manufacture of bricks - properties - uses - suitability - types of bricks - uses in buildings, structural titles, ceramics, terracotta - uses.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. R.J.S.Spencke and D.J.Cook, Building Materials in Developing Countries, John Wiley and Sons,1983.
2. HUDCO -All you want to know about soil stabilized mud blocks, HUDCO Pub., New Delhi, 1989.
3. UNO - Use of bamboo and reeds in construction - UNO Publications.
4. Rural Construction - NBO,New Delhi.

WEBSITES :

http://www.baboo-Flooring.com

http:// ag.avizona.edu/SWES

http://www/angelfite.com/in

http://www.idrc.ca/libary/documents/104800/chapz-e.html

http://www/angelfite.com/inz/granite

	COURSE OUTCOMES (COs)	
	The student will be able	
		Understand the basics of structures and differentiate their types. Know the formation of
		Get sensitized about the various ecological materials and their properties, treatment
		Draw the various types of building components for rural and modern structures using
		.Classify the various types of lime and compare their properties and application in building construction. Identify the mix
		Able to identify the good and clay products
		Identify the various water proofing materials, thermal insulation and their

Mapping of Course Outcomes with Program Outcomes (POs)

	C												
	C												
	C												
	C												
	C												
	C												
	C0												
	Ca	Building Sciences and Applied Engineering (BS &AE)											
	Ap	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 3LI	ARCHITECTURAL DESIGN – III	0	0	13	6

UNIT I

DESIGN STUDIO **120**

Single level planning in small scale, small span, horizontal movement and simple vertical movement, data collection, case studies, analysis and presentation of studies – Data collection with respect to design and detailing for physically handicapped persons – Concepts and presentation of design with scales models – Examples : Residential buildings, Institutional buildings, banks, Nursery or Primary schools, Primary Health Centre, School for children with learning disabilities, neighbourhood market, etc.

UNIT II

COMPUTER LAB STUDIO

Introduction to computer aided drafting system, concepts of real dimension, colours, symbols repeatability modification, layers, exercises related to design projects above.

TOTAL:210 PERIODS

References:

1. De Chiara and Callender, “Time Saver Standards Building Types”, McGraw Hill Co., 2nd Editions, 1980.

2. Edward D. Mills, Planning-“the Architects Handbook” – 10th Edition, British Library C Taloguing in Publishing Data, 1985.

3. Wakita / Linde, “The Professional practice of Architectural working, drawing” Jonh Wiley & Sons, 1984.

4. Andrew Alpern, “Handbook of specialty Elements in Architecture”, McGraw Hill Book Co., 1982.

5. Julius Panero & Martin Zelnik, “Human Dimension and Interior Space”, Whitney Library of Design Publication, 1979.

6. “Neufert Architect’s Data”, Rudolf Hefg, Crosby Lockwood and Sons Ltd., 1970.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	To understand the characteristics of site and the importance of site planning which includes built form and open space.
CO2	Determine spatial arrangements, circulation of buildings and the response of user group through case studies.
CO3	Learn the process of design
CO4	Design of spaces with functional, aesthetics and material considerations by applying the knowledge gained in case studies.
CO5	Producing neat presentation drawings using various media and making scale models .
C06	Ability to perceive, understand and represent fundamental attributes of form-spacewith respect to human experience and use.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H	M	H	M			M	H	H		H
	CO2			M								H	L
	CO3											M	
	CO4	H	L			L			M	M		M	
	CO5		M		M				M		H		H
	C06					M				L			
3	Category	Professional Core (PC)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 301	BUILDING SERVICES I	3	0	0	3

OBJECTIVES:

- To Study Water supply, treatments, distribution and plumbing system for all type of buildings.
- To Study Waste water treatments, Sewer lines for all types of buildings.
- To Study Drainage system for a Small Campus and a Residential neighbourhood.
- To understand Refuse collections, disposal, composting, Landfill, Bio gas for a Town and City.
- Applications of all the above systems to a Buildings, Small Campus and a Residential neighbourhood.

CONTENT:

UNIT I WATER QUALITY, TREATMENTS AND DISTRIBUTION 9

Sources of water supply – Water Quality - Water requirements for all type of residential, commercial, Industrial buildings and for town – Water treatment methods – Screening, aeration, Sedimentation, Filtration, Disinfection, Softening, conveyance of water – Distribution of water – Choice of pipe materials - Types of fixtures and fittings – System of plumbing in all type of buildings.

UNIT II WASTE WATER, TREATMENTS AND DISPOSAL 8

Waste water – Sewage disposal, primary treatment. Secondary treatment, Biological treatment and Modern types of Sewage Treatment Plants - Sewer line fixtures and traps, Manholes, Septic tank.

UNIT III STORM WATER DRAINAGE AND RAIN WATER HARVESTING 10

Basic principles of storm water drainage – drain pipes and type of pipe – storm water gutter –rain water harvesting principles – storage sumps

UNIT IV SOLID WASTE, COLLECTIONS, TREATMENTS, DISPOSAL, MODERN DRAINAGE SYSTEMS 12

Refuse collection, disposal, Incinerator, Composting, Vermicomposting, Sanitary Land filling, Bio gas system and Modern renewable energy system. Modern plumbing system, drainage collection system, disposal for a housing colony, small towns – Selection of pumps and Construction of pump rooms.

UNIT V APPLICATION OF THE ABOVE UNITS 6

Layout design and details of water supply distribution system in a Campus or Small residential neighbourhood - Layout design and details of sewage and drainage system for different types of buildings –

water supply pipe lines, storm water drainage pipe lines and Rain water Harvesting for small residential neighbourhood.

TOTAL: 45 PERIODS

OUTCOMES

1. Students have through understanding of how water and waste water are managed, in residential unit, small campus and for a large city.
2. Students are aware of the principles and best practices for Solid waste management in residential unit, small campus and for a large city.

TEXTBOOK:

1. Manual of water supply and treatment, Second edition, CPHEEO, Ministry of works and housing, New Delhi 1977
2. AFEWise, JASwaffiedWater, Sanitary &Waste Services in buildings –Mitchell Publishing Co. Ltd. – 2002, V Edition
3. Punmia B.C., Waste Water Engineering, Laxmi Publications, 2009.
4. Arceivala S.J., Waste Water Treatment for Pollution Control, Tata McGraw Hill, 2008.

REFERENCES:

1. G.M. Fair, J.C. Geyer and D.Okin, Water and Waste water engineering Volume II, John Wiley & Sons, Inc. New York, 1968
2. Manual on sewerage and sewerage treatment, CPHEEO – Ministry of works and housing, New Delhi, 1980
3. Renewable energy, basics and technology, supplement volume on integrated energy systems) Auroville, 1998 Sri Aurobindo Ashram, Pondicherry 605002 India

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Outline*** the sources and treatment of ground water
CO2	***Explain*** the various water supply and drainage systems
CO3	***Assess*** the water supply requirements and sewerage generated.
CO4	***Select*** the pumps, water supply and drainage pipes.
CO5	***Design*** the water supply and drainage layout of residential buildings.
C06	***Illustrate*** the solid waste management concepts and systems.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		H	M			M	H	H		H
	CO2			M	M						L	H	
	CO3									M			
	CO4					L				M			
	CO5	H	M	M	M				M		H		H
	C06												
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	34th Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 302	HISTORY OF ARCHITECTURE – III	3	0	0	3

UNIT I **9**

ROMANESQUE

The medieval ages – learning in the monasteries, evolution of the guilds – Factors influencing architecture – outline of architectural character in Italy, France and England – Examples: Pisa group, Italy; Abbey Aux Hommes, Caen; Tower of London.

UNIT II **8**

FRENCH GOTHIC

Religious and social influence – evolution of vaulting and development of structural systems – outline of Architectural character – Examples: Notre Dame, Paris.

UNIT III **10**

ENGLISH AND ITALIAN GOTHIC

Development of English gothic vaulting – outline of architectural character in England and Italy – Examples: West Minister Abbey, Hampton Court Place, London: Doges Palace, Venice: Milan Cathedral.

UNIT IV **12**

ITALIAN RENAISSANCE

The Idea of rebirth and revival of art – sociological influences in art architecture – Development of thought, emergence of merchant communities and their patronage. Outline of the Architecture during the Early Renaissance. High Renaissance and Baroque Periods – Features of a typical Renaissance Place, example: Palazzo Ricardi, Study of life History, Philosophy, contribution of the following architects: Brunelleschi, Michael Angelo, and Andrea Palladio.

UNIT V **6**

FRENCH & ENGLISH RENAISSANCE

Outline of the architectural character of French and English Renaissance – Domestic Architecture in England – Study of the life, Philosophy and works of the following architecture: Sir Christopher Wren. Indigo Jones.

TOTAL: 45 PERIODS

Text Books:

1. Sir Bannister Fletcher, "A History of Architecture", University of London, The Antholone Press. 1986.

2. G.K.Hiraskar, Great Ages of World Architecture ,Dhanpat Rai and Sons,Delhi

References:

1. Pier Luigi Nervi, "History of World Architecture Series". Harry N. Abrame Inc. Publication, New York, 1972.

2. S. Lloyd/H.W. Muller, "History of World Architecture" – Series Faber Ltd., London, 1986.

3. Spiro Kostof, "A History of Architecture" – Settings and Rituals, Oxford University Press, London, 1985.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Explain the architectural characters of Medieval Europe through selected examples.
CO2	Analyze the continuity between each style – the factors that connect each style
CO3	Analyze the trend or the pattern of development of architectural styles.
CO4	Interpret the contemporary architectural style and its development leading to new styles.
CO5	Understanding Characteristics and styles of colonial architecture
C06	Understanding the ideas and styles over revolution.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		M			M	H	H		H
	CO2			M							L	H	
	CO3									M			
	CO4		L			L				M			H
	CO5	H	M	M	M				M		H		H
	C06							M					
3	Category	Engineering Sciences (ES)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 303	DESIGN OF STRUCTURES I	3	0	0	3

OBJECTIVES: To introduce the design of various timber components in a building. • To enable the understanding of the types, efficiency and strength, advantages and
Disadvantages of Rivet and welded joints in steel. • To enable the design of Tension (beams) and compression (columns) steel members in a
building under various conditions.
• Case studies and models wherever applicable.

UNIT I

TIMBER STRUCTURES - DESIGN OF BEAMS AND COLUMNS 9

Grading of Timber – Permissible Stresses – Design of timber beams – Madras terrace roof – Design of timber columns.

UNIT II

STEEL STRUCTURES - BOLTED AND WELDED JOINTS 12

Assumptions – failure of Bolted joints – Strength and Efficiency of Bolted Joints – Types – Design of Bolted Joints for Axially Loaded Members (Excluding eccentric connections)Types of
welded joints – Advantages and disadvantages – Design of Fillet welds (Excluding eccentric connections).

UNIT III

TENSION MEMBERS 8

Introduction – Net sectional area – permissible stresses. Design of Axially loaded Tension member – Lug angle – code provision – tension splice.

UNIT IV

COMPRESSION MEMBERS 10

Introduction – various sections – built up section – Design of columns (excluding Lacing, Battening and other connections.)

UNIT V

STEEL BEAMS 6

Introduction – laterally supported and unsupported beams – Design of laterally supported beams.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

Design the timber beams and columns by applying the codal provisions. Able to design the steel joints for maximum efficiency and strength.

Tension members and compression members are designed for various conditions by applying the codal provisions.

Différent types of laterally unsupported & supported beams to be designed for various conditions.

TEXTBOOK:

1. L.S. Negi, Design of Streel Structures – Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.

2. S. Ramachandra, Design of Steel Structures - Standard Book House, Delhi, 1984.

3. Ramamurutham .S, Narayanan .R, Design of Steel Structures, Dhanpat Rai – Sons, 2006.

4. Punmia B.C., Design of Steel Structures, Laxmi Publications, 2005.

REFERENCES:

1. A.S.Arya, Structural Design in Steel, Masonry and Timber, Nemchand and Bros, Roorkee, 1971.

2. National Building Code of India, 1983, Part VI, Structural Design.

3. Gurucharan Singh, Design of Steel Structures, Standard Publishers, New Delhi, 1982.

4. Dayaratnam.P, Design of Steel Structures, Oxford and IBH Publishing Co.

5. IS 883 – Code of Practice for Design of Structural Timber in Buildings

6. IS 800 - 2007 – Code of Practice for use of Structural Steel in General Building Construction

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Illustrate*** masonry walls for axial loads and RCC walls.
CO2	***Apply*** relevant IS Code provisions to ensure safety and serviceability of structural elements
CO3	***Identify*** and compute the main mechanical properties of concrete and steel and structural
CO4	**Design** different types of foundations for axially short and long columns
CO5	***Design*** reinforced concrete slabs and beams by WSM and LSM for flexure
C06	Ability to Differentiate types of laterally unsupported & supported beams to be designed for various conditions

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		M			M	H	H		H
	CO2				M	H	L				L	H	L
	CO3		L			L		M		M			
	CO4		L			L				M			
	CO5	H	M	M	M				M		H	W	H
	C06					H		L					

COURSE CODE	COURSE TITLE	L	T	P/S	C
BMA 304	CLIMATE AND ENVIRONMENTAL STUDIES	3	0	0	3

OBJECTIVES:

- To study human heat balance and comfort.
- To familiarize students with the design and settings for buildings for daylight and factors that influence temperature
- To inform about the air pattern around buildings and the effect of wind on design and siting of buildings
- To expose the students to the various design strategies for building in different types of climatic zones.

UNIT I CLIMATE AND HUMAN COMFORT 9

Factors that determine climate of a place – Components of Climate – Climate classifications for building designers in tropics – Climate characteristics. Human body heat balance – Human body heat loss – Effects of climatic factors on human body heat loss – Effective temperature – Human thermal comfort – Use of C.Mahony's tables.

UNIT II DESIGN OF SOLAR SHADING DEVICES 8

Movement of sun – Locating the position of sun – Sun path diagram – Overhead period–Solar shading– Shadow angles – Design of appropriate shading devices

UNIT III HEAT FLOW THROUGH BUILDING ENVELOPE CONCEPTS 10

The transfer of heat through solids – Definitions – Conductivity, Resistivity, Specific heat,
Conductance, Resistance and Thermal capacity – Surface resistance and air cavities – Air to air transmittance (U value) – Time lag and decrement – Types of envelops with focus on glass.

UNIT IV AIR MOVEMENT DUE TO NATURAL AND BUILT FORMS 12

The wind – The effects of topography on wind patterns – Air currents around the building – Air movement through the buildings – The use of fans – Thermally induced air currents – Stack effect, Venturi effect – Use of court yard.

UNIT V CLIMATE AND DESIGN OF BUILDINGS 6

Design strategies in warm humid climates, hot humid climates, hot and dry climates and cold climates – Climate responsive design exercises.

TOTAL: 45 PERIODS

OUTCOMES

- Understanding of Thermal balance in Human beings
- Designing Climate responsive structure
- Conceptual understanding of Air flow in Buildings

TEXTBOOKS:

1. O.H. Koenigsberger and Others, Manual of Tropical Housing and Building – Part I - Climate design, Orient Longman, Madras, India, 2010.

2. Bureau of Indian Standards IS 3792 (1987), Hand book on Functional requirements of buildings other than industrial buildings, (Part I – IV), Manakbhavan, 9, Bahadur Shah Zafar Marg, New Delhi – 110 002.

REFERENCES:

1. Martin Evans (1980), Housing Climate and Comfort – Architectural Press, London.

2. B. Givoni (1981), Man, Climate and Architecture, Architectural Sciences Series – Applied Science Publishers Ltd., London

3. B. Givoni (1994) Passive and Low Energy Cooling of building, Van Nortrand Reinhold New York, USA.

4. Galloe, Salam and Sayigh A.M.M. (1998) "Architecture, Comfort and Energy", Elsivier Science Ltd., Oxford, U.K.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Understand*** climatic types and design approaches
CO2	***Analyze*** design types of shading devices
CO3	***Understand*** thermal performance of various building materials
CO4	Able to ***design*** of buildings with good ventilation
CO5	Able to ***design*** of climatic conscious buildings
C06	Designing Climate responsive structure

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		H	M			L	H	H		H
	CO2			M	L		L				L	H	
	CO3							L		M			
	CO4					L				M			
	CO5	H	M	M	M				M		H		H
	C06												
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	34th Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 305	COMPUTER STUDIO – I	0	0	4	3

UNIT I

INTRODUCTION TO COMPUTER **15**

Technology of small computer system, computer terminology operation principles of P.C. introduction to application software, and graphic system, and use of printers, scanner, plotter, file management etc.,

UNIT II

INTRODUCTION TO COMPUTER AIDED 2D DRAFTING **15**

Understanding the use of drawing tools, object editing, drawing objects, filling and setting drawing units, scales, limits that size and dimensioning, text, Setting up of drawings of various simple architecture objects with complete text and dimensioning.

UNIT III

ADVANCE COMPUTER AIDED 2D DRAFTING **15**

Advance command programming – transparent overlays hatching utilities, assigned colour and line type, use of multiline, style, block, symbol library manipulation for accurate drawings, incorporating the above said utilities.

UNIT IV

INTRODUCTION TO 3D DRAFTING **15**

Introduction to 3D modeling technique and construction planes, drawing object 3D surface setting up elevation and thickness, and use of dynamic projections.

UNIT V

3D MODELLING **15**

Solid modeling with primitive commands and Boolean Operation. Use of region modeling in solid modification in solid modification.

TOTAL: 75 PERIODS

Text Book:

1. V. Rajaraman, "Principles of Computer Programming" – Prentice Hall of India.

References:

1. "Auto CAD reference manual" – Auto Desk Inc.

2. "Auto CAD Architectural users' guide" – Auto Desk Inc.

CO1	To **apply** softwares in the field of Architecture to represent design ideas.
CO2	***Produce*** 2D technical drawings using AutoCAD
CO3	***Develop*** the 3D model of buildings & objects using AutoCAD and Sketch Up
CO4	***Recreate*** realistic image of objects and buildings by using presentation software.
CO5	Sheet set ***organization*** and plot/print drawing to the scale.
C06	Ability to develop knowledge.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M	H	M			M	H	H		H
	CO2			M	M	H					L	H	L
	CO3					L		M					
	CO4	H	L			L		M					
	CO5	H	M	M	M				M		H		H
	C06					L							
3	Category	ProfessinalAbilityEnhancement Courses (PAEC)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 306	MATERIALS AND CONSTRUCTION II	2	0	4	4

UNIT I

BRICKS AND CLAY PRODUCTS **15**

Drawings of brick foundations - buildings in brickwork, bonds columns,corners - structrual members in brickwork. Reinforced brick masonry - Arches - Lintels - Corbels - copings. Hollow clay blocks - for walls - patritions -roofs. Roofings - Flats Roofs - or Terrace roofs - Sloping roofs. Detailing includes for physically handicapped.

UNIT II

TIMBER AND ALLIED PRODUCTS **15**

Softwood and Hardwood - Secondary Timber - Physical properties and uses - Defects, Conversion, Seasoning, Decay and preservation of timber - Fire retardent treatment, anti-termite treatment. Industrial timbers - plywood,blockboard,particle board, fibre boards. Manufacture and uses - current developments.

UNIT III

TIMBER **15**

Drawings of timber joinery for Windows, doors, ventilators. Timber partitions, panelling, false ceiling,fixed ceiling - wall panelling. Timber staircases - Designed staircase - timber trusses - Lean to - close couple - Kingpost - Queen pot - Trusses. Timber floors - timber built-in-furniture - Detailing and fittings for physically handicapped.

UNIT III

LOW COST BUILDING TECHNOLOGY **15**

Drawings of foundations - walling - Roofs - Partitions - Ceiling panel - Doors and Windows. Miscellaneous - Drawing of Brick Jails, Screen Walls - Pavement blocks - Ferrocement water tanks. Detailing and specifications for physically handicapped.

GLASS **15**

Composition of glass - brief study on manufacture, treatment, properties and uses of glass - special types of glass, sheet glass, plate glass, safety glass, tinte coated glass - Glass blocks - properties and applications in the building Industry -current developments.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. Don A.Watson, Construction Materials and Processes, McGraw Hill Co.,1972.

2. Alanwerth, Materials, The Mitchell Pub.Co.Ltd., London,1986.

3.R.Chudleu,'Building Construction Handbook',British Library Cataloguing in Publication Data,London,1990.

WEBSITES

http://www.ibex-ibex-intl.com

http://www.inika.com/chitra

http://www.routbdge.com

http://www.ventura india.com

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Understand the basics of structures and differentiate their types. Know the formation of soil, their classification and understand the importance of soil in building construction.
CO2	Classify the various types of timber and compare their properties and application in building construction.
CO3	Draw the various types of building components for rural and modern structures using various materials like timber
CO4	Classify the various types of stones and bricks and compare their properties and application in building construction.
CO5	Draw the various types of building components for rural and modern structures using various materials like brick, stone.
C06	Able to identify the good and clay products

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		H	M			M	H	H		H
	CO2			M	M						L	H	
	CO3									M			
	CO4					L				M			
	CO5	H	M	M	M				M		H		H
	C06												
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 4LI	ARCHITECTURAL DESIGN – IV	0	0	13	6

UNIT I

DESIGN STUDIO

Problem related to multi room, single use, small span – Multiple story, Horizontal and vertical movement, Active cum passive energy, Masonry and frame type buildings.

Ex: Department store, Library, higher secondary school, campus students' center, etc. The projects will consciously provide for movement and use by the physically handicapped and elderly.

UNIT II

DESIGN STUDIO – RURAL PROJECT

Problems related to Rural Housing – Visits to selected village – Surveys on socio – economic, physical, housing and surveys, etc. to study existing conditions – analysis of survey data – preparation of report and presentation in a seminar – preparation of design brief solutions for housing and community facilities.

UNIT III

COMPUTER LAB STUDIO

Documentation of rural project of Housing typology using computer – Introduction to 3D modeling and rendering 3D images. **TOTAL: 180 PERIODS**

References:

1. De Chiara and Callender, "Time Saver Standard for building Types". McGraw Hill Co., 2nd Edition 1980.

2. Edward. Mills, Planning – "The Architects handbook – 10th Edition", British Library Cataloguing in Publication Data, 1985.

3. Wakita Linde, "The Professional Practice of Architectural Working", Drawing John Wiley & Sons 1984.

4. Andrew Alphern "Handbook of Specialty Elements in Architecture", McGraw Hill Book Co.,

5. Julius Panero & Martin Zelnik, "Human Dimension and Interior Space", Whitney Library of Design Publication, 1979.

6. "Neufert Architect's Data", Rudolf Herg, Crosby Lockwood and Sons Ltd., 1970.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Understand*** the space and furniture's required for various human activities.
CO2	***Interpretation*** of buildings for spatial arrangements and circulation.
CO3	***Design*** of medium scale public buildings with structural, utility, aesthetics and material considerations by applying the knowledge gained in case studies. Analyse a site with respect to various aspects
CO4	Learn the procedure of studying and **analysis** of rural housing and settlements and preparing design solutions.
CO5	***Involve*** in producing neat presentation drawings using various media like pencil color, water and poster colors, crayons etc.
C06	***Prepare*** scale models of studio exercises using sheets, boards, wood etc.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			M			M	H	H		H
	CO2			M	M	H					L	H	L
	CO3	H				L		H		M		M	H
	CO4		L			L	L			M			
	CO5		M	M	M				M		H		
	C06							H					L
3	Category	Professional Core (PC)											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 401	BUILDING SERVICES II	3	0	0	3

UNIT I **9**

PUMPS AND MACHINERIES

Reciprocating, centrifugal, deep well, submersible automatic pumps, sewerage pump, compressors vacuum pump – their selection installation and maintenance – Hot Water Boiler –Lifts and Escalators – special features required for physically handicapped and elderly – Conveyors – Vibrators – Concrete mixers – DC / AC motors – generators – Laboratory services – gas, water, air and Electricity.

UNIT II **8**

ELECTRICAL SYSTEMS

Basics of electricity – single / three phase supply – Protective devices in electrical installations – Earthing for safety – Types of earthing – ISI Specification.

UNIT III **10**

ELECTRICAL INSTALLATIONS IN BUILDINGS Type of wiring systems and their choice – Planning electrical wiring for building – Main and distribution boards – transformers and switch gears – Layout of substations.

UNIT IV **12**

PRINCIPLES OF ILLUMINATION

Visual Tasks – factors affecting visual tasks – Modern theory of light and colour – Synthesis of light – additive and subtractive synthesis of colour – luminous flux – Candela – Solid angle illumination – Utilisation factor – depreciation factor – MSCP – MHCP – Lans of illumination.

UNIT V **6**

LIGHT DESIGN

Classification of lighting – Artificial light sources – spectral energy distribution – luminous efficiency – colour temperature – colour rendering. Design of modern lighting for stores, offices, schools, hospitals and house lighting. Elementary idea of special features required and minimum level of illumination requited for physically handicapped and elderly in building types.

TOTAL: 45 PERIODS

Text Books:

1. “Handbook for Building Engineering in Metric systems”, NBC, New Delhi, 1968.

References:

1. E.R. Ambrose, "Hear Pumps and electric heating", John and Wiley and Sons, Inc., New York, 1968.
2. "Philips Lighting in Architectural Design", McGraw Hill, New York, 1964.
3. R.G. Hopkinson and J.D. Kay, "The Lighting of buildings", Faber and Faber, London, 1969.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Illustrate*** the basics of electricity, components and installations and ***prepare*** electrical layout
CO2	***Illustrate*** the fundamentals of lighting and ***prepare*** lighting design
CO3	***Outline*** energy efficient lighting design solutions
CO4	***Understand*** the fire safety requirements of buildings
CO5	***Identify*** fire detection and fire fighting systems for buildings and ***prepare*** fire safety
C06	

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	L	H	M			M	H	H		H
	CO2	L		M	M						L	H	
	CO3						M	L		M		M	
	CO4					L				M			
	CO5	M			M				M		H		H
	C06												
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 402	HISTORY OF ARCHITECTURE – IV	3	0	0	3

UNIT I **9**

INTRODUCTION TO ISLAMIC ARCHITECTURE

Brief History of Islam in terms of birth, spread across countries and principles – Influences on Islamic Architecture – Evolution of building types in terms of forms and functions – the mosque, the tomb, and minaret, the madarasa, the palace, the caravanserai, vernacular architecture, the market – important principles, elements and character of Islamic architecture in terms of structure materials and methods of construction, elements of decoration, colour, geometry, light – important examples to illustrate development of Islamic architecture.

UNIT II **8**

ISLAMIC ARCHITECTURE IN INDIA

Advent of Islam into the Indian subcontinent and its impact – source of Islamic Architecture in India and influences on them – Brief history of development and classification urban different styles and regions.

UNIT III **10**

DELHI OR IMPERIAL STYLE

Development of architectural styles during the rule of the slave, Khilji, Tulip Spayed and Lodi Dynasties – important examples for each period.

UNIT IV **12**

PROVINCIAL STYLE

Development of the provincial styles in different regions – Punjab, Jaunpur, Bengal, Gujarat, Malwa, the Deccan (Bijapur, Golconda, Bidar and Gulbarga) – Important examples for each style.

UNIT V **6**

MUGHAL STYLE

Development of the Mughal style under the different rulers – Babur, Shershah, Humayun, Akbar, Jahangir, Shahjahan, Aurangzeb – important examples – development of the Mughal garden – important examples.

TOTAL: 45 PERIODS

Text Books:

1. Brown Percy, “Indian Architecture (Islamic Period)” Taraporevalla and Sons, Bombay, 1983.
2. Satish Grover .The Architecture of India(Islamic) Vikas Publishing House Pvt Ltd. New Delhi

References:

1. "Architecture of the Islamic World" – George Michell – its history and social meaning, Thames and Hudson, London, 1978.

2. "Islamic Architecture, Form, Function and Meaning", Robert Hillenbrand, Edinburgh University Press, 1994.

3. Christopher Tadgell – "The History of Architecture in India" – Penguin Books (India) Ltd., New Delhi, 1990.

4. Satish Grover, "The Architecture of India (Islamic)" Vikas Publishing House Pvt. Ltd., elk New Delhi, 1981.

5. R. Nath – "History of Mughal Architecture" – Abhinav Publications – New Delhi – 1985.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Understand*** the origin of various civilization and Architecture in India at different points of time
CO2	***Understanding*** the architectural responses with respect to materials, technology, style and character in the Buddhist, Hindu and Dravidian Architecture
CO3	***Understand*** the emergence of Islamic Architecture, form and function of different structures and the underlying geometry and concepts of decoration and colour.
CO4	***Gain Knowledge*** on the history related to design thinking, cultural aspiration, social needs, and the evolution of the built environment
CO5	An understanding of the diversity of architecture in India and sensitivity towards its syncretic aspects
C06	Ability to appreciate particular cultural, symbolic, spatial and material qualities in architecture and cities as givers of meaning and continuity.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	M			M	H	H		H
	CO2				M						L	H	
	CO3									M		M	
	CO4		L			L						M	
	CO5	H	M		M				M		H	W	H
	C06												
3	Category	Professional Core (PC)											
4	Approval	31st Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 403	DESIGN OF STRUCTURES II	3	0	0	3

OBJECTIVES:

- To inform about the methods of design through working stress and limit state methods.
- To use the above two methods for the design of Concrete beams and slabs under various conditions.
- To use the limit state method for design of a concrete staircase.
- Case studies and models wherever applicable.

UNITI **9**

DESIGN OF CONCRETE MEMBERS AND WORKING STRESS

DESIGN OF BEAMS

Concept of Elastic method, Ultimate Load Method and Limit State Method – Advantages of Limit State Method over other methods. Analysis and Design of Singly and Doubly reinforced rectangular and flanged beams for bending.

UNITII **8**

LIMIT STATE DESIGN OF BEAMS

Analysis and design of singly and doubly reinforced rectangular and flanged beams for Bending – Design of Continuous beams using IS code co-efficient.

UNIT III **10**

LIMIT STATE DESIGN OF SLABS

Behavior of one way and two way slabs – Design of one way and two way slabs for various edge conditions - Corner effects.

UNIT IV **12**

DESIGN OF CIRCULAR SLABS

Design of Simply supported and fixed Circular slabs subjected to uniformly distributed loads.

UNIT V **6**

DESIGN OF STAIRCASE BY LIMIT STATE METHOD

Types of Staircases – Design of Dog Legged Staircase.

TOTAL: 45 PERIODS

OUTCOMES:

At the end of the course, the student should be able to:

- Understand the different concepts of WSM and LSD methods using the codal provisions.
- RC beams and slabs to be designed by applying the above concepts.
- Dog legged staircase design using LSD.

TEXTBOOK:

1. S.N. Sinha, Reinforced Concrete Design – Tata McGraw Hill Publishing Co. Ltd.,New Delhi,1998.

2. Shah, Reinforced Concrete, Vol. 1 and 2 – Charotar Publishing House, Anand, 1998.

REFERENCES:

1. P.Dayaratnam, Design of Reinforced Concrete Structures, Oxford and IBH Publishing Co., 1983.

2. C. Sinha and S.K. Roy, Fundamentals of Reinforced Concrete, S.Chand & Co., New Delhi, 1983.

3. Dr. B.C. Punmia, Reinforced Concrete Structures, Vol, 1 & 2 Laxmi publication, Delhi, 2004.

4. IS 456:2000, Indian Standard, Plain and Reinforced Concrete – Code of Practice, Bureau of Indian Standards.

5. S. Unnikrishnan Pillai and Devados Menon, Reinforced Concrete Design – Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1999.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Design*** the Pre stressed members
CO2	***Explain*** the design concepts of Shells and folded plates
CO3	***Analyze*** the behavior of steel and R.C.C structural members
CO4	***Design*** the steel connections.
CO5	***Design*** the R.C.C structural members
C06	Understand the different concepts of WSM and LSD methods using the codal provisions

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M	H	M			M	H	H		H
	CO2					H					L	H	
	CO3					L	H					M	
	CO4	L	L			L							
	CO5	L	M	M	M				M		H		H
	C06				L		M						
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 404	SITE PLANNING & LANDSCAPE ARCHITECTURE	0	0	4	3

OBJECTIVES:

- To teach the importance of site and its content in architectural creations
- To orient the students towards several influencing factors which govern the siting of a building or group of buildings in a given site.
- To teach various techniques of site analysis through exercises and case studies.
- To teach the students the methodology of preparing a site analysis diagram. This will serve as a prelude to any architectural creation through exercises.

UNIT I **9**

INTRODUCTION

Definition of plot, site, land and region, units of measurements. Introduction to survey, methods of surveying, where they are used, Surveying Instruments and their application. Need for surveying. Measuring and drawing out a site plan from the measurements

UNIT II **8**

SITE DRAWINGS

Computation of area by geometrical figures and other methods. Drawing marking out plan, layout plan and centerline plan – Importance, procedure for making these drawings and dimensioning. Setting out the building plan on site – Procedure and Precautions. Exercises on the above.

UNITIII **12**

SITE ANALYSIS

Importance of site analysis; On site and off site factors; Analysis of natural, cultural and aesthetic factors – topography, hydrology, soils, vegetation, climate, surface drainage, accessibility, size and shape, infrastructures available - sources of water supply and means of disposal system, visual aspects; Preparation of site analysis diagram. Study of microclimate:- vegetation, landforms and water as modifiers of microclimate. Study of land form;- contours, slope analysis, grading process, grading criteria, functional and aesthetic considerations – Case studies and exercises on the above.

UNITIV **10**

SITE CONTEXT

Context of the site. Introduction to existing master plans land use for cities, development control Rules. Preparation of maps of matrix analysis & composite analysis. Site selection criteria for housing development, commercial and institutional projects - Case studies.

UNIT V **6**

SITE PLANNING AND SITE LAYOUT PRINCIPLES

Organization of vehicular and pedestrian circulation, types of roads, hierarchy of roads, networks, road widths and parking, regulations. Turning radii & street intersections

TOTAL: 45 PERIODS

OUTCOMES

- The contextual importance on site analysis can be understood based on the various site factor with respect to the study area.
- A first hand understanding of site drawings for Landscape Architecture and Urban design is
- studied.
- Various scientific and analytic site analysis techniques is understood.
- A methodological approach for preparation of master plans for small scale and large scale projects can be understood.

TEXTBOOK:

1. Kevin Lynch - Site planning - MIT Press, Cambridge, MA - 1984.

2. Edward. T. Q. Site Analysis – Architectural Media, 1983

REFERENCES:

1. B.C.Punmia - Surveying Vol.I - Standard Book House, New Delhi - 1983.

2. P.B.Shahani - Text of surveying Vol.I, Oxford and IBH Publishing Co – 1980

3. Joseph De.Chiarra and Lee Coppleman - Urban Planning Design Criteria – Van Nostrand Reinhold Co., 1982

4. Storm Steven, Site engineering for landscape Architects, John wiley & Sons Ine, 2004.

5. Development Control Rules – CMDA, 2008.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Illustrate the application of various types of surveys in buildings
CO2	Survey a site or building
CO3	Analyse a site with respect to various aspects
CO4	Design and Develop a site plan
CO5	Outline the Environmental factors related to site planning
C06	Understand the Sensitivity towards aspects of site at macro and micro contexts.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	M			M	H	H		H
	CO2	L		M		H					L	H	L
	CO3									M			
	CO4		L							M			
	CO5	H	M		M				M		H		H
	C06						L					M	
3	Category	Professional Core (PC)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 405	CLIMATE & BUILT ENVIRONMENT	3	0	0	3

OBJECTIVES:

At the end of this course the student is expected to understand what constitutes the environment, what are precious resources in the environment, how to conserve these resources, what is the role of a human being in maintaining a clean environment and useful environment for the future generations and how to maintain ecological balance and preserve bio-diversity. The role of government and non-government organization in environment managements.

UNIT I **9**

INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES

Definition, scope and importance of environment – need for public awareness - Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

Field study of local area to document environmental assets – river / forest / grassland / hill /mountain.

UNIT II **8**

ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY

Concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the

(a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems

(ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographically classification of India

– value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option

values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hotspots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

Field study of common plants, insects, birds; Field study of simple ecosystems – pond, river, hill slopes, etc.

UNITIII **10**

ENVIRONMENTAL POLLUTION

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides.Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT IV **12**

SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies.

– wasteland reclamation – consumerism and waste products – environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act – enforcement machinery involved in environmental legislation- central and state pollution control boards- Public awareness.

UNIT V **6**

HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.

TOTAL: 45 PERIODS

OUTCOMES:

1. Students are sensitized on the need for natural resource management, and sustainable lifestyles
2. Students appreciate the value of ecosystem and the need and methods for conserving the same.
3. Students understand the how pollution and hazards can be mitigated.

TEXT BOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.
2. Erach Bharucha, "Text book of Environmental Studies", University Press, Hyderabad, 2006.
3. Anubha Kaushik and Kaushik C.P., " Perspectives in Environmental Studies" New age International (P) Ltd., New Delhi, 2005
4. Venugopala Rao.P, " Principles of Environmental Science and Engineering" Prentice Hall of India Pvt. Ltd., New Delhi, 2006.

REFERENCES:

1. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
2. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi,2007
3. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press,2005
4. Richard T. Wright, "Environmental Science" Prentice Hall of India Pvt. Ltd., New Delhi,

COURSE OUTCOMES (COs)	
The student will be able	
CO1	To understand what constitutes the environment and how to conserve it.
CO2	To analyse the need for natural resource management, and sustainable lifestyles
CO3	To evaluate the value of ecosystem and the need and methods for conserving the same.
CO4	To understand the how pollution and hazards can be mitigated.
CO5	To analyse with case studies on various social causes and understand the need to spread and learn more about the causes and the ways to prevent them.
C06	An overview of important regulations and bylaws

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M	H	M				H	H		H
	CO2			M					M		L	H	L
	CO3					L		H		M		M	
	CO4					L	L			M		M	
	CO5	H	M		M				M		H		H
	C06						M						
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 406	MATERIALS AND CONSTRUCTION III	2	0	4	4

OBJECTIVES:

- To give an introduction to cement and concrete as materials for building construction.
- To help understand the principles, types, methods of construction and applications of concrete for structural and non-structural building components.
- To enable design and detail using concrete in buildings

1 CEMENT **10**

Varities of cement,compostion,properties and uses - brief study on manufacture of portland cement - tests for cement - mortar for various works.

2 CONCRETE,ITS INGREDIENTS MANUFACTURE & PROPERTIES **15**

Ingredients - suitability requirementsd for aggregates, grading of aggregates - role of water in concrete - reinforcement - admixtures - properties of concrete. Manufacture of concrete and concreting - mix proportioning - batching, mixing, transporting, placing, compaction, curing formwork - quality control - outline of tests for concrete - joints in concrete - concrete finishes.

3 SPECIAL CONCRETE AND CONCRETING METHODS **15**

Lightweight, high density, fibre reinforced, polymer concrete - outline of manufacture, properties and uses of the above - ready mixed concrete - grunting - cold weather and underwater concreting - current developments in concrete products and methods of concreting.

4 CONCRETE CONSTRUCTION **15**

Introduction to frames structures.

Concrete in foundations - types of footings - isolated, combines, continious,strip. Concrete floors, walls and partitions. Concrete Lintels, arches, sunshades Concrete slabs - types - concrete beams and columns.

5 CONCRETE STAIRCASES **20**

Factors involving staircase design - types of staircases like straightflight, doglegged, quarterturn, bifurcated,spiral,helical, etc. - different support conditions like inclined slab,cranked slab,continuous,cantilever - foundations, finishes for staircases- detailing out of handrails and balusters. Designing and detailing for physically handicapped.

TOTAL: 45 PERIODS

TEXTBOOKS:

1. M.S.Shetty, Concrete Technology, S.Chand & Co.ltd,New Delhi,1986.
2. S.C.Rangwala, Engineering Materials, Charotar Publishing House, India, 1997.
3. Dr.B.C.Punmia, Building Construction, Laxmi Publications Pvt.Ltd., New Delhi, 1993.
4. Arthur Lyons - Meterials for Architects and Builders - An introduction Arnold, London,1997.
5. Don A.Watson, Construction Materials and Process, McGraw Hill Co.,1972.
6. Jack M.Launders, Construction Materials and Methods Careers, South Holland, Illinois, Wilcox Co.Ltd.,1986.
7. Francis D.K.Ching, Building Construction Illustrated VNR.1975.
8. Alan Banc, Stairs, Steps and Ramps, Butterworth Heinemann Ltd.,1996.

WEBSITES:

http://dir.yahoo.com/Business-and -
Economy/companies/construction/concrete/materials

http://www.easyads.co.2a/yellow/india/construct

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Explain*** the composition, properties, and tests for cement
CO2	***Summarize*** the ingredients, properties ,quality control of concrete and its construction process
CO3	***Create*** detailed drawings of footing, lintels, beams and slabs
CO4	Ability to use concrete as a versatile material in different contexts and to use it innovatively in simple projects.
CO5	An understanding of the concepts of concrete as a building construction material
C06	Ability to design and detail specific components in concrete where there is scope for architectural design.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	M			M	H	H		H
	CO2			M	M						L		L
	CO3									M			H
	CO4		L			L	H			M		M	H
	CO5		M	M	M				M		H	W	H
	C06	H				M		L					
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 5LI	ARCHITECTURAL DESIGN – V	0	0	13	6

UNIT I

DESIGN STUDIO

Small complexes – multi planning circulation analysis – massing problems involving building technology – Design and detailing for movement of physically handicapped and elderly persons within and around buildings, examples, shopping center (Commercial) apartments (Residential) Nursing home (Institutional) home for aged. Introduction to three dimensional modeling of spaces using computer. Construction and manipulation of three dimensional building data bases, Rendering 3D images, Presentation techniques.

TOTAL:180 PERIODS

References:

1. Edward D. Mills, "Planning, 4 volumes", Newnes, Butterworths, London, 1976.
2. E and O.E. "Planning", Liffee Books Ltd., London, 1973.
3. "National Building Code" IST
4. De Chiara Callender, "Time Saver Standard for Building Types", McGraw Hills Co., 1973.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Demonstrate*** the concept of passive design in built environment
CO2	Ability to critically understand and address issue of resources.
CO3	***Analyze*** the impact of spatial configuration at building level and at site level on passive design.
CO4	***Analyze*** and interpret different case buildings.
CO5	***Design*** and development energy efficient buildings.
C06	***Develop*** working drawings and model displaying energy efficient and green building technologies.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			M			M	H	H		H
	CO2			M	M						L		
	CO3									M			H
	CO4		L			L	H			M		M	
	CO5		M	M	M						H		H
	C06	H				M		L					
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	25th Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 501	BUILDING SERVICES III	3	0	0	3

UNIT I **9**

BASIC REFRIGERATION PRINCIPLES

Thermodynamics – Heat – Temperature, measurement transfer – Change of state – Sensible heat – Latent of fusion, evaporation, sublimation – Saturation temperature – Super heated vapor – sub cooled liquid pressure temperature relationship for liquids – Refrigerants.

UNIT II **8**

REFRIGERATION CYCLE AND SYSTEM COMPONETNS

Vapor compression cycle – compressors – evaporators – Refrigerant control devices – electric motors – starters – Air handling units – Cooling towers.

UNIT III **10**

AIR-CONDIONING SYSTEM AND APPLICATIONS

Window type and package air-conditioners – chilled water plant – fan coil systems – water piping – cooling load – Air-conditioning systems for different types of buildings –Protection against fire to be caused by A.C. systems.

UNIT IV **12**

FIRE SAFETY – GENERAL PROVISIONS

Causes of fire in buildings – safety regulations – NBC – Planning considerations in buildings like Non-combustible materials, construction, staircase and life lobbies, fire escapes and A.C. systems. Special features required for physically handicapped and elderly in building types.

UNIT V **6**

FIRE DETECTION AND FIGHTING INSTALLATIONS

Heat and smoke detectors – Fire Alarm system, snorkel ladder – Fire lighting pump and water storage – Dry and Wet risers – Automatic sprinklers.

TOTAL: 45 PERIODS

Text Books:

1. William H. Severns and Julian R. Fellows, "Air conditioning and Refrigeration", John Wiley and Sons, London, 1988.

References:

1. A.F.C. Sherratt. "Air conditioning and Energy Conservation", The Architectural Press, London.
2. "National Building Code".

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Illustrate*** the basics of building management systems, scope and its importance.
CO2	***Outline*** the basics of BIM and Controllers.
CO3	***Categorize*** all the aspects of BMS and its role in advanced building services.
CO4	***Assess*** the components of BMS and its application in buildings
CO5	***Summarize*** the various technological advancements, current trends in BMS
C06	Ability to integrate services in buildings.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	M			M	H	H		H
	CO2			M	M	H					L		L
	CO3					L				M			H
	CO4		L			L	H			M		M	H
	CO5		M	M	M				M		H	W	H
	C06	H				M		L					
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/ S	C
BAR 402	HISTORY OF ARCHITECTURE – V	3	0	0	3

UNIT I **9**

LEADING TO A NEW ARCHITECTURE

Historical overview – Origins if Neo-Classicisms – Enlightenment Architects: Boulle and Ledoux. Beginning of New Extra – Industrial Revolution & its impart – Materials & Technology's History of Steel concrete glass.

UNIT II **8**

REVIEWING INDUSTRIALIZATION

Architecture Industrial Exhibition Arts and Crafts Movement in Europe and America – Art Nouveau and the works of Gaudi, Horta, Guimard, Macintosh – Early works of F.L. Wright.

UNIT III **10**

ISSUES OF ORNAMENTATION AND AESTHETICS

Adolf loos and the Arguments on Ornamentation – Futurists Movement Manifestos and the works of Sant Elia – Expressionism and the works of Mendelssohn, Taut, Polzeig – Cubism and Constructivism and its influence on Architecture – De stijl : Ideas and works.

UNIT IV **12**

INSTITUTIONS

Werkbund and Bahaus/Works of Behrens and Gropius – Cannonising Modernism – International Style – CIAM Congresses and Declarations.

Works and Ideas – Le Corbusier – Mies – Later Works of Wright – Alvar Alto.

UNIT V **6**

ARCHITECTURE IN COLONIAL INDIA

Colonialism and its impact – Early British Neo – classical Architecture – Indo – Sarcenic Architecture and the works of Chisholm – P.W.D. and the Institutionalisation of Architecture – Building New Delhi.

TOTAL: 45 PERIODS

Text Books:

2. Mechy Design – "Architecture after Independence".

References:

1. Leonardo Benevolo, “History of Modern Architecture”, 2 Vols. Routledge & Kegan Paul, London, 1971.

2. Manfredo Taferi/Franceso dal co., “Modern Architecture”, Faber and Faber / Electra, 1980.

3. Sigfried Giedion, “Space Time and Architecture”. The Growth of a New Tradition, Harvard University Press, 1978.

4. Thomas Metcalf, “An Imperial Vision”, Faber and Faber, London. 1989.

5. Tzonis Alexander – Santiago Calatrava International Publication

6. Kenneth Frampton, “Modern Architecture”. A Critical History, Thames and Hudson, London 1994.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Differentiate*** the chronological development of architectural style in relation with the material development and cultural change.
CO2	***Interpret*** the spatial configuration and three dimensional articulation of master architects
CO3	***Examine*** the contextual design solution, Spatial organization and spatial qualities of different typologies of buildings.
CO4	***Develop*** the knowledge towards logical design development.
CO5	An understanding of modernity as a fundamental transformation in Western society that spread across the world and the resultant architectural production.
C06	An insight into the development of modern architecture.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	M			M	H	H		H
	CO2	L	H	l	M	H					L	H	L
	CO3	H	L			L		L	L	M		M	l
	CO4	H	L			L	M		M	M		M	H
	CO5	H	M	M	M				M		H	W	H
	C06					L							

3	Category	Professional Core (PC)
4	Approval	29th Meeting of Academic Council

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 503	DESIGN OF STRUCTURES III	3	0	0	3

OBJECTIVES:

- To inform about structural design through working stress and limit state methods.
- To enable use of the above two methods for the design of concrete beams and slabs under different conditions.
- To enable use of limit state method for design of a concrete staircase.

UNIT I **9**

LIMIT STATE DESIGN OF RCC COLUMS

Code provisions – design of axially loaded short and long columns of rectangular and circular sections – ties and spiral reinforcements.

UNIT II **8**

LIMIT STATE DESING OF BEAMS, SLABS AND STAIRCASE

Limit state design of continuous beams and slabs using code coefficients. Types of staircases – design of doglegged staircase.

UNIT III **10**

SEISMIC STUDY AND STRUCTURAL APPLICATION IN BUILDING DESIGN

Introduction of seismic study – identification of seismic zones – effects of earthquake in environment and in built forms – types of structural damages due to seismic effects – precautions in structural design – form and shapes of built forms and structures. Materials related to structural forms – related building codes – safety factors.

UNIT IV **12**

WORKING STRESS DESIGN OF FOUNDATION

Types of foundation – isolated pad footings – combined footings – design principles for rafts, pile foundations. (No design calculations)

UNIT V **6**

WORKING STRESS DESIGN OF RETAINING WALLS

Design of RCC Cantilever retaining walls

TOTAL: 45 PERIODS

Text Books :

1. P. Dayaratnam, “Design of Reinforced Concrete Structure”, Oxford and IBH Publishing Co., 1983.

2. N.C. Sinha and S.K. Roy, Fundamentals of Reinforced Concrete’, S. Chand and Co., New Delhi, 1983.

References:

1. Vazirani and Ratwani, 'Concrete Structures', Khanna Publishers, New Delhi 1969.

2. S.N. Sinha 'Reinforced Concrete Design' Tata McGraw Hill, New Delhi 1998.

3. Ashok K. Jain 'Reinforced Concrete Limit State Design" Nemchand, Bros Roorkeee 1983.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Ability to understand the different concepts of WSM methods using the code provisions
CO2	Ability to understand the different concepts of LSD methods using the code provisions
CO3	Ability to design RCC beams and slabs by applying the aboveconcepts.
CO4	Ability to design RCC slabs by applying the aboveconcepts.
CO5	Ability to design RCC dog legged staircase design usingLSD.
C06	Ability to design RCC foundation.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		M				H	H		H
	CO2			M		H					L		
	CO3					L				M			
	CO4					L				M		M	
	CO5	H		M	M				M		H	W	H
	C06						H	H					
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 5E1	ELECTIVE I- ENERGY EFFICIENT ARCHITECTURE	3	0	0	3

OBJECTIVES:

- To inform the need to use alternative sources of energy in view of the depleting resources and climate change.
- To familiarise the students with simple and passive design considerations
- To inform about the importance of day lighting and natural ventilation in building design
- To make the students aware of the future trends in creating sustainable built environment.

UNIT I **9**

PASSIVE DESIGN

Significance of Energy Efficiency in the contemporary context, Simple passive design considerations involving Site Conditions, Building Orientation, Plan form and Building Envelope - Heat transfer and Thermal Performance of Walls and Roofs

UNIT II **8**

ADVANCED PASSIVE ARCHITECTURE- PASSIVE HEATING

Direct Gain Thermal Storage ofWall and Roof - Roof Radiation Trap - Solarium - Isolated Gain

UNIT III **10**

PASSIVE COOLING 8

Evaporative Cooling - Nocturnal Radiation cooling - Passive Desiccant Cooling - Induced Ventilation - Earth Sheltering - Wind Tower - Earth Air Tunnels

UNIT IV **6**

DAY LIGHTING AND NATURAL VENTILATION

Daylight Factor - Daylight Analysis - Daylight and Shading Devices - Types of Ventilation - Ventilation and Building Design.

UNIT V **12**

CONTEMPORARY AND FUTURE TRENDS 12

Areas for innovation in improving energy efficiency such as Photo Voltaic Cells, Battery Technology, Thermal Energy Storage, Recycled and Reusable Building materials, Nanotechnology, smart materials and the future of built environment, Energy Conservation Building code.

TOTAL: 45 PERIODS

OUTCOMES:

- The students are exposed to alternative sources of energy and are exposed to passive design considerations
- An understanding on day lighting and natural ventilation in design in addition to the future trends in creating sustainable built environment

TEXTBOOK:

1. Manual on Solar Passive Architecture, IIT Mumbai and Mines New Delhi - 1999
2. Arvind Krishnan & Others, Climate Responsive Architecture, A Design Handbook for Energy Efficient Buildings, TATA McGraw Hill Publishing Company Limited, New Delhi, 2001
3. Majumdar M, Energy Efficient Building in India, TERI, 2000.

REFERENCES:

1. Fuller Moore, Environmental Control Systems, McGraw Hill INC, New Delhi - 1993
2. Sophia and Stefan Behling, Solpower, the Evolution of Solar Architecture, Prestel, New York, 1996
3. Givoni .B, Passive and Low Energy Cooling of Buildings, Van Nostrand Reinhold, New York, 1994
4. The energy efficient home: a complete guide by PatrickWaterfield, Crowood press ltd.
5. Dean Hawkes, Energy Efficient Buildings:Architecture, Engineering and Environment, W.W. Norton & Company
6. David Johnson, Scott Gibson, Green from the Ground Up: Sustainable, Healthy and Energy efficient home construction, Published April 2008 by Tauton.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Demonstrate*** the concept of passive design in built environment
CO2	Ability to critically understand and address issue of resources.
CO3	***Analyze*** the impact of spatial configuration at building level and at site level on passive design.
CO4	***Analyze*** and interpret different case buildings.
CO5	***Design*** and development energy efficient buildings.
C06	***Develop*** working drawings and model displaying energy efficient and green building technologies.

Mapping of Course Outcomes with Program Outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			M			M	H	H		H
	CO2			M	M						L		
	CO3									M			H
	CO4		L			L	H			M		M	
	CO5		M	M	M						H		H
	C06	H				M		L					
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	25th Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 5E1	ELECTIVE I- THEORY OF DESIGN	3	0	0	3

OBJECTIVES:

- To understand design and the role of the designer in changing society.
- To familiarize the students with methodologies, theories and models of the design process.
- To inform students about the term creativity and introduce techniques which will enable creative thinking.
- To inform the approaches that generate ideas for architectural design and the importance of the participatory approach to design.

UNIT I **9**

INTRODUCTION TO DESIGN

Definition and understanding of design- design in history -changing role of designer on society different classifications of design according to scale, process, mode of production, etc.,

UNIT II **8**

DESIGN METHODOLOGY MOVEMENT

Context for the rise of the design methodology movement- theories of the first generation and the second generation design methodologists- various models of the design process- focus on the design problem: ideas of escalation/regression and wicked problem.

UNIT III **10**

CREATIVE THINKING

Understanding the term creativity- theories on thinking: left brain/ right brain, convergent and divergent thinking, lateral and vertical thinking- design spectrum from the logical to chance - blocks in creative thinking- various techniques to generate creativity

UNIT IV **12**

ARCHITECTURAL CREATIVITY

Design puzzles and traps - approaches to generate ideas for architectural design - types of concepts- personal philosophies and strategies of individual designers - channels to creativity in architecture

UNIT V **6**

DESIGN AND PEOPLE

Concept of pattern language- participatory approach to design - design as process

TOTAL: 45 PERIODS

OUTCOMES:

An ability to think about architecture as one of the many fields under the broader ambit of design as a fundamental human activity.

TEXTBOOK:

1. Geoffrey Broadbent - Design in Architecture - Architecture and the human sciences - John Wiley & Sons, New York, 1981.

2. Bryan Lawson - How Designers Think, Architectural Press Ltd., London, 1980.

3. Anthony Antoniades, Poetics of architecture- Theory of design

4. Paul Alan Johnson, Theory of Architecture- Concepts, Themes,Wiley 2008 VNR, 1994

5. Christopher Alexander, Pattern Language, Oxford University Press,1977

6. James C. Snyder, Anthony J. Catanese, Timothy L. McGinty- Introduction to Architecture, McGraw Hill 1979.

REFERENCES:

1. Victor Papanek, Design for the real world

2. Edward De Bono, Lateral Thinking, Penguin, 1990.

3. Design methods- Christopher Jones, Wiley, 1980.

4. Tom Heath - Method in Architecture, John Wiley & Sons, New York, 1984.

5. Nigel Cross - Developments in Design Methodology, John Wiley & Sons, 1984.

6. Evans, Helen Marie; Dumesnil, Carla Davis- An Invitation to Design, Macmillan Publishing Co., New York, 1982

COURSE OUTCOMES (COs)	
The student will be able	
CO1	An ability to think about architecture as one of the many fields under the broader ambit of design as a fundamental human activity.
CO2	Focuses on the aesthetic and **function** of the structure.
CO3	It's **design** works to create a space that flows with its surroundings.
CO4	The infinite variety of these spaces can be as varied as life itself
CO5	**design theory** is a system of ideas that explains how and why **design** works.
CO6	To know how everything they put on a page communicates, influences, directs, invites, entices and excites an audience

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	a	b	c	d	e	f	g	h	i	j	k	l
	CO2	H					M			M			
	CO3		L			L					H		
	CO4	M		M				L					
	CO5		L				M						M
3	Category	PE											
4	Approval	27THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 5L2	COMPUTER STUDIO II	0	0	4	3

OBJECTIVES:

- To introduce Computer operation principles and explore image editing through a visual composition using graphics.
- To impart training in Computer aided 2D drafting and 3D Modeling through projects
- To enable the rendering of a building so as to create a photo realistic image.

UNIT I **10**

INTRODUCTION TO COMPUTER AND IMAGE EDITING

Technology of small computer system, computer terminology operation principles of P.C., introduction to application software, and graphic system, and use of printers, scanner, plotter, File management, etc. Understanding Bitmap images and Vector Graphics, Image size and Resolution. Basic Tools for Editing and Creating Graphics.

UNIT II **15**

THE BASICS OF BUILDING MODELLING

Creating a basic floor plan, About Temporary Dimensions, Adding and Modifying Walls, Working with Compound Walls, Using Editing Tools, Adding and Modifying Doors, Adding and Modifying Windows

UNIT III **20**

VIEWING THE BUILDING MODEL

Understanding the drawing unit's settings, scales, limits, drawing tools, drawing objects, object editing, and text, dimensioning. Transparent overlays, hatching utilities, line type, line weight and colour. Multiline, Polyline, etc. Styles, blocks and symbol library.

UNIT IV **15**

INTRODUCTION TO 3D MODELLING

Project: Create 3D sculpture using 3D primitives (cubes, spheres etc.)

Tools: Slide facilities script attributes, V-port, editing session. Introduction to 3D-modelling technique and construction planes, drawing objects, 3D surfaces setting up elevation thickness and use of dynamic projections.Solidmodelingwith primitive command andBoolean operation.

UNIT V **15**

3D RENDERING AND SETTING

Project: Visualize a building. Explore the potential of lights and camera and use the same in the model created for the final submission. Tools: Rendering and scene setting to create a photo realistic picture,

understanding material mapping, environment setting and image filling. Exercise to identify and visualize a building using the above said utilities.

TOTAL: 75 PERIODS

OUTCOMES:

- The students benefit by learning software which helps them to better visualize complicated forms and also helps in producing photo realistic images of those 3D forms.

TEXTBOOK:

1. Photoshop 7Bible ProfessionalEdition,Wiley John&Son INC,NewYork,Deke McClelland, 2000.

2. AutoCAD architectural user guide – Autodesk Inc., 1998.

3. A. Watt, Fundamentals of Three-Dimensional Computer Graphics, Addis Wesley, Massachusetts, 1989.

REFERENCES:

1. The Illustrated AutoCAD 2002 Quick Reference, Ralph Grabowski,

2. Autocad 2000: A Problem-Solving Approach, Sham tikoo. Pub: Thomson Learning, 1999.

3. 3D MAX - 6 Bible, Wiley, 2004.

CO1	To ***apply*** softwares in the field of Architecture to represent design ideas.
CO2	***Produce*** 2D technical drawings using AutoCAD
CO3	***Develop*** the 3D model of buildings & objects using AutoCAD and Sketch Up
CO4	***Recreate*** realistic image of objects and buildings by using presentation software.
CO5	Sheet set ***organization*** and plot/print drawing to the scale. In photoshop
C06	Ability to develop knowledge.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M	H	M			M	H	H		H
	CO2			M	M	H					L	H	L
	CO3					L		M					
	CO4	H	L			L		M					
	CO5	H	M	M	M				M		H		H
	C06					L							
3	Category	ProfessinalAbilityEnhancement Courses (PAEC)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 504	MATERIALS AND CONSTRUCTION – IV	2	0	4	4

UNIT I

FERROUS METALS **5**

Brief study on manufacture,properties and uses of cast iron,wrought iron,pig iron and steel - anticorrosive measures for steel - mechanical and heat treatment of steel - market forms of steel - structural steel, stainless steel, steel alloys - properties and uses - current developments.

UNIT II

STEEL CONSTRUCTION **10**

Structural steel sections - types of connections in steel - steel in foundations, columns and beams - different types of steel roof trusses including northlight truss - space frames - materials for roofcovering. Steel staircases and handrails,balusters. Steel doors and windows - openable, sliding - collapsible gates - rolling shutters. Steel in furniture and other interior uses. Detailing and specification for physically handicapped.

UNIT III

NON FERROUS METALS **15**

Aluminium and Aluminium Alloys - brief study on manufacture,properties and uses - Aluminium products - extrusions,foils,castings,sheets,etc.-tin and lead,properties and uses - current developments.

UNIT III

CONSTRUCTION USING NON-FERROUS METALS **20**

Aluminium doors - openable, sliding, pivoted.

Aluminium windows -

openable,sliding,fixed,pivoted.

Aluminium ventilators - top hung,bottom

hung,pivoted,louvred,fixed. Aluminium partitions,false

ceiling,shopfront handrails,curtainwalling. Aluminium roofing -

northlight glazing bar ,Aluminium roofing sheets.

Use of other nonferrous metals like copper,bronze,brass,etc.,in architectural construction. Detailing and specification for physically handicapped.

UNIT III

PLASTICS 10

Thermoplastics and thermosets - properties and architectural uses of plastics - structural plastics - reinforced plastics and decorative laminates - plastic coatings,adhesives and seatants - modifiers and plasticzers - fillers and stablizers - fabrications of plastics. Primary plastic building products for walls,roof and partitions -

secondary building products for rooms,windows,roof lights, domes,gullers handrails.

TOTAL:60 PERIODS

TEXTBOOKS:

1. .C.Rangwala,Engineering Materials, Charotar Publishing House,India,1997.
2. B.C.Punmia,Building Construction,laxmi Publications Pvt.Ltd.,New Delhi,1993.
3. Arthur Lyons - Materials for Architects and Builders - An Introduction - Arnold,London,1997.
4. Don A.Watson,Construction Materials and processes,McGraw Hill Co.,1972.
5. Harold B.Olin,Construction Principles materials and Method, The Institute of Financial Education, Chicago,1980.
6. Time Saver Standards for Architectural Design Data,Callendar JH,McGraw Hill,1974.

WEBSITES

http://www.britmetfed.org.uk/medu.html

http://www.indiabussinesSonline.com

http://www.nrwas.com

http://www.arcadiaproducts.com

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Identify*** the appropriate Ferrous and Non-Ferrous materials in construction.
CO2	***Identify*** appropriate construction techniques using Ferrous and Non-Ferrous materials in construction
CO3	***Assess*** the suitable steel roof truss for different spans of industrial buildings.
CO 4	***Detailed drawings of Ferrous and Non Ferrous, Glass based building components***
CO5	***Apply the property of glass towards "Energy conservation***
C06	***Knowledge of properties of ferrous and non-ferrous metals as materials for buildings***

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M	H				M		H		H
	CO2	L	H		M						L	H	L
	CO3	H				L				M			
	CO4	M	L							M			
	CO5		M	M					M		H		M
	C06					H	M						
3	Category	Building Sciences and Applied Engineering (BS &AE)											
4	Approval	32nd Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR6L1	ARCHITECTURAL DESIGN VI	0	0	16	8

OBJECTIVE:

- To introduce buildings as consumers of resources for human needs and to enable responsible, creative addressing of this fact through design choices.
- To enable an understanding of architectural design as integrating diverse functional concerns in a building through analysis and innovation.
- To impart training in the resolving of spatial considerations with other physical aspects such as structures, services and climate.

TOTAL: 240 PERIODS

CONTENT:

Design of large structures – Multiuse multispan – non masonry building types involving buildings – Design and detailing for movement and use by physically handicapped people within and around building technology and services.

Examples: College (Institutional) Office Buildings Resorts – etc., Working drawings for any one design using computers.

OUTCOME:

- Understand issues in buildings with respect to density, services and energy consumption as well as make the right choices in design situations involving these issues.fabric. Ability to bring inclusivity into the architectural design process.

REFERENCES

1. Edward D Mills, “Planning, 4 volumes”, Newnas Butterworths, London 1976.
2. E and OE “planning” 11ffee Books Ltd., London 1973.
3. National Building Code 151
4. Da Chara and Callandar, “Time saver standards for building type McGraw Hall Col. 1983.
5. Henry J Cowan,foerresr Wilson Structural Systems -Van Nostrand Reinhold Company, London / New York
6.Mario Salvadori Robert Heller Structures in Architecture- Prentice International series in Architecture

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Understand issues in buildings with respect to density, services and energy consumption as well as make the right choices in design situations involving these issues.
CO2	Understand Green Building concepts and basic principles of sustainable built environment.
CO3	Integrating the services in the design
CO4	Design and Produce computer aided presentation drawings and making scale models
CO5	Understanding the impact of design on site and various aspects
C06	Understanding the design and form of building typologies that are the result of
	pressure on urban lands with a thrust on issues like urban land economics, technology

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H		H				L		
	CO2	H	M	L	H		M				L		M
	CO3	M	H	M	H		M						
	CO4	M	M	L									M
	CO5										L		
	C06												
3	Category	Professional Core (PC)											
4	Approval	34th Meeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR601	BUILDING SERVICES IV	3	0	0	3

OBJECTIVE:

- To introduce the condition of modernity and outline its impact on society, cities and architecture.
- To give a detailed understanding of modern architecture as new expression with different strands rising from various aspects and effects of modernity.
- To create an overall understanding of the architectural developments in India rising out of colonial modernity and nationalism.

UNIT I	FUNDAMENTALS	6

Sound waves, frequency, intensity, wave length, measure of sound, decibel scale, speech and music frequencies, human ear characteristics – Tone structure.

UNIT II	SOUND TRANSMISSION AND ABSORPTION	9

Outdoor noise levels, acceptable indoor noise levels, sonometer, determinate of density of a given building material, absorption co-efficients and measurements, choice of absorption material, resonance, reverberation, echo, exercises involving reverberation time and absorption co-efficient.

UNIT III	NOISE CONTROL AND SOUND ABSORPTION	9

Types of noise, transmission of noise, transmission loss, noise control and sound insulation, remedial measures and legislation.

.

UNIT IV	CONSTRUCTIONAL MEASURES	12

Walls/partitions, floors/ceilings, window/doors, insulating fittings and gadgets, machine mounting and insulation of machinery.

UNIT V	ACOUSTICS AND BUILDING DESIGN	9

Site selection, shape, volume, treatment for interior surface, basic principles in designing open air theatres, cinemas, broadcasting studios, concert halls, class rooms, lecture halls and theatres.

TOTAL: 45 PERIODS

OUTCOMES:

- Identify the sound insulation materials in design
- Collection of sound proof materials

REFERENCES:

1. Dr. V. Narasimhan – "An Introduction to Building Physics" – Kabeer printing Works, Chennai – 5. 1974.

2. D.J. Groomet – "Noise, Building and People" – Pergumon Press – 1997.

3. Thomas D. Northwood – "Architectural Acoustics" – Dowden, Hutchinson and Ross Inc. 1997.

4. Peter Templeton and Saunders- Detailing for Architectural acoustics – Architectural press Acoustical design for Auditoriums – IS 2526 ISI 1963

5.S.L .Suri Acoustics Design and Practice Asia Publishing house

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Identify the sound insulation materials in design
CO2	Collection of sound proof materials
CO3	Analyse the materials with respect to various aspects
CO4	Design and Develop in a building
CO5	To understand the usage of materials in sound proof building for auditorium and lab
CO6	Understand the design methodology

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H		M							
	CO2			H									L
	CO3		H	L					M			L	
	CO4		H	L									
	CO5		H	L									L
3	C06												
4	Approval	34THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR602	HISTORY OF ARCHITECTURE – VI	3	0	0	3

OBJECTIVE:

- To introduce the condition of modernity and outline its impact on society, cities and architecture.
- To give a detailed understanding of modern architecture as new expression with different strands rising from various aspects and effects of modernity.
- To create an overall understanding of the architectural developments in India rising out of colonial modernity and nationalism.

UNIT I	CRITIQUING MODERNISM	6

Challenging CIAM declaration: Team X and Brutalism – Writing of Venturi – Jane Jacobus – Aldo Rosi – Christopher Alexander.

UNIT II	AFTER MODERNISM	9

Conditions of POST – Modernity – Tools of New Architecture: Collage, Technology and New Science – Canonization of Post – Modernist Architecture – Historic Revivalism – Pop Architecture – Critical Regionalism – Deconstructivist Theory and Practice.

UNIT III	ALTERNATIVE PRACTICE	9

Ideas and Works of Fathy – Baker – Ando – Soleri – Bawa.

.

UNIT IV	POST – INDEPENDENT ARCHITECTURE IN INDIA	12

Chandigarh and Bhuvaneswar experiments – Influence of Corbusier, Louis Kahn, Koenigsberger – The formation of Institutions – Debates on Tradition as source and burden – works and ideas : Nari Gandhi – Doshi – Kanvinde – Correa – Raje – Jain – Stein Housing and the issues of Appropriate Technology – Architecture in the Horizon.

UNIT V	CONTEMPORARY ARCHITECTURE	9

Overview of larger changes in society from late 20th century and their influence on architecture. Outline of architecture related to parametric design and digital processes, sustainability, globalisation, phenomenology, complexity. Ideas and works of ZHA, contemporary Dutch architecture, Bjarke Engels and BIG, OMA and Rem Koolhaas, Steven Holl, Mcdonough, Yeong, Zumthor, Pallasma, Murcutt. Outline of contemporary architecture in the non Western world. Large scale changes in India from the 90s. Outline of post 1990s architecture of India.

TOTAL: 45 PERIODS

OUTCOMES:

- Differentiate the chronological development of architectural style in relation with the material development and cultural change.

REFERENCES:

1. Aldo Rossi, 'The Architecture of the City", MiT Press, Massachusett 1982.

2. Charles Jencks, "The Language of Post – Modem Architecture", 1984.

3. Christopher Alexander, "Pattern Language", Oxford University Press Oxford.

4. D. Ghirardo, "Architecture After Modernism", Thames and Hudsoi London, 1980.

Robert Venturi, "Complexity and Contradiction in Architecture", The Architectural Press, London,

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Differentiate*** the chronological development of architectural style in relation with the material development and cultural change.
CO2	***Interpret*** the spatial configuration and three dimensional articulation of master architects works.
CO3	***Examine*** the contextual design solution, Spatial organization and spatial qualities of different typologies of buildings.
CO4	***Develop*** the knowledge towards logical design development.
CO5	An understanding of modernity as a fundamental transformation in Western society that spread across the world and the resultant architectural production.
CO6	An insight into the development of modern architecture.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	M			M	H	H		H
	CO2	L	H	l	M	H					L	H	L
	CO3	H	L			L		L	L	M		M	l
	CO4	H	L			L	M		M	M		M	H
	CO5	H	M	M	M				M		H	W	H
4	Approval	34THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 603	COST ESTIMATION	3	0	0	3

UNIT I	INTRODUCTION TO ESTIMATION	6

Quantity survey – Principle of measurement and billing, elementary billing and measurement of basic materials like brick wood, concrete, etc., Advance billing and measurement of basic materials like brick wood, concrete, etc., Advance billing and measurement of structural and service item of work.

UNIT II	COST ESTIMATING	9

Calling Function of cost planner, liaisons with consultant construction planning techniques for efficient cost control or cost budgeting of a project.

Exercise in variation, cost adjustment and cost analysis norms and standard for building project. Relationship between specification with B.O.Q. on ground of cost economics.

UNIT III	COST BUILDING	9

The business environment, and its structure in practice details and information on taxation, depreciation, operation cost, economics of buildings plant and materials handling.

.

UNIT IV	FINANCE AND BUDGETING	12

Financial control and management for building construction and maintenance investment role of various financial agencies for building and land development.

UNIT V	PROJECT EVALUATION	9

Financial of projects, economic feasibility report, valuating depreciation and its implication, and assessment of completed project.

: 45 PERIODS

OUTCOMES:

- To enable understanding with respect to quality and quantity of materials, quantity and classes of skilled and unskilled labours, and tools and plants required for projects.
- To give an understanding of how to draw up specifications for the different items of a building project and also to prepare the schedule of programming of the project.
- To give knowledge on how to prepare approximate as well as detailed estimates and to have a clear picture of the project expenditure.
- To help calculate the exact quantities of items of work done for effecting payment especially when direct measurements are difficult and also to determine the quantities of different materials required for various items of work.
- To give understanding of how to prepare valuation report of real and landed property.
- To give exposure to budgeting in projects.

REFERENCES:

1. Dutta, "Estimating and Costing", S. Dutta and Co., Lucknow
2. S.C. Rangwala, "Elements of Estimating and Costing", Charoter Publishing House, India.
3. W.H. King and D.M.R. Esson, "Specification and Quantities for Civil Engineering", The English University Press Ltd.
4. "T.N. Building Practice", Vol. 1. Civil, Govt. Publication
5. "P.W.D. Standard specification", Govt. Publication.
6. CPWD Specifications- Government of India

COURSE OUTCOMES (COs)	
The student will be able	
CO 1	Understand the unit measurement of materials.
CO2	Understand the techniques of estimating and costing related to building construction.
CO3	Apply and understand the various methods of quantity surveying, rate analysis of building and valuation for different materials used. Calculate material cost of given component/product.
CO4	Know about Specification for basic building material and apply the same for another example
CO5	Understand and apply the concepts of project planning and basics of financial management
CO6	Analysingthe cost of the projects

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H							M				
	CO2		L								M		H
	CO3			M			M			L			
	CO4	H			H			L					H
	CO5		M			H			L				
3	Category	PC											
4	Approval	27THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 604	HUMAN SETTLEMENTS & PLANNING	2	0	2	4

OBJECTIVE:

- To introduce the vocabulary, elements and classification of human settlements.
- To give exposure to planning concepts at different scales of settlements.
- To give an understanding of planning addressing current issues.

UNIT I	INTRODUCTION	6

Elements of Human Settlements – Role of Man and Society in the growth and decay of human settlements

UNIT II	PLANNING CONCEPTS	9

Contribution to planning through – Patric Geddes, Ebenezer Howard – CA Perry – Le Corbusier – Doxiadis – Mumford – Relevance to Indian Planning Practice

UNIT III	URBAN PLANNING	9

Various types of plans, Master plan, Structure plan, Comprehensive plan, subject plan, Zonal Development plan, their scope and content, planning process

UNIT IV	URBAN DEVELOPMENT PROGRAMMING	12

IUDP, IDSMT, Megacity, IFRE, Sustainable City Programme – their context, concept, scope, content and funding mechanism.

UNIT V	RURAL PLANNING	9

Rural settlement structure – Demographic dynamic – micro level planning: Scope and content.

TOTAL: 45 PERIODS

OUTCOMES:

- Understand the origin, evolution and growth of settlements.
- Learn about planning theories by prominent planners.
- Study the planning concepts in planned cities

REFERENCES:

1. C.L. Doxiadis, Ekistios, "An Introduction to the Science of Human Settlements", Hutchinson, London 1968.

2. Madras Metropolitan Development Authority, "Master Plan for Madras Metropolitan Area, Second Master Plan – 1995".

3. Government of India, "Report of the National Commission on Urbanisation" 1988.

4. Ministry of Urban affairs and Employment, Government of India, New Delhi "Urban Development plans: Formulation & implementation" – Guidelines - 1996.

5. Hansen N. "Regional Policy and Regional Integration" Edward Elgar, UK, 1996.

6. Centre for Human Settlements, Anna University, Chennai "Development Plan for Uthokottai Taluk, Cheyyur Taluk", 1999.

7. Andro D Thomas Housing and Urban renewal george Allen and Unwin Sydney

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Understand*** the origin, evolution and growth of settlements.
CO2	***Learn*** about planning theories by prominent planners.
CO3	***Understand*** about the dynamics of Urban Form and various Human Settlements pattern
CO4	***Understand*** Planning process and techniques adopted at various levels.
CO5	***Study*** the planning concepts in planned cities
C06	Arrangement of city pattern

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M				H							
	CO2		M										
	CO3			L									
	CO4				H	M							
	CO5	M											
	C06												M

3	Category	Professional Core(PC)
4	Approval	35th Meeting of Academic Council

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 6E2	SUSTAINABLE ARCHITECTURE I	3	0	0	3

OBJECTIVE:

- To make student aware about the concepts, of environment, ecology, role of institutions in the country.
- To provide basic knowledge on Sustainable Technologies involved – tracing the growth of settlements – their response to climate – other technical options.
- To provide an orientation to students from Macro Level to Micro Level Design aspects, and
- To expose to students International and National Level agenda on concepts of conservation of Environment and its implications on sustainable concepts of Architecture and planning.

UNIT I	INTRODUCTION	7

Planning Concept – Environment Impact Analysis – Ecological Footprints – Essential ingredients of Sustainable Development apart from Social and Economical – Environment, Stakeholders Participation, and Institutional Mechanism.

UNIT II	DEVELOPMENT IN HISTORICAL CONTEXT	9

Early settlement pattern – Climate Responsive Planned Layouts – orientation of Streets and Buildings, Creation of Habitable Environment, Early Planning Methods – Land Generation, Soil and Water Conservation, Bioregional Approach.

UNIT III	RESOURCE EFFICIENCY	9

Land, Water, Energy, Human Resource, Biodiversity – Suitable practices at settlement, Campus and Building Level

UNIT IV	SUSTAINABLE ARCHITECTURE	12

Appropriate materials and construction – review of their properties workability, Eco Friendly construction practices – Need for Legislation – sustainable campuses, neighborhoods, programs and case studies.

UNIT V	SUSTAINABLE PLANNING AND POLICIES	9

Awareness program at National, International levels Rio de Jenero agenda – Earth summits – agenda involved – their realization.

TOTAL: 45 PERIODS

OUTCOMES:

- The students are oriented about the concepts of ecosystem carrying capacity, erlolqkn I footprint sustainability and sustainable development. Knowledge of vernacular architectural forms i different regions.

REFERENCES:

1. Bioclimatic Architecture – ENEA and IN/ARCH Publication Edition – 1989.
2. Brotoc, Sustainable architecture high-tech housing.
3. Roofs, Eco-house a design guide

COURSE OUTCOMES (COs)	
The student will be able	
CO1	An understanding of Indian vernacular architecture as a process and to also provide an overview of various approaches and concepts towards its study.
CO2	Knowledge of vernacular architectural forms in different regions.
CO3	An understanding of the impact of colonial rule on vernacular architecture in India.
CO4	To understand how the contexts of a region have an impact on **vernacular** architectural forms.
CO5	The impact of context of a region over architectural forms
CO6	Expressions will lead to sensible and context specific and sensitive design solutions.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				L						M	
	CO2		L				M				H		
	CO3	L			L					M			
	CO4		M				M						
	CO5			L					M				H
3	Category	PE											
4	Approval	34THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR7L1	ARCHITECTURAL DESIGN VII	0	0	18	8

OBJECTIVE:

- To enable an understanding of architecture as having the capacity to critically interpret and transform status quo in the built environment and society through the act of design.
- To guide in the taking of critical/ philosophical/ ideological positions relating to specific design situations in the current world and to explore architectural morphology as an expression of those positions.

TOTAL: 180 PERIODS

DESIGN OF ADVANCED AND COMPLEX PROBLEMS **180**

Design of advanced and complex problems – comprising group multi storied structures and infrastructure – with regard to climatic conditions, orientation, services, circulation problems relating to large developments Design and detailing for movement and use by handicapped persons within and around building and campuses to be addressed – examples: campus design, urban centers, Housing Senior citizens neighbourhood and Time problem using computer aided design

OUTCOME:

- Understand the concept of energy efficient design & green building technologies.
- Ability to bring inclusivity into the architectural design process.

REFERENCES

1. Edward D Mills, ‘Planning 4 volumes”, newness Butterworths, London 1976.
2. E and 05 “Planning London” 11ffe Books Ltd 1973.
3. “National Building” Code ISI
4. De Chiara and Callendar – “Time savers standards for Building Types”- McGraw Hill Co. 1973.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Understand the concept of energy efficient design & green building technologies.
CO2	Understand the impact of spatial configuration at building level and at site level on energy consumption
CO3	Analyze and interpret different case buildings.
CO4	Design and development energy efficient buildings.
CO5	Develop working drawings and model displaying energy efficient and green building technologies.
CO6	Demonstrate an understanding of the design philosophy, or vision of the architectural office and its implementation in the project/s

Mapping of Course Outcomes with Program Outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L- Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M				L	
	CO2		H			M							
	CO3			L			M				M		
	CO4	H			M								L
	CO5		H				H				L		
3	Category	PC											
4	Approval	32NDMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 701	URBAN DESIGN	2	0	2	4

OBJECTIVE:

- To create an understanding of urbanism and urban morphology as rising from various forces through history.
- To introduce the components of the modern city and their interdependencies.
- To introduce the scope and nature of urban design as a discipline
- To introduce key theories associated with urbanism and cities.
- To create awareness of contemporary urban issues and how they are addressed.
- To give exposure to ways of perceiving, documenting and analysing cities

UNIT I	INTRODUCTION	6

Relationship between Architecture, Urban Design and Town Planning – Perception of city from and pattern – Townscape elements.

UNIT II	ROLE OF SPACE IN HISTORICAL TOWNS	9

Comparative analysis of public spaces, their organization and articulation in pre-history, early, mediaeval and renaissance periods in west and east.

UNIT III	ORGANISATION OF SPACE	9

Understanding, organizing and articulation of spaces for residential, commercial industrial and recreational areas.

UNIT IV	RENEWAL AND RE-DEVELOPMENT	12

Objectives, surveys program of urban renewal and public involvement and participation.

UNIT V	CONTEMPORARY PRACTICE	9

Townscape policies, need for new bye-laws, regulations and emerging areas of development

TOTAL: 45 PERIODS

OUTCOMES:

- Plan / Undertake a study to identify existing issues related urban design in built environment.
- Identify various factors that are responsible urban conditions
- Gather, correlate and interpret the data that are required for
- design proposal at historic cities.

REFERENCES:

1. Lawrence Hatprin – "Cities" Reinhold Publishing Corporation N.Y. 1964.

2. Gosling and Maitland – "Urban Design" – St. Martin's Press, 1984.

3. Jonathan Barnett – "An Introduction to Urban Design" – Harper & Row, Publishers, N.Y. 1982.

4. Image of the city –Kevin Lynch

5. Architecture of Town and cities – Paul D Speriregon The MIT press

6. Urban Design – Ornamentation & Decoration – Cliff Monghtin

7. Urban Design – Street and square – Cliff Monghtin

8. Town and square – Paul Zucker – Bath prss

9. Urban Pattern - Arthur B Gallion CBS Publication

10. Architecture and Urban Experience – Raymond J Curran

11. Indian city in the Arid west – Kulbhushan Jain – Aadi centre

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Plan / Undertake a study to identify existing issues related urban design in built environment.
CO2	Identify various factors that are responsible urban conditions.
CO3	Gather, correlate and interpret the data that are required for design proposal at historic cities.
CO4	Develop an urban renewal proposal for a city.
CO5	Develop a design proposal for the urban issues relating to the built environment
CO6	To provide a framework for exploring the meaning and **scope of urban design**

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	L						M					
	CO2		H								M		
	CO3			M			M						
	CO4	M						M					H
	CO5		L				L				H		
3	Category	PC											
4	Approval	30THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR702	RESEARCH METHODOLOGY AND PRE THESIS WORK	2	0	2	4

OBJECTIVE:

- To enable an understanding of urbanism as a continuous experience involving the interrelated disciplines of architecture, urban design and town planning.
- To understand architecture as influenced by and influencing the dynamics of cities.
- To facilitate the taking of architectural design decisions in the context of the urban

TOTAL: 240 PERIODS

CONTENT:

Design studio emphasize on explaining and understanding Architecture primarily through the mode of making. Dissertation offers an opportunity to look at architecture, history and design primarily through textual. However, like design, dissertation involves process of observation, reflection and abstraction. Students are encouraged to choose any topic of their interest during the Practical Training -I undertaken by the student in IX semester and obtain approval from the Department before commencement of the Practical Training-II at the X semester.
The dissertation proposal in about 1500 words stating the topic, issues to be explored and the scope must be submitted before the commencement of Practical Training II for the approval of the department. The topic chosen may range from analyzing the works of an architect, history, typological changes, writing, design process and many more. After approval the work would be reviewed atleast twice during the semester by the department. Students are advised to seek the guidance of the architects under whom they go through the Practical Training II.
The final dissertation report shall contain objectives, followed by exhaustive documentation and arguments. The emphasis however, could vary according to the topic. A well written report of a minimum 15,000 words must be submitted in the prescribed format, if any provided by the University. The student would subsequently make a presentation of his/her work and appear for the Viva voce examination to be conducted at the end of Practical Training II.

OUTCOMES:

- Undertake the research systematically in a chosen topic.
- Illustrate the various methods available for the collection of information.

REFERENCES

1. Ian Border, Kurt Rueideu, The Dissertation, An Architectural Students Hand Book, Architectural Press, 2000

2. Linda Grant and David Wang, Architectural Research Methods, John Wiley Sons, 2002

COURSE OUTCOMES (COs)	
The student will be able	
CO1	*Undertake* the research systematically in a chosen topic.
CO2	Illustrate the various methods available for the collection of information.
CO3	analyses and interpret the information obtained from the study.
CO4	Organize the collected information graphically
CO5	*Develop* a report of the analyzed information with the logical reasoning and conclusion.
CO6	Builds his his/her capacity to work independently and methodically in a variety of intellectually demanding contexts.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	L					M				H		
	CO2		M		M					H			
	CO3	L				M						L	
	CO4		H				H						M
	CO5	L						L			M		
3	Category	PAEC											
4	Approval	26THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 703	PROFESSIONAL ETHICS & PRACTICE	3	0	0	3

UNIT I	EASEMENTS	6

EASEMENTS Definition – types of easement – acquisition extinction and protection of easements.

UNIT II	TENDER	9

Calling for tenders – tender documents – open and closed tenders – item rate, lump sum, labour and demolition tender – conditions offender – submission of tender – scrutiny and recommendations.

UNIT III	CONTRACT	9

Conditions of contract – Form of contract articles of agreement – Contractor's bill certification.

UNIT IV	ARBITRATION	12

Arbitration in disputes – arbitration agreement – sole arbitration – umpire – excepted matters award.

UNIT V	LEGISLATION	9

Environmental Acts and Laws – Special Rules governing Hill Area Development – coastal area development and management – Heritage Act of India – Consumer protection act and their relevant provisions.

: 45 PERIODS

OUTCOMES:

- Relate the responsibility of architect towards the society.
  Know the office procedure, work with allied
  professionals as a team in accordance with the architect's act 1972

REFERENCES:

1. Publications of COA IIA “Hand book on Professional Practice”, The Architects publishing Corporate of India, Bombay 1987.
2. D.C. Rules for Chennai Metropolitan Area 1990.
3. T.N.D.M. Building Rules, 1972.
4. T.N.P. Building Rules, 1942.
5. Chennai City Corporation Building Rules 1972.
6. Denk Sharp, The Business of Architectural Practice William Coliins Sons & Co. Ltd., 8 Erafton St. London W1 1986.
7. Roshan Namavathi, Professional Practice, Lakshmi Book Depot, Mumbai 1984.
8. Publication of IIA.
9. Environmental Laws of India – by Kishore Vanguri, C.P.R. Environmental Education Centre Chennai.
10. The Tamil Nadu Hill Areas Special Building Rules – 19.
11. Heritage Act
12. Consumer Protection Act.
13. Indian Easements Act.

COURSE OUTCOMES (CO:)

The student will be able	
CO1	Relate the responsibility of architect towards the society.
CO2	Illustrate the building rules and regulations essentials for practice.
CO3	Know the ethics to be followed while practicing the profession
CO4	Prepare tenders
CO4	Know the office procedure, work with allied professionals as a team in accordance with the architect's act 1972
CO 6	Prepare contract documents

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H							M				
	CO2		L				M						M
	CO3	L		H									
	CO4		M					M			L		
	CO5	M				M							M
3	Category	PAEC											
4	Approval	33RDMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 704	PROJECT MANAGEMENT	3	0	0	3

OBJECTIVE:

- To introduce housing in the Indian context and the various agencies involved in the production of housing.
- To outline factors, aspects and standards related to housing.
- To inform about the various housing design typologies and the processes involves in housing project development.
- To inform about current issues and aspects in housing.

UNIT I	INTRODUCTION TO PROJECT MANAGEMENT	6

Introduction to project Management concepts of background of management, purpose, goal and objectives, characteristics of projects and different aspects of management.
Traditional management system, Gantt's approach load chart, progress chart, bar-chart merits and limitation. Schedule, time estimates units.

UNIT II	PROJECTS PROGRAMMING	9

Project programming, resources balancing, phasing of activities, program, scheduling, project control, reviewing, updating and monitoring.
Introduction to modem management, concepts, uni dimensional management techniques – Introduction to PERT and CPM introduction to network concepts, network elements and inter-relationships.

UNIT III	NETWORK – TECHNIQUES	9

Network techniques, network logic o inter relationships, activity information, data sheets, development of network. CPM for management, CPM network analysis, identification of critical path float computation result sheets.

UNIT IV	PERT NETWORK	12

PERT Network, introduction to the theory of probability and statistics, probabilistic time estimation for activities of PERT network. Different types of tender.

UNIT V	PROJECT COST	9

Introduction to two dimensional network analysis, activity cost information. Cost time relationship, crashed estimates for the activities, compression potential, cost slope, utility, data sheet, project direct cost and indirect cost.

Crashed program, network compression least cost solution least time solution, optimum time solution. Network techniques, PERT/CPM, generating alternative strategies using computersTOTAL

: 45 PERIODS

OUTCOMES:

- Knowledge of various issues concerning housing & housing development in Indian & global context covering a cross section of income groups.
- Ability to appreciate socio-economic aspects in housing.
- An understanding of housing standards, site planning principles, housing concepts and types.
- An understanding of key issues in housing today.

REFERENCES:

1. S.P. Mukhopadyay, “Project Management for Architects and Civil Engineers”, IIT, Kharagpur, 1974.

2. Jerome D. Wiest and Fenfinand K. Levy, “A Management Guide to PERT / CPM”. Prentice Hall of Indian Pub. Ltd. New Delhi 1982.

3. R.A. Burges and G. White, “Building production and Project Management”, The Construction Press, London 1979.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Initiate projects with clearly identified scope, requirements, and stakeholders
CO2	Plan complex projects using appropriate **planning** tools
CO3	Develop plans to implement quality and resource management processes.
CO4	Manage project risk.
CO 5	Manage project costs including procurement process for project resources.
CO 6	Benefits that are observable within the targeted environment

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M				L					L		
	CO2		H				M					L	
	CO3	L			M			H					
	CO4		H			H					M		
	CO5			L			L			M			
3	Category	PAEC											
4	Approval	25THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 7E3	INTERIOR DESIGN	3	0	0	3

OBJECTIVE:

- To introduce the vocabulary of interior design.
- To familiarize the students with an overview of interior and furniture design and design Movements through history.
- To inform the various components of interior space and treatment and finishes for the same.
- To familiarize the students with the various components of interior design like lighting, landscaping and furniture.

UNIT I	INTRODUCTION TO INTERIOR DESIGN	7

Definition and process of interior design - vocabulary of interior design in terms of principles and elements - introduction to the design of interior spaces as related to typology and function, themes and concepts

UNIT II	HISTORY OF INTERIOR AND FURNITURE DESIGN	9

Overview of interior and furniture design in the Western context through the ages relating to historical context, design movements and ideas -overview of folk arts and crafts of India with reference to their role in interior decoration.

UNIT III	COMPONENTS OF INTERIOR SPACE- INTERIOR TREATMENT AND FINISHES	9

Treatment of components such as floors, ceilings, walls, partitions, window treatments, accessories, etc., in terms of their choice and design related to materials, methods of construction, colour, texture, etc., based on functional, aesthetic and psychological criteria

UNIT IV	COMPONENTS OF INTERIOR SPACE- LIGHTING AND LANDSCAPING	12

.

Interior lighting - different types of lighting - types of lighting fixtures- their effects and suitability in different contexts Interior landscaping elements: rocks, plants, water, flowers, fountains, paving,artifacts, etc., their physical properties and effects on spaces

UNIT V	COMPONENTS OF INTERIOR SPACE- - FURNITURE	9

Furniture design as related to human comfort and function, materials and methods of construction, changing trends and lifestyles, innovations and design ideas - furniture for specific types of interiors: office furniture, children's furniture, residential furniture, display systems, etc.

TOTAL: 45 PERIODS

OUTCOMES:

- An understanding of interior design as an interdisciplinary as well as allied field related to architecture.

REFERENCES:

1. 1. Helen Marie Evans, An Invitation to design, Macmillan Pub Co 1982
2. 2. Julius Penero and Martin Zelnik, Human Dimensions and Interior space, Whitney
3. Library of Design NY 1979
4. 3. Inca-Interior Design Register, Inca Publications, Chennai 1989
5. 4. Kathryn B.Hiesinger and George H.Marcus, Landmarks of twentieth Century Design; Abbey Ville Press 1993
6. Susanne Slesin and Stafford Cliff, Indian Style, Clarkson N.Potter, Newyork 1990

COURSE OUTCOMES (COs)	
The student will be able	
CO1	To become aware of the planning principle for **designing** various **interior** spaces.
CO2	To gain better understanding as regard the History of furniture, Anthropometric data in space **designing** for various activities.
CO3	To apply Ergonomics in **interior designing**.
CO4	Create a full set of design documents for an interior design project
CO5	Compose written justification of project designs and verbally communicate design
CO6	collaboration, creating a positive impact on the classroom

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				L						M	
	CO2		L				M				H		
	CO3	L			L					M			
	CO4		M				M						
	CO5			L					M				H
3	Category	PE											
4	Approval	34THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 801	URBAN HOUSING	2	0	4	4

OBJECTIVE:

- To introduce housing in the Indian context and the various agencies involved in the production of housing.
- To outline factors, aspects and standards related to housing.
- To inform about the various housing design typologies and the processes involves in housing project development.
- To inform about current issues and aspects in housing.

UNIT I	INTRODUCTION TO HOUSING AND HOUSING ISSUES IN INDIA	6

Housing and its importance in architecture, its relationship with neighborhood and city planning. Housing demand and supply. National Housing Policy. Housing agencies and their role in housing development. Impact of life style. Rural Housing. Public and private sector housing.

UNIT II	SOCIO-ECONOMIC ASPECTS	9

Economics of housing. Social economic factors influencing housing affordability. Formal and informal sector. Equity in housing development. Sites and services. Slum housing, upgradation and redevelopment. Low Cost Housing. Health principles in housing. Legislation for housing development. Cost-effective materials and technologies for housing. Case studies in India and developing countries.

UNIT III	HOUSING STANDARDS	9

UDPFI guide lines, standard and regulations.DCR. Performance standards for housing.

UNIT IV	SITE PLANNING AND HOUSING DESIGN	12

Site Planning for housing. Selection of site for housing, consideration of physical characteristics of site, location factors, orientation, climate, topography, landscaping. Integration of services and parking. Housing design relating to Indian situations – traditional housing, row housing, cluster housing, apartments, high-rise housing. Case studies in India of the various types.

UNIT V	CURRENT ASPECTS AND ISSUES IN HOUSING	9

Green building and sustainable practices. Disaster resistance and mitigation. Prefabrication Community participation.

TOTAL: 45 PERIODS

OUTCOMES:

- Knowledge of various issues concerning housing & housing development in Indian & global context covering a cross section of income groups.
- Ability to appreciate socio-economic aspects in housing.
- An understanding of housing standards, site planning principles, housing concepts and types.
- An understanding of key issues in housing today.

REFERENCES:

1. Christopher Alexander, 'A Pattern Language', Oxford University press, New York 1977.

2. Leuris S, 'Front to back: A Design Agenda for Urban Housing', Architectural Press, 2006.

3. S.K.Sharma, 'Mane A New Initiative in Public Housing', Housing & Urban Development Corporation, 1991.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	student must be aware of the significance of housing
CO2	The context of both global scenario.
CO3	critical social and economic issues related to housing
CO4	They should familiarize to the various housing schemes
CO5	Housing Finance, Sources of Housing Finance
CO6	Concept of Aided Self Help- Housing the poor through the NGO s

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					L						
	CO2	H						M				M	
	CO3		M				M						L
	CO4	M			L					M			
	CO5			M					M				
3	Category	PC											
4	Approval	31STMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 802	VERNACULAR ARCHITECTURE	2	0	2	3

OBJECTIVE:

- To introduce the study of vernacular architecture as a process and not a product.
- To provide an overview of the different approaches and concepts to the study of vernacular architecture.
- To study the various vernacular architecture forms in the different regions of the country.
- To look at the impact of colonial rule on the vernacular architecture of India.

UNIT I	INTRODUCTION	7

Definition and classification of vernacular architecture. Vernacular architecture as a process. Methodology for survey and study of vernacular architecture. Overview of cultural and contextual responsiveness of vernacular architecture.

UNIT II	APPROACHES AND CONCEPTS	9

Overview of different approaches and concepts to the study of vernacular architecture. Aesthetic, architectural and anthropological studies in detail.

UNIT III	VERNACULAR ARCHITECTURE OF THE WESTERN AND NORTHERN REGIONS OF INDIA	9

Forms, spatial planning, cultural aspects, symbolism, colour, art, materials of construction and construction technique of the vernacular architecture of the deserts of Kutch and Rajasthan (including havelis of Rajasthan), rural and urban Gujarat (including wooden mansions/ havelis in general and that of the Bohra Muslims) and geographical regions of Kashmir (including house boats).

UNIT IV	VERNACULAR ARCHITECTURE OF SOUTH INDIA	12

Forms, spatial planning, cultural aspects, symbolism, art, colour, materials of construction and construction technique, proportioning systems, religious beliefs and practices in the vernacular architecture of Kerala (including houses of the Nair & Namboothri community, Koothambalam and Padmanabhapuram palace) and Tamil Nadu (including houses and palaces of the Chettinad region, agraharams).

UNIT V	WESTERN INFLUENCES ON VERNACULAR ARCHITECTURE OF INDIA	9

Colonial influences on the traditional Goan house. Evolution of the bungalow from the traditional bangla, Victorian villas. Planning principles and materials and methods of construction of the bungalow. Settlement pattern and house typologies of Pondicherry and Cochin.

TOTAL: 45 PERIODS

OUTCOMES:

- An understanding of Indian vernacular architecture as a process and to also provide an overview of various approaches and concepts towards its study.
- Knowledge of vernacular architectural forms in different regions.
- An understanding of the impact of colonial rule on vernacular architecture in India.

REFERENCES:

1. Paul Oliver, 'Encyclopedia of Vernacular Architecture of the World', Cambridge University Press, 1997.

2. Amos Rapoport, 'House, Form & Culture', Prentice Hall Inc. 1969.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	An understanding of Indian vernacular architecture as a process and to also provide an overview of various approaches and concepts towards its study.
CO2	Knowledge of vernacular architectural forms in different regions.
CO3	An understanding of the impact of colonial rule on vernacular architecture in India.
CO4	To understand how the contexts of a region have an impact on **vernacular** architectural forms.
CO5	The impact of context of a region over architectural forms
CO6	Expressions will lead to sensible and context specific and sensitive design solutions.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				L						M	
	CO2		L				M				H		
	CO3	L			L					M			
	CO4		M				M						
	CO5			L					M				H
3	Category	PE											
4	Approval	34THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 8E4	EARTHQUAKE RESISTANT ARCHITECTURE	3	0	0	3

OBJECTIVE:

.

- To enable an understanding of the fundamentals of earthquake and the basic terminologies.
- To give basic knowledge of earthquake resistant design concepts.
- To provide familiarity with design codes and building configuration
- To enable understanding of the different types of construction details to be adopted in a seismic prone area.
- To give knowledge for applying earthquake resistant principles in an architectural design project.

UNIT I	FUNDAMENTALS OF EARTHQUAKES	7

Earth's structure, seismic waves, plate tectonics theory, origin of continents, seismic zones in India. Predictability, intensity and measurement of earthquake. Basic terms- fault line, focus, epicentre, focal depth etc.

UNIT II	SITE PLANNING, PERFORMANCE OF GROUND AND BUILDINGS	9

Historical experience, site selection and development. Earthquake effects on ground, soil rupture, liquefaction, landslides. Behaviour of different types of building structures, equipments, lifelines, collapse patterns. Behaviour of non-structural elements like services, fixtures in earthquake-prone zones

UNIT III	SEISMIC DESIGN CODES AND BUILDING CONFIGURATION	9

Seismic design code provisions. Introduction to Indian codes. Building configuration - scale of building, size, horizontal and vertical plane, building proportions, symmetry of building - torsion, re-entrant corners, irregularities in buildings like short storeys, short columns, etc.

UNIT IV	DIFFERENT TYPES OF CONSTRUCTION DETAILS	12

. Seismic design and detailing of masonry structures, wood structures, earthen structures. Seismic design and detailing of RC and steel buildings. Design of non-structural elements - architectural elements, water supply, drainage, electrical and mechanical components.

UNIT V	URBAN PLANNING AND ARCHITECTURAL DESIGN	9

Vulnerability of existing buildings, facilities planning, fires after earthquake, socio-economic impact after earthquakes. Conceptual design for earthquake resistance involving institutional masonry building with horizontal spread and height restriction, multi-storeyed RC framed apartment/commercial building.

TOTAL: 45 PERIODS

OUTCOMES:

- Ability to understand the formation and causes of earthquakes
- An understanding of the factors to be considered in the design of buildings and services to resist earthquakes.

REFERENCES:

1. Ian Davis, 'Safe Shelter within Unsafe Cities: Disaster Vulnerability and Rapid Urbanization'
2. Open House International, UK, 1987
3. 'Socio-economic developmental record'- Vol.12, No.1, 2005.
4. Mary C. Comerio, Luigia Binda, 'Learning from Practice- A Review of Architectural Design and Construction Experience after Recent Earthquakes', Joint USA-Italy workshop, Oct.18-23, 1992, Orvieto, Italy.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Introduction to Disaster and disaster management
CO2	Basic knowledge of dynamics and methods of dynamic analysis
CO3	Blast and fire resistant design of structures
CO4	Earthquake resistant design of structures
CO5	Design of shear wall
CO6	Retrofitting, rehabilitation and strengthening of structures

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				L						M	
	CO2		L				M				H		
	CO3	L			L					M			
	CO4		M				M						
	CO5			L					M				H
3	Category	PE											
4	Approval	34THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR 8E5	CONTEMPORARY PROCESS IN ARCHITECTURAL DESIGN	3	0	0	3

OBJECTIVE:

.

- To introduce theories of media and its influence on the perception of space.
- To enable study of the various aspects of digital architecture and its exploration through emerging phenomena that relies on abstraction of ideas.
- To give understanding of the works of contemporary architects who have illustrated the influence of the digital media in architecture.

UNIT I	INTRODUCTION	7

Investigation of contemporary theories of media and their influence on the perception of space and architecture. Technology and art. Technology and architecture. Digital technology and architecture.

UNIT II	ASPECT OF DIGITAL ARCHITECTURE	9

Aspects of digital architecture. Design and computation. Difference between digital process and non-digital process. Architecture and cyberspace. Qualities of the new space. Issues of aesthetics and authorship of design. Increased Automatism and its influence.

UNIT III	CONTEMPORARY PROCESS	9

Emerging phenomena such as increasing formal and functional abstractions. Diagrams, diagrammatic reasoning, diagrams and design process. Animation and design. Digital hybrid.

UNIT IV	GEOMETRIES AND SURFACES	12

Fractal geometry. Shape grammar. Hyper surface. Liquid architecture. Responsive architecture.

UNIT V	CONTEMPORARY PROCESS AND ARCHITECTURAL WORKS	9

Ideas and works of architects related to contemporary processes. The architects to include Greg Lynn, Reiser + Umemotto, Lars Spuybroek / NOX Architects, UN studio, Diller Scofidio, Dominique Perrault, Decoi, Marcos Novak, Foreign Office Architects, Asymptote, Herzog and de Meuron, Neil Denari, Serie Architects, BIG Architects. Study to be undertaken in the form of assignments/discussions/seminars/presentations.

TOTAL: 45 PERIODS

OUTCOMES:

- An understanding of the effect of contemporary theories of media on contemporary architectural design.
- Insight into contemporary design process/theories and their relation to computation.
- Ability to understand specific aspects of contemporary processes appropriate to a design situation.
- Familiarity with architectural works derived from contemporary processes.

REFERENCES:

1. Gillian Hunt, 'Architecture in the Cyberspace II', John Wiley & Sons, 2001.
2. L. Convey et al, 'Virtual Architecture', Batsford, 1995.
3. Rob Shields (ed.), 'Cultures of the internet: Virtual Spaces, Real Histories, Living bodies', Sage, London, 1996.
4. John Beckman, 'The Virtual Dimension, Architecture, Representation and Crash Culture', Princeton Architecture Press, 1998.
5. William J Mitchell, City of Bits: Space, Place and the Infobahn',MIT Press, Cambridge, 1995.
6. Marcos Novak, 'Invisible Architecture: An Installation for the Greek Pavilion', Venice Biennale, 2000.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	***Understand*** the impact of literature in architecture on philosophical development of design.
CO2	***Understand*** the alternative architectural methods available.
CO3	***Exposed*** to the master architects works and trace the development of evolution of their style.
CO4	Understand the spatial organization and spatial qualities of different typologies of buildings.
CO5	Knowledge of the contemporary design process and apply the same in the architectural design.
CO6	To gain knowledge of the spatial organization and articulation in the works of master

Mapping of Course Outcomes with Program Outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						H					M
	CO2		H				M				H		
	CO3	M			M				M				
	CO4		H			H						M	
	CO5	M		M							L		
3	Category	PE											
4	Approval	34THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR8L1	ARCHITECTURAL DESIGN VIII	0	0	18	8

OBJECTIVE:

- To enable an understanding of urbanism as a continuous experience involving the interrelated disciplines of architecture, urban design and town planning.
- To understand architecture as influenced by and influencing the dynamics of cities.
- To facilitate the taking of architectural design decisions in the context of the urban

TOTAL: 240 PERIODS

CONTENT:

Urbanism is a dynamic phenomenon involving many aspects - urban growth, landuse distribution and change, urban form, demographics including gender and class, cultural aspects such as place and heritage, physical infrastructure such as roads and transportation nodes, public spaces, etc., Architecture is an integral and large part of urbanism, shaping and being shaped by it. It can serve to include/ gather society and enrich the urban environment in a seamless manner.

Understanding of this aspect of architecture will be achieved by architectural projects involving interdependencies between architecture and the city. Some of the issues and areas that could be addressed are- transportation nodes, heritage areas, adaptive reuse, suburban sprawl, place making, identity, collective memory, mixed use programming, large scale urban interventions, revitalisation and renewal of urban fragments, urban waterfront development, urban nodes, multi-use urban complexes.

The tools and techniques can include contemporary ways/ tools of perceiving, gathering and analysing data, inclusive, collaborative and participatory approaches, etc.,
It is preferable to have one major project with small exercises under it if required.

OUTCOME:

- Ability to perceive and design buildings as contributing to/ transforming the urban
- fabric. Ability to bring inclusivity into the architectural design process.

REFERENCES

1.Jonathan Barnett, 'An Introduction to Urban Design', Harper and Row; 1982 Cavallo, R. et al, 'New Urban Configurations', IOS Press, 2014.

2.Henriette Steiner & Maximilian Sternberg, 'Phenomenologies of the City: Studies in the History and Philosophy of Architecture', Routledge 2015.

3.Jan Gehl, 'Life between Buildings- Using Public Space', Arkitektens Forleg 1987. 'Time Savers

4.Standard for Urban Design', Donald Watson, McGraw Hill, 2005.

5.Malcolm Moore & Jon Rowland Eds, 'Urban Design Futures', Routledge, 2006.

6.Michelle Provoost et al., 'Dutchtown', NAI Publishers, Rotterdam, 1999. Lawrence Halprin,

'Cities', 7.Reinhold Publishing Corporation, New York, 1964. Gosling and Maitland, 'Urban Design', St. Martin‟s Press, 1984.

8.Kevin Lynch, 'Site Planning', MIT Press, Cambridge 1967.

9.Jeremy Till et al, 'Spatial Agency: Other Ways of Doing Architecture', Routledge, 2011.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Demonstrate knowledge of the spatial planning system and basic tools of spatial policy in Poland and the EU.
CO2	Demonstrate knowledge of contemporary ideas of shaping space in cities.
CO3	Identify principles of formulating local zoning plans for advanced urban complexes using the applicable notation.
CO4	Demonstrate broad knowledge which takes into consideration the interdisciplinary character of circumstances of urban planning
CO5	Demonstrate advanced knowledge of parameters of traffic engineering and the principles of designing roads, streets, cycle lanes, pedestrian precincts and parking lots and equipment of technical infrastructure
CO6	Identify the regulations and procedures of formulating local land-use plans. zoning and their impact on the investment.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		L					M				
	CO2		H				L				M		
	CO3	M			L					M			
	CO4		L			L						M	
	CO5	M					M						L
3	Category	PC											
4	Approval	34THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR9PT	PRACTICAL TRAINING	0	0	0	14

OBJECTIVE:

- To introduce the challenges of architectural practice.
- To enable overall understanding of different stages in real life architectural projects in practice.
- To create involvement in these stages as much as possible within the scope of a specific architectural practice - initiation of project, development of concepts into schematic drawings, approval process, presentations and working drawings, involvement in office discussions and client meetings, integrating structural and service concerns, estimation and tendering processes, site supervision and coordination in the construction process.

TOPICS OF THE STUDY	6

CONTENT:

Practical Training will be done in offices/ firms in India, empanelled by the institution, in which the principal architect is registered with the Council of Architecture. The student will attempt to learn as much of aspects outlined in the objectives, either first hand or indirectly.
The progress of practical training will be assessed periodically internally through submission of log books along with work done by the students in terms of drawings, reports, etc., along with the regular progress report from the employers.

The students will be evaluated based on the criteria related to their contribution in the office some of which are given below.

- Understanding and involvement in the process of architectural practice as mentioned in the objectives within the scope of the specific office in which training is undertaken.
- Adherence to time schedule, overall responsibility and professional conduct.
- Ability to carry out the instructions on preparation of schematic drawings, presentation drawings, working drawings and skill in this regard.
- Ability to work as part of a team in an office and contribute to related activities.
- Ability to participate in client meetings and discussions.
- Involvement in supervision at project site.
- Involvement/ initiative/ participation in any other aspects during the course of the training.
- At the end of the Practical Training, a portfolio of work done during the period of internship along with certification from the office should be submitted for evaluation through a viva voce examination.

OUTCOMES:

- An overall idea of the nuances of architectural practice.
- An understanding about the total process that goes into the making of a building.
- Maturity in using the experience gained from internship in the thesis project.

CO1	Demonstrate an understanding of the design philosophy, or vision of the architectural office and its implementation in the project/s
CO2	Interpret the architectural design process evolves when structural and service issues are integrated to create the final product.
CO3	Demonstrate the Knowledge on how the Drawings are used at site and an insight into the relationship between the site and drawing.
CO4	Develop a office and run the office successfully
CO5	offices / firms in India empanelled by the Institution in which the principal architect
CO6	progress of practical training shall be assessed internally through submission

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M					L				M		
	CO2		L		M								
	CO3	M								H			L
	CO4		H				M				L		
	CO5	M		L									
3	Category	PAEC											
4	Approval	26THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BARXTH	THESIS	0	0	32	18

OBJECTIVE:

- All the architectural design courses offered since semester II culminate in the thesis Project to motivate students to involve in individual research and methodology. This is to train them in handling projects independently.

TOPICS OF THE STUDY	6

The main areas of study and research can include advanced architectural design, including contemporary design processes, urban design including urban-infill, environmental design, conservation and heritage precincts, housing etc. However, the specific thrust should be architectural design of built environment. Preparation of presentation drawings, working drawings, detailed drawings and study model are part of the requirements for submission.

- The Thesis Project shall be submitted in the form of drawings, project report, models, slides, CDs and reports.

TOTAL: 510 PERIODS

OUTCOMES:

- A comprehensive understanding in handling a major Architectural independently

REFERENCES:

1. Donald Appleyard, The Conservation of European Cities, M.I.T. Press, Massachusetts, 1979.
2. Michelle Provoost et al., Dutchtown, NAI Publishers, Rotterdam, 1999
3. Richard Kintermann and Robert small site planning for cluster Housing van nastrand reinhold company, Jondon/New York 1977.
4 Miller T.G. Jr., Environmental Sciences, Wadsworth Publishing Co. (TB)
5. Kevin Lynch - Site planning - MIT Press, Cambridge, MA - 1967.
6. Geoffrey And Susan Jellico, The Landscape of Man, Thames And Hudson, 1987.
7. Arvind Krishnan & Others, Climate Responsive Architecture, A Design Handbook for Energy

8.Efficient Buildings, TATA McGraw Hill Publishing Company Limited, New Delhi, 2007

COURSE OUTCOMES (COs)	
The student will be able	
CO1	To use all the skills acquired in the duration of preceding academic courses.
CO2	Methodically self-direct effort by choosing the project of choice, builds capacity to work independently and methodically in a variety of intellectually and professionally demanding contexts.
CO3	Learn to make an original and individual, creative contribution to the academic discipline and/or the professional field in some cases.
CO4	Be able to interpret the urban forms of the past and present.
CO5	Articulate their stance and position as a designer within discourses of urbanism.
C06	Research and analyse information relevant to developing the proposal

Mapping of Course Outcomes with Program Outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	L				M				M			
	CO2		H				H				M		
	CO3	M			M			L					
	CO4		M						M				M
	CO5	L										M	
3	Category	PC											
4	Approval	28THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR XE6	ARCHITECTURAL JOURNALISM AND PHOTOGRAPHY	3	0	0	3

OBJECTIVE:

- To introduce general skills necessary for the practice of professional journalism.
- To introduce the fundamentals of writing, explain different strategies and their criticism.
- To give particular exposure to architectural journalism.
- To introduce photojournalism, bring out importance/ contributions of photography in the
- Architectural profession and to help develop proficiency in modern photography techniques.

UNIT I	INTRODUCTION	7

Introduction to journalism, key concepts and objectives of journalism. Specialised journalism with emphasis on architectural journalism. Journalism skills: research, reporting, writing, editing, photography, columnists, public relationships, criticism. Issues such as copyright, public art policy, the arts and urban redevelopment. Introduction to local culture scene.

UNIT II	TECHNOLOGIES IN JOURNALS	9

Environment, social change, persuasion. Interviewing techniques, argument and debate as a technique in the investigation of social problems. Evidence, proof, refutation, persuasion. Training in argumentative speaking. Introduction to software needed in journalism and photography, video coverage, walk-through of buildings, production of contemporary architectural journalism. Understanding the individual demands in the context of newspapers, radio, film, and television.

UNIT III	CONTEMPORARY ARCHITECTURAL JOURNALISM	9

Role of the editor. Editing of articles, features and other stories. Editing for online newspaper and magazines. Text preparation, mode of presentation, standards and guidelines for documentation. Code of ethics. Basic knowledge on press laws, Press Council of India. Multimedia/ online journalism and digital developments.

UNIT IV	DISCUSSIONS AND ISSUES	12

Regional, national and international discussion forums. Changes in contemporary and historical design practices. Discussions on topics needed in an architectural journal and current issues. Types of journals. Works of key architectural journalists. Public discourse on the internet. Mass media and public opinion. Critique on selected pieces of journalism.

UNIT V	ARCHITECTURAL PHOTOGRAPHY	9

Introduction to architectural photography and role of the photographic image in the global world. Equipment - cameras and lenses. Techniques- film speed, exposure measurement, gray scale, photo-finishing and editing digital images. Perspectives- single point, two- point, three- point and methods of correcting distortions. Lighting - external and interior

TOTAL: 45 PERIODS

OUTCOMES:

- An An ability to critically think and analyse about the effects of architecture on society as well as the tools to enable recording of the same

REFERENCES:

1. Martin Huckerby, 'The Net for Journalists: A Practical Guide to the Internet for Journalists in Developing Countries'. UNESCO/Thomson Foundation/ Common wealth Broadcasting Association, 2005.
2. S. J. A.Ward, 'Philosophical Foundations of Global Journalism Ethics', Journal of Mass Media Ethics, Vol. 20, No. 1, 3-21, 2005.
3. M. Heinrich, 'Basics Architectural Photography', Bikhauser Verlag AG, 2008.
4. Gerry Kopelow, 'Architectural Photography: The Professional Way', Princeton Architectural Press, 2007.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	Discuss the history of Photography, moving images and Photo Journalism
CO2	Demonstrate a brief understanding of news values, photo journalism and sources.
CO3	Explain various types of cameras, its components and accessories
CO4	Discuss the legal and ethical aspects of photography and photojournalism.
CO5	Assess the importance of digital technology in photography
CO6	Critically analyse and appreciate photographs

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M			M			L					
	CO2		H				H				L		
	CO3	L		L		M							
	CO4		M		M							L	
	CO5	M					M						H
3	Category	PE											
4	Approval	34THMeeting of Academic Council											

COURSE CODE	COURSE TITLE	L	T	P/S	C
BAR XE6	ARCHITECTURAL CONSERVATION	3	0	0	3

OBJECTIVE:

.

- To introduce theories of media and its influence on the perception of space.
- To enable study of the various aspects of digital architecture and its exploration through emerging phenomena that relies on abstraction of ideas.
- To give understanding of the works of contemporary architects who have illustrated the influence of the digital media in architecture.

UNIT I	INTRODUCTION TO CONSERVATION	7

Understanding heritage. Defining conservation, preservation and adaptive reuse. Heritage conservation- need, debate and purpose. History of conservation movement. International agencies like ICCROM, ICOMOS, UNESCO and their role in conservation. Charters.
Principles and ethics of conservation.

UNIT II	CONSERVATION IN INDIA	9

Museum conservation. Monument conservation and the role of ASI, SDA, INTACH. Central and state government policies and legislations. Inventories and projects. Selected case studies of sites such as Hampi, Golconda, Mahabalipuram. Craft Issues of conservation.

UNIT III	CONSERVATION METHODS AND MATERIALS	9

Investigation techniques and tools. Behaviour of historic materials and structures. Problems with masonry, foundation. Repair methods, traditional and modern methods. Seismic retrofit, services additions and disabled access to historic buildings. Moisture and pollution problems.

UNIT IV	CONSERVATION PRACTICE	12

Listing of monuments. Documentation of historic structures. Assessing architectural character. Historic structure report. Guidelines for preservation, rehabilitation and adaptive re-use of historic structures. Case studies of palaces in Rajasthan, dwellings in Chettinad and Swamimalai. Heritage site management

UNIT V	URBAN CONSERVATION AND CONSERVATION PLANNING	9

Understanding the character and issues of historic towns. Selected case studies. Historic districts and heritage precincts. Conservation as a planning tool. Financial incentives and planning tools such as TDR. Urban conservation and heritage tourism. Case studies of sites like Cochin, Pondicherry French town. Conservation project management.

TOTAL: 45 PERIODS

OUTCOMES:

- An understanding of the importance of heritage, issues and practices of conservation through case studies.
- Familiarity with historic materials and their properties, different technologies for investigating masonry, foundation and also traditional and modern repair methods.

REFERENCES:

5. James M. Fitch, Historic Preservation: Curatorial Management of the Built World by University Press of Virginia; Reprint Edition,1990.

6. Robert E. Stipe, 'A Richer Heritage: Historic Preservation in the Twenty-First Century, University of North Carolina Press, 2003.

7. B.P. Singh, 'India's Culture- The State, The Arts and Beyond', Oxford University Press, 2000

8. A.G. K. Menon (Ed), 'Conservation of Immovable Sites', INTACH Publication, N. Delhi. John H. Stubbs and Emily G Makas; Architectural Conservation in Europe and the Americas, John Wiley & Sons, 2011.

COURSE OUTCOMES (COs)	
The student will be able	
CO1	The recognition and protection of the historic environment to gain awareness
CO2	Understands the techniques and the theoretical frame which are essential for preparing the documentation work besides the restoration projects of the cultural heritage.
CO3	Understands the techniques and the theoretical frame which are essential for preparing the documentation work besides the restoration projects of the cultural heritage.
CO4	Improves the critical point of view using the examples.
CO5	Realizes the responsibilities of legaslation aspects.
CO6	Realizes the necessity of sustainable design: sustainability in architecture and urban design decisions and areas of natural

Mapping of Course Outcomes with Program Outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					M					M	
	CO2		M					L					M
	CO3	M			H						L		
	CO4		M				L						M
	CO5	M				L					M		
3	Category	PE											
4	Approval	34THMeeting of Academic Council											

CURRICULUM AND SYLLABUS(R2015)

CHOICE BASED CREDIT SYSTEM

(Applicable to the batches admitted from July 2015)

B. Arch – BACHELOR OF ARCHITECTURE

(FULL TIME)

I-X SEMESTERS

SEMESTER – I

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
	STUDIO				
BAR 1LI	Architectural Basic Design I	0	0	14	6
	THEORY				
BAR 101	Theory of Architecture I	3	0	0	3
BAR 102	History of Architecture I	3	0	0	3
BAR 103	Mechanics of structures I	3	0	0	3
BMA 102	Mathematics	3	0	0	3
BEN 102	English	2	0	1	3
	THEORY / STUDIO				
BAR 106	Architectural Graphics & Art studio	0	0	6	3
	TOTAL	**35**			**24**

SEMESTER – II

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
	STUDIO				
BAR 2LI	Architectural Design - II	0	0	11	6
	THEORY				
BAR 201	Theory of Architecture II	3	0	0	3
BAR 202	History of Architecture II	1	0	2	3
BAR 203	Mechanics of structures II	3	0	0	3
BAR 204	Personality development, soft skills enhancement	3	0	0	3
	THEORY / STUDIO				
BAR 205	Architectural Graphics II	0	0	6	3
BAR 206	Materials & construction I	2	0	4	4
	TOTAL	**35**			**25**

SEMESTER – III

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
	STUDIO				
BAR 3LI	Architectural Design - III	0	0	13	6
	THEORY				
BAR 301	Building services I	3	0	0	3
BAR 302	History of Architecture III	3	0	0	3
BAR 303	Design of structures I	3	0	0	3
BAR 304	Climate & Environmental studies	3	0	0	3
	THEORY / STUDIO				
BAR 305	Computer studio I	0	0	4	3
BAR 306	Materials & construction II	2	0	4	4
	TOTAL	**35**			**25**

SEMESTER – IV

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
	STUDIO				
BAR 4LI	Architectural Design - IV	0	0	13	6
	THEORY				
BAR 401	Building services II	3	0	0	3
BAR 402	History of Architecture IV	3	0	0	3
BAR 403	Design of structures II	3	0	0	3
BAR 404	Site planning & Landscape Architecture	0	0	4	3
BAR 405	Climate & Built Environment	3	0	0	3
	THEORY / STUDIO				
BAR 406	Materials & construction III	2	0	4	4
	TOTAL	**35**			**25**

SEMESTER – V

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
	STUDIO				
BAR 5LI	Architectural Design - V	0	0	13	6
	THEORY				
BAR 501	Building services III	3	0	0	3
BAR 502	History of Architecture V	3	0	0	3
BAR 503	Design of structures III	3	0	0	3
BAR 5E1	**ELECTIVE I**	3	0	0	3
	THEORY / STUDIO				
BAR 5L2	Computer studio - II	0	0	4	3
BAR 504	Materials & construction IV	2	0	4	4
	TOTAL	**35**			**25**

SEMESTER – VI

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
	STUDIO				
BAR 6LI	Architectural Design - VI	0	0	16	8
	THEORY				
BAR 601	Building services IV	3	0	0	3
BAR 602	History of Architecture VI	3	0	0	3
BAR 603	Cost estimation	3	0	0	3
BAR 604	Human settlements & Planning	2	0	2	4
BAR 6E2	**ELECTIVES II**	3	0	0	3
	TOTAL	**35**			**24**

SEMESTER – VII

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
	STUDIO				
BAR 7LI	Architectural Design - VII	0	0	18	8
	THEORY				
BAR 701	Urban design	2	0	2	4
BAR 702	Research Methodology & Pre thesis work	2	0	2	4
BAR 703	Professional Ethics & Practice	3	0	0	3
BAR 704	Project Management	3	0	0	3
BAR 7E3	**ELECTIVE III**	3	0	0	3
	TOTAL	**35**			**25**

SEMESTER – VIII

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
	THEORY				
BAR 801	Urban Housing	2	0	2	4
BAR 802	Vernacular Architecture	2	0	2	3
BAR 8E4	**ELECTIVES IV**	3	0	0	3
BAR 8E5	**ELECTIVES V**	3	0	0	3
	STUDIO				
BAR 8L1	Architectural Design - VIII	0	0	18	8
	TOTAL				**21**

SEMESTER – IX

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
BAR 9PT	Practical Training - I				14
	TOTAL				**14**

SEMESTER – X

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
	STUDIO				
BAR XTH	Thesis	**0**	**0**	32	18
	THEORY				
BAR XE6	**ELECTIVES VI**	3	0	0	3
	TOTAL	**35**			**21**

TOTAL CREDITS FOR THE PROGRAMME – 222

PROFESSIONAL ELECTIVE I

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
BAR 5E1	ENERGY EFFICIENT ARCHITECTURE	3	0	0	3
BAR 5E1	THEORY OF DESIGN	3	0	0	3

PROFESSIONAL ELECTIVE II

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
BAR 6E2	SUSTAINABLE ARCHITECTURE	3	0	0	3

PROFESSIONAL ELECTIVE III

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
BAR 7E3	INTERIOR DESIGN	3	0	0	3
BAR 7E3	LANDSCAPE AND ECOLOGY	3	0	0	3

PROFESSIONAL ELECTIVE IV

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
BAR 8E4	EARTHQUAKE RESISTANT BUILDINGS	3	0	0	3
BAR 8E4	CONTEMPORARY PROCESS IN ARCHITECTURE	3	0	0	3

PROFESSIONAL ELECTIVE V

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
BAR 8E5	ADVANCED STRUCTURES	3	0	0	3
BAR 8E5	STEEL ARCHITECTURE AND DESIGN	3	0	0	3

PROFESSIONAL ELECTIVE VI

SUBJECT CODE	SUBJECT TITLE	L	T	P/S	CREDITS
BAR XE6	ARCHITECTURAL CONSERVATION	3	0	0	3
	ARCHITECTURAL JOURNALISM AND PHOTOGRAPHY				

PROFESSIONAL CORE COURSES (PC)

Sl.No	Code No	Course Title	Contact Periods	L	T	P	C
1	BAR102	HISTORY OF ARCHITECTURE I	3	3	0	0	3
2	BAR101	THEORY OF ARCHITECTURE I	3	3	0	0	3
3	BAR1L1	ARCHITECTURAL BASIC DESIGN	12	0	0	12	6
4	BAR106	ARCHITECTURAL GRAPHICS AND ART STUDIO	5	1	0	4	3
5	BAR205	ARCHITECTURAL GRAPHICS – II	5	1	0	4	3
6	BAR2L1	ARCHITECTURAL DESIGN I	12	0	0	12	6
8	BAR202	HISTORY OF ARCHITECTURE II	3	3	0	0	3
9	BAR3L1	ARCHITECTURAL DESIGN II	14	0	0	14	8
10	BAR302	HISTORY OF ARCHITECTURE III	3	3	0	0	3
11	BAR404	SITE PLANNING & LANDSCAPE ARCHITECTURE	3	2	0	2	3
12	BAR4L1	ARCHITECTURAL DESIGN IV	14	0	0	14	8
13	BAR402	HISTORY OF ARCHITECTURE IV	3	3	0	0	3
14	BAR5L1	ARCHITECTURAL DESIGN V	14	0	0	14	8
15	BAR502	HISTORY OF ARCHITECTURE V	3	3	0	0	3
16	BAR604	HUMAN SETTLEMENT AND PLANNING	3	3	0	0	3
17	BAR603	COST ESTIMATION	3	0	0	0	3
18	BAR6L1	ARCHITECTURAL DESIGN VI	16	0	0	16	8
19	BAR602	HISTORY OF ARCHITECTURE V	3	3	0	0	3
20	BAR701	URBAN DESIGN	3	3	0	0	3
21	BAR 702	RESEARCH METHODOLOGY & PRE THESIS WORK	2	0	0	2	4
22	BAR202	THEORY OF ARCHITECTURE II	3	3	0	0	3
23	BAR801	URBAN HOUSING	3	3	0	0	3
24	BAR 802	VERNACULAR ARCHITECTURE					
25	BAR7L1	ARCHITECTURAL DESIGN VII	16	0	0	16	8
26	BAR8L1	ARCHITECTURAL DESIGN VIII					
27	BARX	THESIS	**32**	**0**	**0**	**32**	**18**
Total Credits	**120**						

BUILDING SCIENCESAND APPLIED ENGINEERING (BS & AE)

SL.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	BAR103	MECHANICS OF STRUCTURES I	4	2	2	0	3
2	BAR102	MATHEMATICS	4	2	2	0	3
3	BAR203	MECHANICS OF STRUCTURES II	4	2	2	0	3
4	BAR206	MATERIALS AND CONSTRUCTION I	5	1	0	4	3
5	BAR303	DESIGN OF STRUCTURES I	3	2	2	0	3
6	BAR301	BUILDING SERVICES I	3	2	0	2	3
7	BAR306	MATERIALS AND CONSTRUCTION II	4	1	0	4	3
8	BAR403	DESIGN OF STRUCTURES II	4	2	2	0	3
9	BAR401	BUILDING SERVICES II	3	2	0	2	3
10	BAR405	CLIMATE & BUILT ENVIRONMENT	3	3	0	0	3
11	BAR406	MATERIALS AND CONSTRUCTION III	5	1	0	4	3
12	BAR503	DESIGN OF STRUCTURES III	4	2	2	0	3
13	BAR501	BUILDING SERVICES III	4	2	0	2	3
14	BAR504	MATERIALS AND CONSTRUCTION IV	5	1	0	4	3
Total Credits							**54**

PROFESSIONAL ABILITY ENHANCEMENT COURSES (PAEC)

SL.NO.	COURSE CODE	COURSE TITLE	CONTACT PERIODS	L	T	P	C
1	BEN102	ENGLISH	3	2	0	2	3
2	BAR204	PERSONALITY DEVELOPMENT & SOFT SKILLS ENCHANCEMENT	4	2	0	2	3
3	BAR305	COMPUTER STUDIO I	4	1	0	4	3
4	BAR5L2	COMPUTER STUDIO II	4	1	0	4	3
5	BAR704	PROJECT MANAGEMENT	3	3	0	0	3
6	BAR703	PROFESSIONAL ETHICS AND PRACTICE	3	3	0	0	3
7							
8	BAR9PT	PRACTICAL TRAINING	FULL DURATION OF SEMESTER	–	–	–	**12**
Total Credits							**36**

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No	Sub Area	Credit As per Semester										No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII	IX	X		
1	Professional Core (PC)	15	12	11	14	11	14	14	11	-	18	120	52.63%
2	Building Sciences and Applied Engineering (BS & AE)	6	6	12	12	9	6	3	-	-	-	54	23.68%
3	Professional Ability Enhancement Courses (PAEC)	3	3	3	-	3	-	3	9	12	-	36	15.78%
4	Professional Elective	-	-	-	-	3	3	3	6	-	3	18	8%
	Total Credit	24	21	26	26	26	23	23	26	12	21	228	-
	Total Contact Hour	34	34	34	35	37	34	33	36	FULL SEMESTER	35		-

BHARATH INSTITUTE OF HIGHER EDUCATION AND RESEARCH

R-2015

CURRICULUM

School of Aeronautical Engineering

School of Aeronautical Engineering

- B.Tech - Aeronautical Engineering
- B.Tech - Aerospace Engineering

REGULATION 2015

B.TECH - AERONAUTICAL ENGINEERING

CURRICULUM AND SYLLABUS

SEMESTER I						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
Theory						
BEN101	HS	English-I	2	1	0	3
BMA101	BS	Mathematics –I	3	0	0	3
BPH 101	BS	Engineering Physics – I	3	0	0	3
BCH101	BS	Engineering Chemistry – I	3	0	0	3
BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
BSS101	HS	Personality Development	1	1	0	2
BBT 102	BS	Biology for Engineers	2	0	0	2
BCE101	ES	Basic Civil Engineering	2	0	0	2
BME101	ES	Engineering Graphics-E	2	2	0	4
Practical						
BCM1L1	ES	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	2	1
BSS1L4/ 1L5/IL6	HS	NCC/NSS/NSO to be conducted during week ends				1
E- Civil, Mechanical, Aeronautical Branches						

Total No. of Contact Hours: 27 **Total No. of Credits: 27**

** Engineering graphics – Final examination will be evaluated by internal faculty.

* Laboratory classes on alternate weeks. The lab examinations will be held only in the second semester (including the first semester experiments also).

SEMESTER II						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN 201	HS	English-II	2	1	0	3
BMA201	BS	Mathematics- II	3	1	0	3
BPH 201	BS	Engineering Physics – II	3	0	0	3
BCH201	BS	Engineering Chemistry – II	3	0	0	3
	HS	Foreign/Indian Language	3	0	0	3
BME202	ES	Engineering Mechanics	2	1	0	3
BEE201	ES	Basic Electrical and Electronics Engineering	2	0	0	2
Practical						
BCS2L2	ES	Computer Practices Lab	0	0	2	1
BEE2L1	ES	Basic Electrical and Electronics Engineering Practices	0	0	2	1
BPC2L1*	BS	Physics and Chemistry Laboratory	0	0	2/2	1
BSS2L7	HS	Yoga to be conducted during week ends				1
# Any one of the following courses: BFR201 – French, BGM201 – German, BJP201- Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 – Tamil						
*Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)						

Total No. of Contact Hours: 26 **Total No. of Credits: 24**

SEMESTER III							
SL. NO	**SUBJECT CODE0**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1	BMA301	BS	Mathematics – III	3	1	0	4
2	BAN301	PC	Fundamentals of Aeronautics and Astronautics	3	0	0	3
3	BAN302	PC	Fundamentals of Fluid Mechanics	3	1	0	4
4	BAN303	PC	Fundamentals of Aero - Thermodynamics	3	1	0	4
5	BAN304	PC	Fundamentals of Structural Mechanics	3	1	0	4
6	BAN305	PC	Mechanics of Machines	3	0	0	3
PRACTICALS							
7	BCE3L1	ES	Fluid Mechanics and Machineries Laboratory	0	0	4	2
8	BCE3L2	ES	Strength of Materials Laboratory	0	0	4	2
9	BME3L1	ES	Machine Drawing	0	0	4	2

Total No. of Contact Hours: 34Total No. of Credits: 28

SEMESTER IV

SL. NO	**SUBJECT CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1	BMA402	BS	Numerical Methods	3	1	0	4
2	BAN401	PC	Aircraft Structures – I	3	1	0	4
3	BAN402	PC	Aerodynamics – I	3	1	0	4
4	BAN403	PC	Aircraft Propulsion	4	0	0	4
5	BAN404	PC	Aircraft Systems and Instrumentation	3	0	0	3
6	BCE407	HS	Environmental Studies	3	0	0	3
PRACTICALS							
7	BAN4L1	PC	Aircraft Structures Laboratory	0	0	4	2
8	BME4L1	ES	Manufacturing Engineering Laboratory	0	0	2	1
9	BAN4L2	PC	Computer Aided Design and Drafting	0	0	2	1

Total No. of Contact Hours: 30Total No. of Credits: 26

SEMESTER V							
SL. NO	**SUBJECT CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1	BAN501	PC	Aircraft Structures – II	3	1	0	4
2	BAN502	PC	Aerodynamics – II	3	1	0	4
3	BAN503	PC	Advanced Aerospace Propulsion	4	0	0	4
4	BAN504	PC	Flight mechanics	3	1	0	4
5	BME505	ES	Manufacturing Engineering	3	0	0	3
6	-	CE	Core Elective – I	3	0	0	3
PRACTICALS							
7	BAN5V1	PR	Value Added Program I	0	0	2	1
8	BAN5L1	PC	Aerodynamics Laboratory	0	0	4	2
9	BAN5L2	PC	Aero Design and Modeling Laboratory	0	0	2	1
10	BAN5L3	PC	Computer Aided Analysis	0	0	2	1

Total No. of Contact Hours: 32Total No. of Credits: 27

SEMESTER VI							
SL. NO	**SUBJECT CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1	BSS601	HS	Value Education and professional Ethics	3	0	0	3
2	BAN601	PC	Aerospace Structural Materials and Composites	3	0	0	3
3	BAN602	PC	Finite Element Methods	3	1	0	4
4	BAN603	PC	Control Engineering	3	0	0	3
5	-	CE	Core Elective – II	3	0	0	3
6	-	NE	Non – Major Elective – I	3	0	0	3
PRACTICALS							
7	BAN6V1	PR	Value Added Program – II	0	0	2	1
8	BAN6L1	PC	Aircraft System Laboratory	0	0	4	2
9	BAN6L2	PC	Propulsion Laboratory	0	0	4	2
10	BAN6L3	PC	Aircraft Design Project – I	0	0	4	2

Total No. of Contact Hours: 33Total No. of Credits: 26

SEMESTER VII							
SL. NO	**SUBJECT CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1	BAN701	PC	Computational Fluid Dynamics	3	0	0	3
2	BAN702	PC	Avionics	3	0	0	3
3	BAN703	PC	Heat Transfer	3	0	0	3
4	-	CE	Core Elective – III	3	0	0	3
5	-	NE	Non – Major Elective – II	3	0	0	3
6	-	OE	Open Elective – I	3	0	0	3
PRACTICALS							
7	BAN7L1	PC	Airframe and Aero Engine Repair Lab	0	0	2	1
8	BAN7L2	PC	Avionics Laboratory	0	0	2	1
9	BAN7L3	PC	Aircraft Design Project – II	0	0	4	2
10	BAN7P1	PR	Project Phase 1	0	0	4	2

Total No. of Contact Hours: 30 Total No. of Credits: 24

SEMESTER VIII							
SL. NO	**SUBJECT CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1	-	NE	Non – Major Elective – III	3	0	0	3
2	-	OE	Open Elective – II	3	0	0	3
PRACTICALS							
3	BAN8P1	PR	Project Work	0	0	18	9
4	BAN8C1	PR	Comprehension	0	0	0	1

Total No. of Contact Hours: 24Total No. of Credits: 16

TOTAL NO. OF CREDITS FOR THE PROGRAM : 198

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No.	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	6	7	-	3	-	3	-	-	19	9.6
2	Basic Sciences (BS)	11	10	4	4	-	-	-	-	29	14.7
3	Engineering Sciences (ES)	10	7	6	1	3	-	-	-	27	13.7
4	Professional Core (PC)	-	-	18	18	20	16	13	-	85	42.9
5	Core Electives (CE)	-	-	-	-	3	3	3	-	9	4.5
6	Non major Electives (NE)	-	-	-	-	-	3	3	3	9	4.5
7	Open Electives (OE)	-	-	-	-	-	-	3	3	6	3
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	-	-	1	1	2	10	14	7
	Total Credit	27	24	28	26	27	26	24	16	198	100
	Total Contact Hour	27	26	34	33	30	32	30	24	236 Hrs	

LIST OF ELECTIVES

List of Core Elective (CE) I:

Code No.	Course Title	L	T	P	C
BANE01	Basics of Aircraft Maintenance and Repair	3	0	0	3
BANE02	Rockets and Missiles	3	0	0	3
BANE03	Experimental Stress Analysis	3	0	0	3
BANE04	Experimental Aerodynamics	3	0	0	3

List of Core Elective (CE) II:

Code No.	Course Title	L	T	P	C
BANE05	Helicopter Maintenance	3	0	0	3
BANE06	Space Mechanics	3	0	0	3
BANE07	Theory of Vibrations	3	0	0	3
BANE08	Helicopter Aerodynamics	3	0	0	3

List of Core Elective (CE) III:

Code No.	Course Title	L	T	P	C
BANE09	Aircraft Engine Repair and Maintenance	3	0	0	3
BANE10	Cryogenic Rocket Propulsion	3	0	0	3
BANE11	Theory of Plates and Shells	3	0	0	3
BANE12	Hypersonic Aerodynamics	3	0	0	3

List of Non Major Elective (NE) I:

Code No.	Course Title	L	T	P	C
BANE13	An Introduction to Combustion	3	0	0	3
BANE14	Principles of Turbo machinery in Air breathing Engines	3	0	0	3
BANE15	Nano Science and Technology	3	0	0	3
BANE16	Unmanned Aerial Vehicle	3	0	0	3

List of Non Major Elective (NE) II:

Code No.	Course Title	L	T	P	C
BANE17	Boundary Layer Theory	3	0	0	3
BANE18	Fatigue and Fracture Mechanics	3	0	0	3
BANE19	High Temperature Materials	3	0	0	3

List of Non Major Elective (NE) III:

Code No.	Course Title	L	T	P	C
BANE20	Wind Energy	3	0	0	3
BANE21	Satellite Technology	3	0	0	3
BANE22	Aircraft Rules and Regulations CAR I and II	3	0	0	3

List of Open Elective (OE) I:

Code No.	Course Title	L	T	P	C
BBA001	Principles of Management and Organizational Behavior	3	0	0	3
BANE23	Airport Management	3	0	0	3
BANE24	Aerospace Bio – Medical and Life Support Engineering	3	0	0	3

List of Open Elective (OE) II:

Code No.	Course Title	L	T	P	C
BBA008	Total Quality Management	3	0	0	3
BANE25	Industrial Aerodynamics	3	0	0	3
BANE26	Mechanics of Heterogeneous Materials	3	0	0	3

BMA301	MATHEMATICS III	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Mathematics I & II				
	Course Designed by – Department of Mathematics				

OBJECTIVES

1. To introduce Fourier series analysis that is important to many applications in engineering apart from its use in solving boundary value problems.
2. To acquaint the student with Fourier transform techniques used in wide variety of situations.
3. To introduce the effective mathematical tools for the solutions of partial differential equationsthat model several physical processes.
4. To develop Z transform techniques for discrete time systems.
5. To develop the Fourier transform techniques and convolution theorem.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Classify** the different methods for solving partial differential equations. **(Understand)**
CO 2	**Apply** Fourier series solution method for engineering problems.**(Apply)**
CO 3	**Analyze**the solutions ofone dimensional and two dimensional boundary value problems in partial differential equations. **(Analyze)**
CO 4	**Apply**the concept of Laplace transform to various engineering problems.**(Apply)**
CO 5	**Evaluate** theengineering problems using inverse Laplace techniques.**(Evaluate)**
CO 6	**Apply** Fourier transform to engineering problems.**(Apply)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H	H										H		
CO 2	H	H			H							H		
CO 3	H	H	H		H							H		
CO 4	H	H	H		H							H		
CO 5	H	H	H	L	H							H		
CO 6	H	H	H	L								H		
Category	**Basic Sciences (BS)**													

Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	**PARTIAL DIFFERENTIAL EQUATIONS**	**12**
Formation of PDE by eliminating arbitrary constants, functions – Solutions of first order PDE – Standard types-homogeneous linear PDE of second order with constant coefficients - Lagrange's Linear PDE – Method of grouping, multiplier methods.		
UNIT II	**FOURIER SERIES**	**12**
Dirichlet's conditions – General Fourier series – Half-range Sine and Cosine series – Parseval's identity – Harmonic Analysis.		
UNIT III	**BOUNDARY VALUE PROBLEMS**	**12**
Classifications of second order linear partial differential equation – Solutions of one-dimensional wave equation and one-dimensional heat equation.		
UNIT IV	**LAPLACE TRANSFORMS**	**12**
Laplace transform of simple functions – Transform of elementary functions – Basic properties – initial and final value theorem – Transform of derivatives and integrals – transform of periodic functions – inverse Laplace transforms –Convolution theorem (excluding proof) – Solution of linear ODE of second order with constant coefficients and solutions of simultaneous first order differential equations with constant coefficients using Laplace transformation techniques.		
UNIT V	**FOURIER TRANSFORMS**	**12**
Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms – Properties – Transform of simple function – Convolution theorem – Parseval's identity.		

Text Books:

1. Grewal, B.S., Higher Engineering Mathematics, Khanna Publications, 2007.

References:

1. Glyn James, Advance Modern Engineering Mathematics, Pearson Education, 2007.
2. Kreyszig. E, Advanced Engineering Mathematics, (8^{th} edition), John Wiley & Sons, Singapore, 2000.
3. Kandasamy P et al, Engineering Mathematics, Vol. II & III (4^{th} revised edition), S. Chand & Co., New Delhi, 2000.
4. Narayanan S., Manicavachagom Pillay T. K., Ramanaiah G., Advanced Mathematics for Engineering Students, Volume II & III (2^{nd} edition), S. Viswanathan Printers and Publishers, 1992.
5. Venkataraman M. K., Engineering Mathematics – Vol. III – A & B (13^{th} edition), National Publishing Co., Chennai, 1998.
6. Julius S. Bendat and Allan G **BANE20**. Piersol., Random Data: Analysis and Measurement Procedures (4^{th} edition), Wiley Series in Probability and Statistics, 2010.
7. *https://www.wolfram.com/**mathematica**/*

BAN301	FUNDAMENTALS OF AERONAUTICS AND ASTRONAUTICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering.				

OBJECTIVES

1. To equip students with the knowledge about the development of aircrafts and spacecraft through historical reviews and about their basic configurations.
2. To accustom students the various basic aerodynamic terms and about the generation of aerodynamic forces.
3. To introduce students about the basic types of aircraft constructions and materials and the various loads acting on it.
4. To familiarize the studentsabout the different kinds of propulsion for aircrafts and materials for gas turbine engines
5. To acquaint the students about space vehicles, re- entry, heat transfer and basics of satellite technology

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the basic components of airplane and various flight vehicles. (**Remember**)
CO 2	**Summarize** the variation of aircraft performance at various altitudes. (**Understand**)
CO 3	**Explain** the structural components of airplane and materials used for aircraft construction. (**Understand**)
CO 4	**Describe** the working of different types of aircraft engines and their performances. (**Understand**)
CO 5	**Discuss** the theory behind rocket propulsion and the problems associated with hypersonic vehicle operation. **(Understand)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									M			H	
CO 2	H				L								H	
CO 3	H									M		H	H	
CO 4	H											H	H	
CO 5	H											H	H	

Category	Professional Core (PC)	
Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	INTRODUCTION TO FLIGHT	8
Brief history of Aviation-Hot air balloon and heavier than air flying machines-early airplane configurations-Modern Airplanes-Components of airplane and their functions-Rotary wing aircrafts-Space vehicles.		
UNIT II	FUNDAMENTALS OF AERONAUTICS	11
International Standard Atmosphere-Pressure, Temperature and Density altitude, Basic Aerodynamics - Continuity, Momentum and Energy equations, Bernoulli's equation-Mach number-subsonic, transonic, sonic and supersonic flow regimes, Measurement of pressure and airspeed- IAS,EAS and TAS. Airfoil geometry and nomenclature-infinite and finite wing sections-lift, drag and moment coefficients-angle of attack-aspect ratio-Reynolds number-induced drag and parasite drag-airfoil characteristics, Elements of Aircraft performance, stability and control.		
UNIT III	AIRCRAFT STRUCTURE AND MATERIALS	8
Structural components of an airplane- monocoque and semi monocoque structure –materials for structural components – composite materials and their significance in Aviation Technology		
UNIT IV	AIRCRAFT PROPULSION	10
Propeller Engine – Gas Turbine Engine – Turbo prop, Turbo jet, Turbo fan Engines- specific fuel consumption-variation of thrust and power with speed and altitude – materials for engine components.		
UNIT V	SPACE VEHICLES & ASTRONAUTICS	8
Basics of Rocket Technology-escape velocity-reentry vehicles-heat transfer problems of space vehicles-ablative cooling-Satellite technology– Hypersonic vehicles, Elements of Astronautics.		
Total Periods: 45		

Text Books:

1. Anderson, J. D., Introduction to Flight,TataMcGraw-Hill Higher Education, 6th edition 2010.
2. Kermode, A. C, Barnard, R. H and Philpott, D. R, Mechanics of Flight, Pearson education, 2012.

References:

1. Shevell, R. C., Fundamentals of Flight., Prentice hall (2nd edition), 1989.
2. Steven, A. Brandt, Randall J. Stiles, John J. Bertin and Ray Whitford, Introduction to Aeronautics: A Design Perspective, AIAA Education series (2nd edition),2004.
3. Torenbeek, E and Wittenberg, H, Flight Physics: Essentials of Aeronautical Disciplines and Technology, with Historical Notes, Springer, 2009.
4. *www.grc.nasa.gov/WWW/k-12/airplane/*

BAN302	FUNDAMENTALS OF FLUID MECHANICS	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Engineering Physics,Engineering Mechanics, Mathematics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce students about properties of fluid and its classification.
2. To teach Students about fluid statics and dynamics.
3. Significance of similarity and model studies
4. To know about boundary layer concepts and its applications to pipe design.
5. To learn about pumps and turbine design.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Recall** the concepts of fluids, properties of fluids and its classification. (**Remember**)
CO 2	**Calculate** the flow properties using the fundamental equations of fluid motion. (**Apply**)
CO 3	**Solve** problems based on dimensional analysis and fluid flow analysis. (**Apply**)
CO 4	**Examine t**he pipe line system for minimum head loss. (**Apply**)
CO 5	**Calculate** the performance and operating characteristics of turbines and pumps. **(Apply)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H												H	
CO 2	H												H	
CO 3	H											L	H	
CO 4	H									H			H	
CO 5	H									H			H	
Category	**Professional Core (PC)**													

Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	**INTRODUCTION**	**10**
Fluid –definition-Fluid properties-Newton's law of viscosity-Classification of fluids-fluid statics-Hydrostatic forces on submerged surfaces- Stability of floating bodies		
UNIT II	**FLUID FLOW ANALYSIS AND FLOW MEASUREMENT**	**14**
Ideal and real flow-Concept of continuum-Eulerian and Lagrangian approaches-Velocity field-Pathline, Streakline, Streamline- Stream tube- Fluid acceleration-Continuity, momentum differential equations-Navier Stokes equation- Stream function – Vorticity –Irrotationality- Potential function-Potential flow-Laplace equation-Bernoulli's equation and its applications-Venturi meter-Orificemeter, Flow Rate and Velocity Measurement.		
UNIT III	**DIMENSIONAL ANALYSIS**	**10**
Buckingham Pi Theorem-Non dimensional numbers and their significance-Flow similarity and model studies.		
UNIT IV	**FLOW THROUGH PIPES**	**12**
Laminar and turbulent flow- Boundary layer flow – Boundary layer thickness - Reynolds number and its significance-Laminar fully developed pipe flow-Hagen-Poiseuille flow-Coefficient of friction-Head loss – Darcy-Weisbach equation-Hydraulic gradient- Total energy lines-Moody's diagram-Turbulent flow through pipes.		
UNIT V	**FLUID MACHINERY**	**14**
Classification of fluid machines-Reciprocating and centrifugal pumps-impulse and reaction turbines-Working principle of Pelton, Francis and Kaplan turbines-Velocity triangles-fans and blowers.		
Total Periods: 60		

Text Books:

1. Frank M White, Fluid Mechanics, The McGraw Hill companies. (7^{th} edition), 2011.
2. Rathakrishnan, E, Fundamentals of Fluid Mechanics, Prentice-Hall (3^{rd} edition), 2012.

References:

1. Yunus A Cengel and John M Cimbala, Fluid mechanics: Fundamentals and Applications, Tata McGraw Hill (2^{nd} edition), 2010.
2. Irving H Shames, Mechanics of Fluids, The McGraw Hill companies (4^{th} edition), 2003.
3. Yuan, S.W, Foundations of Fluid Mechanics, Prentice-Hall, 1967.
4. *reu.eng.ua.edu › Programs*
5. *www.**fluidmechanics**.co.uk/*

BAN303	FUNDAMENTALS OF AERO – THERMODYNAMICS	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Physics, Basics of Mechanical Engineering				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVE: To make the student understand about the basics of engineering thermodynamics, various laws and their applications, prediction of thermodynamic performance of various engines, and other thermal devices.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Apply** the fundamental laws of thermodynamics and its thermodynamic relations. (**Apply**)
CO 2	**Compute** the air standard efficiencies using P-V and T-S diagram of various air power cycles. (**Apply**)
CO 3	**Calculate** the efficiency of various Vapor power cycles (**Apply**)
CO 4	**Estimate** the COP of refrigeration and air-conditioning systems. (**Analyze**)
CO 5	**Calculate** the efficiency of jet propulsion cycles. (**Apply**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H												H	
CO 2	H											M	H	
CO 3	H									M		M	H	
CO 4	H												H	
CO 5	H									M			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**BASIC THERMODYNAMICS**	**16**

Systems, Zeroth law, First law - Steady flow energy equation - Heat and work transfer in flow and non-flow processes - Second law, Kelvin-Planck statement - Clausius statement – Reversibility and irreversibility - Concept of Entropy, Clausius inequality, Principle of increase of entropy – Absolute entropy – Availability - Entropy change in non-flow processes

UNIT II	AIR POWER CYCLES	12

Carnot, Otto, Diesel, Dual, Stirling and Ericsson cycle - Air standard efficiency – Mean effective pressure – Actual and theoretical PV diagram of two stroke and four stroke IC engines.

UNIT III	VAPOUR POWER CYCLES	12

Introduction – Rankine cycle – Means of increase of efficiency of the Rankin cycle – Ideal reheat and regenerative Rankine cycle – Second law analysis of vapour power cycles – Cogeneration.

UNIT IV	REFRIGATION AND AIR – CONDITIONING	10

Principles of refrigeration and Psychometric - Vapour compression - Vapour absorption types - Co-efficient of performance, Properties of refrigerants – Basic Principle and types of Air conditioning.

UNIT V	THERMODYNAMICS OF AIRCRAFT PROPULSION CYCLES	10

Isentropic flow through passages – Brayton cycle – Brayton cycle with intercooling, reheat and regeneration – Ideal jet propulsion cycles. Basics of heat transfer.

Text Books:

1. Rathakrishnan E., Fundamentals of Engineering Thermodynamics, Prentice-Hall India, 2012.
2. Nag.P.K.,Engineering Thermodynamics, Tata McGraw-Hill, New Delhi, 2007.

Reference Books:

1. Yunus A Cengel and Michael A Boles., Thermodynamics- an Engineering approach, McGraw Hill Education (7^{th} edition), 2012.
2. Holman.J.P.,Thermodynamics, McGraw-Hill (3^{rd} edition), 2007.
3. Gordon J. Van Wylen and Richard E. Sonntag and Claus Borgnakke., Fundamentals of Classical Thermodynamics – Vol 1, Wiley Eastern, 1994.
4. Arora C.P., Thermodynamics, Tata McGraw-Hill, New Delhi, 2003.
5. Merle C Potter and Craig W Somerton., Thermodynamics for Engineers, Schaum's Outline Series, Tata McGraw-Hill (2^{nd} edition), 2009.
6. *www.thermocalc.com/*
7. *www.grc.nasa.gov/WWW/cdtb/**software**/t-mats.html*

BAN304	FUNDAMENTALS OF STRUCTURAL MECHANICS	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Engineering Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To provide the students, an understanding about the basics of strength of materials
2. To acquaint the student with the procedures for estimating the stresses acting in beams
3. To impart knowledge on estimation of deflections of various types of beams under different loading conditions
4. To develop the basic understanding of torsion of structural members
5. To develop the basic understanding about the bi-axial state of stress and basics of elasticity

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Compute** the stress developed in statically determinate and indeterminate structures subjected to axial load. (**Apply**)
CO 2	**Sketch** shear force and bending moment diagram for a given beam. (**Apply**)
CO 3	**Determine** the deflection of beams using various methods (**Apply**)
CO 4	**Compute** the shear stress developed in circular shafts and springs subjected to torsional and axial load. (**Apply**)
CO 5	**Determine** the principal stresses developed in structural components using Mohr's Circle. (**Apply**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									H			H	
CO 2	H				M								H	
CO 3	H											M	H	
CO 4	H											M	H	
CO 5	H				M					H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT		
UNIT I	**INTRODUCTION TO STRENGTH OF MATERIALS**	**16**
Introduction to mechanics of deformable bodies - Material selection criteria – stress – strain – Stress and strain diagram – Hook's law - Elastic constants – definition of engineering constants: elastic moduli – Young's modulus, Bulk Modulus& Volumetric Strain, Poisson's ratio, Shear Modulus, relation between three elastic moduli and Poison's ratio, Statically determinate and indeterminate problems in tension and compression – Thermal stress – Impact loading – Composite bars		
UNIT II	**STRESSES IN BEAMS**	**10**
Shear force and bending moment diagrams for simply supported, cantilever beams and overhanging beams– bending stress variation in beams of symmetric sections, neutral axis		
UNIT III	**DEFLECTION OF BEAMS**	**10**
Double integration, Macaulay's method, moment area method, conjugate beam method, method of superposition, Maxwell's reciprocal theorem.		
UNIT IV	**TORSION**	**10**
Torsion of solid and hollow circular shafts – Shear stress variation – Power transmission in shafts – Open and closed-coiled helical springs – Stresses in helical springs.		
UNIT V	**BI – AXIAL STRESSES AND ELEMENTS OF ELASTICITY**	**14**
Stresses in thin cylindrical and spherical shell under internal pressure and volumetric strain– Principle stresses and maximum shear stresses– Combined loading – Mohr's circle and its construction – concept of theory of elasticity, basic assumptions, coordinate transformation, plane stress and plane strain conditions, stress tensor		
Text Books: 1. Gere & Timoshenko, Mechanics of Materials, McGraw Hill, 1993 2. William Nash, Strength of Materials, Tata McGraw Hill, 2004		
Reference Books: 1. F. P. Beer, E.R. Johnston, and J.T. Dewolf, Mechanics of Materials, McGraw-Hill (4^{th} edition), 2006 2. Dym,C.L., and Shames,I.H., Solid Mechanics, McGraw Hill, Kogakusha, 1973. 3. Stephen Timoshenko, Strength of Materials, Vol I & II, CBS Publishers and Distributors, Third Edition. 4. R.K.Rajput, Strength of Materials, S. Chand and Co., 1999. 5. Timoshenko,S. and Young,D.H., Elements of Strength of Materials, T.VanNostrand Co. Inc., Princeton, N.J., 1977. 6. *www.mdsolids.com/* *7.* *https://www.actuspotentia.com/MechMat.shtml*		

BAN305	MECHANICS OF MACHINES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To impart students with the knowledge about motion, masses and forces in machines.
2. To enable students to apply fundamental of mechanics to machines which include engines, linkages etc.,
3. To impart students with the knowledge about various power transmitting devices such as gears, belts etc.
4. To facilitate students to understand the concept of balancing of rotating and reciprocating masses.
5. To give awareness to students on the phenomenon of vibration and its effects.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the working of different mechanisms along with inversion and their corresponding velocity and acceleration diagrams. (**Apply**)
CO 2	**Determine** the Power transmission in machine elements using fundamentals of friction. (**Apply**)
CO 3	**Sketch** the Cam profile for various follower motions. (**Apply**)
CO 4	**Determine** the unbalanced forces acting on rotating and reciprocating parts in engine. **(Apply)**
CO 5	**Classify** the types of vibration and the frequencies of vibrating systems. **(Understand)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H				H					H			H	
CO 2	H												H	
CO 3	H				H					H			H	
CO 4	H				H					H			H	
CO 5	H												H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	MECHANISMS	8
Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom –Kutzbach criterion - Slider crank and crank rocker mechanisms – Inversions – Applications –Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.		
UNIT II	**FRICTION**	**9**
Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (Flat and Vee) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.		
UNIT III	**GEARING AND CAMS**	**9**
Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, Compound gear trains and epicylic gear trains - Determination of speed and torque - Cams – Types of cams and followers.		
UNIT IV	**FORCE ANALYSIS AND BALANCING**	**10**
Introduction to force analysis - Static and dynamic – Inertia force and inertia torque – D'Alembert's principle -Static and dynamic balancing – Single and several masses in different planes –Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multicylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method.		
UNIT V	**VIBRATION**	**9**
Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.		

Text Books:

1. Rattan.S.S., Theory of Machines, Tata McGraw–Hill Publishing Co, New Delhi, 2004.
2. Balaguru. S., Dynamics of Machinery, SciTech publication (2nd edition), 2009.

Reference Books:

1. Rao, J.S and Dukkipati, R.V, "Mechanism and Machine Theory", Second Edition, Wiley Eastern Ltd., 1992.
2. Malhotra, D.R and Gupta, H.C., "The Theory of Machines", SatyaPrakasam, Tech. India Publications, 1989.
3. Gosh, A. and Mallick, A.K., "Theory of Machines and Mechanisms", Affiliated East West Press,1989.
4. Shigley, J.E. and Uicker, J.J., "Theory of Machines and Mechanisms", McGraw-Hill, 1980.
5. Burton Paul, "Kinematics and Dynamic of Planer Machinery", Prentice Hall, 1979.
6. *ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=5593596*
7. *www.simple**machines**.org/*

BCE3L1	FLUID MECHANICS AND MACHINERIES LAB	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Engineering Mechanics				
	Course Designed by – Department of Civil Engineering				

OBJECTIVES

1. To help the student to understand about pipe flow losses and flow through notches and weirs.
2. To accustom the student about buoyancy test and Bernoulli's principle
3. To introduce to the student about the various flow meters
4. To acquaint the student about the performance characteristics of various pumps
5. To introduce to the student about the performance characteristics of various turbines

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Observe** the flow characteristics in a fluid flow system. **(Imitation)**
CO 2	**Acquire** the pressure data with manometers/sensors for finding the efficiency of given system. **(Manipulation)**
CO 3	**Perform**the basic calculations and plot graphs to infer fluid behaviour at various flow conditions. **(Precision)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H			H	
CO 2	H								H	H			H	
CO 3	H								H	H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Determination of pipe flow losses.
2	Calibration of orifice meter and venture meter.
3	Flow through notches and weir.
4	Flow through open orifice.
5	Verification of Bernoulli's Equation.
6	Performance characteristics of centrifugal pump.

7	Performance characteristics of submergible pump.
8	Performance characteristics of jet pump.
9	Characteristics of impulse turbine – Pelton wheel turbine.
10	Characteristics of reaction turbine – Francis turbine.

References:

1. Fluid Mechanics and Machinery Lab Manual, Department of Civil Engineering, 2015

BCE3L2	STRENGTH OF MATERIALS LAB	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Engineering Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To enable the student to understand about the tensile test and stress – strain curves and also about the compression tests
2. To accustom the student about shear test, torsion test and hardness tests.
3. To introduce to the student about the impact test.
4. To acquaint the student about the open and closed coil spring tests.
5. To introduce to the student about fatigue test.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Carry out** elementary mechanical coupon testing of materials as per the given procedure**. (Imitation)**
CO 2	**Acquire** data using the available measuring devices. **(Manipulation)**
CO 3	**Perform** basic mathematical calculation using the appropriate formulae and represent the results in form of graph and table**.(Precision)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H			H	
CO 2	H								H	H			H	
CO 3	H								H	H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Tension test of a mild steel rod.
2	Shear test on mild steel and aluminum rod.
3	Torsion test on mild steel rod.
4	Hardness test (a) Brinell& (b) Rockwell.
5	Impact tests (a) Izod (b) Charpy.

6	Deflection test on helical spring.
7	Deflection of beams with various end conditions.
8	Flexural Test by 3-point Bending method.
9	Block compression test.
10	Determination of fracture strength and fracture pattern of ductile and brittle material.

References:

1. Strength of Materials Lab Manual, Department of Aeronautical Engineering, 2015

BME3L1	MACHINE DRAWING	L	T	P	C
	Total Contact Hours – 30	0	0	**4**	2
	Prerequisite – Engineering Graphics				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

1. To give the students an idea of fundamental issues common to almost all areas of machine drawing.
2. To train the student to draw an assembled diagram of a machine part based on the details of individual parts.
3. To help the student to understand the machine drawing, nomenclature and various notations.
4. To train the students to prepare a working drawing of machines.
5. To enable the student to communicate his ideas through drawings.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Observe** basic representation of symbols used in Engineering drawings. **(Imitation)**
CO 2	**Acquire** attributes of Production Drawing and Limits, fits, tolerances. **(Manipulation)**
CO 3	**Complete** the assembly of a given set of machine components. **(Manipulation)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H	H							H	H			H	
CO 2	H	H							H	H			H	
CO 3	H	H							H	H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

Indian standard code (BIS) of practice for engineering drawing – general principle of presentation, conventional representation of threaded parts, springs, Gears and common features, Abbreviations and symbols used in technical drawings.

Tolerance – Types – Symbols used and representation on the drawing – fit types, selection for different application – Allowance, Interchangeability. Surface finish Relation to the manufacturing processes – Types of representation on the drawing welding symbols.

Preparation of working drawing for given machine components: Bolts, Screws, Studs, Nuts, Keys and Key-ways.

Preparation of simple assembly drawings: Different types of cotter and knuckle joints.

Preparation of simple assembly drawing for following machine with part drawings given: Screw jack, Plummer block, connecting rod, machine vice, tail stock of lath, fuel injection pump for single cylinder engine, stop valve.

List of Experiments:

1. Draw the various Types of representation on welding symbols.
2. Preparation of working drawing for given machine components Bolts and Nuts.
3. Preparation of working drawing for given machine components Screw.
4. Preparation of working drawing for given machine components Key and Key-ways.
5. Draw the sectional assembled view of Sleeve and cotter joint
6. Draw the sectional assembled view of Knuckle joint.
7. Draw the sectional assembled view of Screw Jack.
8. Draw the sectional assembled view of Plummer Block.
9. Draw the sectional assembled view of Connecting Rod.
10. Draw the sectional assembled view of Tail stock.

Text Books:

1. Narayanan. K. L. Machine Drawing, New age publisher, 2006.

References:

1. Bhatt, N. D.., Machine Drawing, Charotar publishing house, 2000.
2. Gopala Krishnan, Machine Drawing, Subash publishers, 2001.
3. *https://www.smartdraw.com/**software**/mechanical-**drawing-software**.htm*
4. *https://www.**machine**designonline.com/*

BMA402	NUMERICAL METHODS	L	T	P	C
	Total Contact Hours – 60	3	**1**	0	4
	Prerequisite – Mathematics III, Engineering Physics, Engineering Mechanics				
	Course Designed by – Department of Mathematics				

OBJECTIVES

1. To introduce the solution of equations and Eigen value problems.
2. To acquaint the student with interpolation techniques used in wide variety of situations.
3. To introduce the effective mathematical tools for the solutions of numerical differentiation and integration.
4. To develop the initial value problems for ordinary differential equations.
5. To develop the boundary value problems for ODE and PDE.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Apply** numerical techniques to solve equations and linear system of equations. **(Apply)**
CO 2	**Interpolate** the value of a dependent variable in the given data by Newton's forward and backward difference formulae and also unequal intervals. **(Understand)**
CO 3	**Understand** and apply the concept of numerical methods to differentiation and integration. **(Understand)**
CO 4	**Evaluate**initial value problems of ODE by applying single step and multistep methods. **(Evaluate)**
CO 5	**Analyse** the two dimensional and one-dimensional ordinary differential equation with numerical techniques. **(Analyse)**
CO 6	**Solve** the boundary value problems in engineering with the help of finite difference methods. (**Create)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	H	H	H		H							H		
CO 2	H	H	H		H							H		
CO 3	H	H	H									H		
CO 4	H	H	H		H							H		
CO 5	H	H	H		H							H		
CO 6	H	H	H		H							H		

Category	Basic Sciences (BS)	
Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	INTERPOLATION (FINITE DIFFERENCES)	12
Iterative method, Newtown-Raphson method for single variable-solutions of linear system by Gaussian, Gauss-Jordan, Jacobian and Gauss-Siedel methods, Inverse of matrix by Gauss-Jordan method , Eigen value of a matrix power and Jacobian methods.		
UNIT II	INTERPOLATION (FINITE DIFFERENCES)	12
Newton's Divided difference formula, Lagrange's interpolation-forward and backward difference formula-Stirling's and Bessel's central difference formula.		
UNIT III	NUMERICAL DIFFERENTIATION AND INTEGRATION	12
Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal Simpson's 1/3" and 3/8" rule, Double integrals using Trapezoidal and Simpson's rule.		
UNIT IV	INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS	12
Single step methods, Taylor series, Euler and modified Euler, Runge kutta method of first and second order differential equations, multiple step methods, Milne and Adam's – Bash forth predictor and corrector method.		
UNIT V	BOUNDARY VALUE PROBLEMS FOR ODE AND PDE	12
Finite difference for the second order ordinary differential equations, finite difference solutions for one dimensional heat equations (both implicit and explicit), one dimensional wave equation, Two dimensional, Laplace and Poisson equation.		
Text Books: 1. Jain. M. K. Iyengar, S. R. K. And Jain, R K., Numerical Methods for Scientific and Engineering Computation, 3rd edition, New age international publication, company, 1993 2. Grewal, B.S., Higher Engineering Mathematics, Khanna Publications, 2007.		
References: 1. M. K. Venkatraman., Numerical Methods, NPC, Chennai. 2. Richard W. Hamming., Numerical Methods for Scientists and Engineers, Dover Publications (2nd edition), 1987. 3. *https://www.wolfram.com/**mathematica**/*		

BAN401	AIRCRAFT STRUCTURES I	L	T	P	C
	Total Contact Hours – 60	3	**1**	0	4
	Prerequisite – Engineering Mechanics, Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint students with the fundamentals of aircraft structures.
2. To acquaint students with statically determinate and indeterminate structures.
3. To introduce students to energy methods applied to simple aerospace structural elements.
4. To introduce various structural analysis of various column type aerospace structural elements.
5. To introduce various failure theory of structural analysis.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Determine**the forces acting in the members of statically determinate truss and frames. (**Apply**)
CO 2	**Calculate** the slope and deflection of statically indeterminate beams. (**Apply**)
CO 3	**Calculate** the deflection and strain energy ofstatically determinate and indeterminate structures. (**Apply**)
CO 4	**Compute** the buckling load and crippling stress of columns with different end conditions.(**Apply**)
CO 5	**Determine** the safe stress of the structural component using failure theories. (**Apply**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									M			H	
CO 2	H											M	H	
CO 3	H											M	H	
CO 4	H												H	
CO 5	H									M			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**TRUSSES AND FRAMES**	**12**

Statically determinate frames - Analysis of plane Truss - Method of joints - 3 D Truss- Plane frames - Composite beam.

UNIT II	**STATICALLY DETERMINATE AND INDETERMINATE STRUCTURES**	**12**

Propped Cantilever - Fixed-Fixed beams - Clapeyron's Three Moment Equation – slope deflection and energy distribution method.

UNIT III	ENERGY METHODS	12

Strain energy evaluation in structural members – energy theorems – dummy load & unit load methods – Maxwell's reciprocal theorem – energy methods applied to statically determinate and indeterminate beams, frames, rings & trusses

UNIT IV	COLUMNS	12

Euler's column curve – inelastic buckling – effect of initial curvature – the Southwell plot – columns with eccentricity – use of energy methods – theory of beam columns – beam columns with different end conditions – stresses in beam columns.

UNIT V	FAILURE THEORY	12

Fail safe and safe life structures, factor of safety, Brief introduction of yield material, brittle vs. ductile behavior, Creep and creep rupture, viscoelastic materials - environmental stress, stress potentials, effect of time and temperature - Fatigue and Fracture - Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory – Application to aircraft Structural problems.

Text Books:

1. Donaldson, B.K., Analysis of Aircraft Structures – An Introduction, McGraw-Hill,1993.
2. Megson T M G, Aircraft Structures for Engineering Students, Edward Arnold Publishers
3. C.T.Sun, Mechanics of aircraft structures, John wiley & sons, inc.

References:

1. Timoshenko, S., Strength of Materials, Vol. I and II, Princeton D. Von Nostrand Co, 1990.
2. Peer, D. J., and Azar J. J., Aircraft Structures, McGraw – Hill (2nd edition), 1999.
3. Bruhn.E.F., Analysis and design of flight vehicle structures, Tri set of offset company, 1973.
4. Michael C.Y.Niu ,Airframe structural design (ISBN No.962-7128-04-X), 1998
5. Rivello,Theory and Analysis of Flight Structures, McGraw-Hill, 1969.
6. Perry, Aircraft Structures, McGraw-Hill, 1950.

BAN402	AERODYNAMICS I	L	T	P	C
	Total Contact Hours – 60	3	**1**	0	4
	Prerequisite – Fundamentals of Fluid Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce student about basic concepts of mathematical formulation of air flow.
2. To impart theoretical knowledge about the elementary flow and their combination to analysis flow over real object.
3. To Study the distribution of pressure around airfoil for incompressible inviscid flow. To study transformation of flow over circle cylinder into flow over the airfoil
4. To study flow around wing and measure lift generated.
5. To introduce the students about viscous flow theory for flow over flat plate and solution for incompressible boundary layer

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Identify** the concepts of various types of flow based on mathematical equations. (**Understand**)
CO 2	**Apply** the concept of inviscid flow theory to solve flow over basic aerodynamic shapes. (**Apply**)
CO 3	**Practice** the construction of airfoils numerically with the help of mathematical transformations. (**Apply**)
CO 4	**Describe** the concept of lift generation and will be able to analyze the factors for efficient wing design. (**Understand**)
CO 5	**Determine** the skin friction drag over surfaces. (**Apply**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									M			H	
CO 2	H												H	
CO 3	H				L							H	H	
CO 4	H											H	H	
CO 5	H									M			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT		
UNIT I	**BASIC AERODYNAMIC PRINCIPLES**	**10**
Models of fluid - System and Control volume approach, substantial, local and convective derivative, Continuity, momentum and energy equations, Inviscid flow, Euler equation, incompressible Bernoulli‟s Equation. Circulation and Vorticity		
UNIT II	**FUNDAMENTALS OF INVISCID FLOWS**	**13**
Elementary Flows and their combinations – Ideal Flow over a circular cylinder, D‟Alembert‟s Paradox, Magnus effect, KuttaJoukowski Theorem, Starting Vortex, Kutta condition, Real flow over smooth and rough cylinder		
UNIT III	**AIRFOIL THEORY**	**15**
Complex Potential, Methodology of Conformal Transformation, Kutta-Joukowski transformation and its applications, Karman Trefftz Profiles, Thin Airfoil theory and its applications.		
UNIT IV	**FINITE WING THEORY**	**11**
Vortex Filament, Biot and Savart Law, Bound Vortex and trailing Vortex, Horse Shoe Vortex, Lifting Line Theory and its limitations, induced drag coefficient, elliptic and general lift distribution, Oswald's wing efficiency factor, effect of plan form and aspect ratio.		
UNIT V	**VISCOUS FLOW THEORY**	**11**
Laminar Boundary layer and its thickness, displacement thickness, momentum thickness, Energy thickness, Shape parameter, Boundary layer equations for a steady two-dimensional incompressible flow, Boundary Layer growth over a Flat plate, Critical Reynolds Number, Blasius solution, Basics of Turbulent flow		
Text Books: 1. Anderson, J.D., Fundamentals of Aerodynamics, McGraw Hill Book Co., 1999, Indian Edition		
References: 1. Rathakrishnan, E., Theoretical Aerodynamics, John Wiley & Sons, Inc., 2013 2. Milne Thomson, L.H., Theoretical Aerodynamics, Macmillan, 1985. 3. John J Bertin., Aerodynamics for Engineers, Pearson Education Inc, 5th Edition. 4. Clancy L J., Aerodynamics, John Wiley & sons, 1991.		

BAN403	AIRCRAFT PROPULSION	L	T	P	C
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Engineering Mechanics, Fundamentals of Aero – Thermodynamics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To provide students with an overview of various aerospace propulsion systems.
2. To provide students with a sound foundation in the fundamentals of thermodynamics of aircraft engines
3. To teach students the elementary principles of inlets and nozzle
4. To teach students basic principles of compressors and turbines used in aircraft propulsion
5. To teach students about the various type of combustion chamber and combustion process

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Compare** the performance characteristics of turbojet, turbofan, turboprop and propeller engines. **(Understand)**
CO 2	**Identify** the engine starting problems associated with inlets. **(Understand)**
CO 3	**Discuss** the types of nozzles and the losses in nozzles. (**Understand**)
CO 4	**Explain** the working principle of axial and centrifugal flow compressors. **(Understand)**
CO 5	**Discuss** important factors affecting combustion chamber design and the problems associated with flame stabilization. (**Understand**)
CO 6	**Analyze** the working principle of axial and radial flow turbines and their overall performance. **(Analyze)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	H												H	
CO 2	H												H	
CO 3	H											H	H	
CO 4	H									M		H	H	
CO 5	H											H	H	
CO 6	H									M			H	
Category	**Professional Core (PC)**													

Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	**FUNDAMENTALS OF ENGINES**	**10**
History and classifications of Aero engines, working of gas turbine engine – Thrust equation – Factors affecting thrust – Engine performance parameters – Efficiency, Specific fuel consumption, Methods of thrust augmentation – Characteristics of propeller, turboprop, turbofan and turbojet engines.		
UNIT II	**INLETS AND NOZZLES**	**14**
Subsonic inlets– External and internal flow pattern – inlet performance criterion –Boundary layer separation – Supersonic inlets – the starting problem – shock boundary layer problem – external deceleration – flow stability problem – Exhaust nozzles –Theory of flow in isentropic nozzles – Losses in nozzles –Nozzle efficiency—nozzle choking –Over expanded and under expanded nozzles – Ejector and variable area nozzles – Interaction of nozzle flow with adjacent surfaces – Thrust reversal		
UNIT III	**COMPRESSORS**	**14**
Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of pre whirl – Rotation stall – Elementary theory of axial flow compressor – Velocity triangles – degree of reaction – Three dimensional – Air angle distributions for free vortex and constant reaction designs – Compressor blade design – Centrifugal and Axial compressor performance characteristics.		
UNIT IV	**COMBUSTION CHAMBERS**	**12**
Classification of combustion chambers – Important factors affecting combustion chamber design – Combustion process – Combustion chamber performance – Effect of operating variables on performance – Flame tube cooling – Flame stabilization – flame holders.		
UNIT V	**TURBINES**	**10**
Elementary theory of axial flow turbine – Vortex theory – Stator and rotor blades – losses in the blade – choice of blade profile, chord and pitch – stage and overall performance – blade cooling – radial flow turbine.		
Text Books: 1. Hill, P.G. & Peterson, C.R, Mechanics & Thermodynamics of Propulsion, Addison – Wesley Longman INC, 1999. 2. Cohen, H. Rogers, G.F.C. and Saravana Muttoo, H.I.H., Gas Turbine Theory, Longman, 1989.		
References: 1. Ahmed F. El-Sayed, Aircraft Propulsion and Gas turbine engines, CRS Press, 2008 2. Saeed Farokhi, Aircraft Propulsion, John Wiley & Sons, Inc., 2009 3. Rolls Royce Jet Engine – 5thEdition – 1996. 4. Oates, G.C., Aero thermodynamics of Aircraft Engine Components, AIAA Education Series.		

BAN404	AIRCRAFT SYSTEMS AND INSTRUMENTATION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Aeronautics and Astronautics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with the various aircraft systems
2. To introduce to the student about the different control systems in aircrafts
3. To familiarize the student to the different systems associated with aircraft engines
4. To acquaint the student to the several auxiliary systems in aircrafts
5. To enable the student to understand about the working of basic aircraft instruments

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Identify** the components of Hydraulic, Pneumatic, Landing gear and brake system. (**Understand**)
CO 2	**Compare** the advantages and disadvantages of conventional and modern flight control systems. (**Understand**)
CO 3	**Explain** the operating principle of various systems associated with the aircraft engines. (**Understand**)
CO 4	**Describe** the working principle of air-conditioning, oxygen, fire protection and ice protection systems. (**Understand**)
CO 5	**Describe** the operating principle of flight and navigation instruments. (**Understand**)
CO 6	**Summarize** the working principle of engine instruments such as tachometers, temperature gauges and Pressure gauges. (**Understand**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									H			H	H
CO 2	H												H	H
CO 3	H												H	H
CO 4	H									H			H	H
CO 5	H												H	H
CO 6	H												H	H

Category	Professional Core (PC)	
Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	AIRCRAFT SYSTEMS	12
Hydraulic systems - Study of typical workable system - components –Hydraulic systems controllers – Pneumatic systems - Advantages - Working principles - Typical Air pressure system – Brake system- Typical Pneumatic power system - Components, Landing Gear systems – Classification.		
UNIT II	AIRPLANE CONTROL SYSTEMS	10
Conventional Systems - fully powered flight controls - Power actuated systems – Modern control systems - Digital fly by wire systems - Auto pilot system active control Technology.		
UNIT III	ENGINE SYSTEMS	8
Fuel systems for Piston and jet engines, - Components of multi engines. Lubricating systems for piston and jet engines - Starting and Ignition systems - Typical examples for piston and jet engines.		
UNIT IV	AUXILIARY SYSTEMS	8
Basic Air cycle systems - Vapour Cycle systems, Evaporative vapour cycle systems -Evaporative air cycle systems –Oxygen systems - Fire protection systems, Deicing and anti icing systems.		
UNIT V	AIRCRAFT INSTRUMENTS	7
Flight Instruments and Navigation Instruments – Gyroscope - Accelerometers, Air speed Indicators – TAS, EAS- Mach Meters - Altimeters - Principles and operation - Study of various types of engine instruments - Tachometers - Temperature gauges – Pressure gauges - Operation and Principles.		
Text Books: 1. McKinley, J.L., and Bent, R.D., Aircraft Maintenance & Repair, McGraw-Hill,1993. 2. General Hand Books of Airframe and Powerplant Mechanics, U.S. Dept. of Transportation, Federal Aviation Administration, The English Book Store, NewDelhi1995.		
References: 1. Mekinley, J.L. and Bent, R.D., Aircraft Power Plants, McGraw-Hill, 1993. 2. Pallet, E.H.J., Aircraft Instruments & Principles, Pitman & Co., 1993. 3. Treager, S., Gas Turbine Technology, McGraw-Hill, 1997.		

BCE407	ENVIRONMENTAL STUDIES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Chemistry, Biology for Engineers				
	Course Designed by – Department of Humanities and Sciences				

OBJECTIVES

1. To acquaint the student about the various natural resources and their associated problems
2. To accustom the student about ecosystem and the different types of ecosystems and their importance
3. To introduce to the student about the values of bio diversity and the importance of its conservation and also on environmental pollution
4. To familiarize the student on the social issues that have a direct effect on the environment
5. To help the student understand about the effects of human population on the environment and remedial measures

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Summarize** the types of natural resources and identify the role of an individual in conservation of nature. (**Understand**)
CO 2	**Describe** different eco systems and energy flow in a defined ecosystem. (**Understand**)
CO 3	**Define** ecosystem bio-diversity and the threats to biodiversity. (**Remember**)
CO 4	**Define** types of pollution, effects and control measures of pollution. (**Remember**)
CO 5	**Explain** the need for sustainable development and water conservation. (**Understand**)
CO 6	**Express** the need for population control and the impact of population growth in economy. (**Understand**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H					H	H							
CO 2	H					H	H			M				
CO 3	H					H	H			M				
CO 4	H					H	H							
CO 5	H					H	H		L					
CO	H			L		H	H							

6														

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**NATURAL RESOURCES AND ASSOCIATED PROBLEMS**	**6**

The multidisciplinary nature of environmental studies definition, scope and importance – need for public awareness – Natural Resources – Forest Resources – Water Resources - Mineral Resources –Energy resources – Land Resources – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT II	**ECOSYSTEMS**	**9**

Concept of an ecosystem structure and function of an ecosystem, produces consumers and decomposes, energy flow in the ecosystem, Ecological succession food chains, food webs and ecological pyramids, introduction, types, characteristics features, structure and function of different ecosystem

UNIT III	**BIODIVERSITY AND ENVIRONMENTAL POLLUTION**	**12**

BIODIVERSITY

Introduction – definition ;.genetic, species and ecosystem diversity, biogeographically classification of India, value of biodiversity; consumptive use productive use social, ethical aesthetic and option values, biodiversity at global, national and local levels India as a mega-diversity nation, hot spots of biodiversity, threats to biodiversity habitual loss poaching of wild life man, wildlife conflicts, endangered and endemic species of India, conservation of biodiversity in-situ and ex-situ conservation of biodiversity.

ENVIRONMENTAL POLLUTION

Definition,causes, effects and control measure of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards, solid waste management – causes, effects and its control measure – role of an individual in presentation of pollution and case studies.

UNIT IV	**SOCIAL ISSUES AND THE ENVIRONMENT**	**9**

From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people its problems and concerns , case studies environmental ethics, issues and possible solution climate change global warming add rain, ozone layer depletion nuclear accident and holocaust case studies waste land reclamation, various environment protection act , issues involved enforcement of environmental legislation public awareness.

UNIT V	**HUMAN POPULATION AND THE ENVIRONMENT**	**9**

Population growth variation among nations, population explosion family welfare program environment and human health, human right, value education, HIV/AIDS, women and child welfare role of information technology in environment and human health case studies.

FIELDWORK

Visit to a local area to document assets river forest/ grass land/ hill mountain, visit to local polluted site rural/industrial / agricultural, study of common plants, insects, birds, study of simple ecosystems = ponds,

river hill slopes etc(field work equal to 5 lecture hours)

Text Books:

1. Sharma.B.K. andKaur, Environmental Chemistry, Goel Publishing House, Meerut, 1994.
2. De.A.K., Environmental Chemistry, New Age International (p) lt., New Delhi, 1996.
3. Kurian Joseph and Nagendran.R, Essential of Environmental Studies, Pearson Education, 2004.

References:

1. Dara S.S., A Text Book of Environmental Chemistry and Pollution Control, S.Chand and company Ltd., New Delhi, 2004.
2. Jeyalakshmi.R, Principles of Environmental Science, First Edition, Devi Publications, Chennai, 2006.
3. Kamaraj.P and Arthanareeswari.M, Environmental Science - Challenges and Changes, first Edition, Sudhandhir Publications, 2007.

BAN4L1	AIRCRAFT STRUCTURES LABORATORY	L	T	P	C
	Total Contact Hours – 30	0	0	**4**	2
	Prerequisite – Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student to the various experimental processes to carry out structural analysis.
2. To familiarize to the student about the analysis of beams.
3. To enable the student to understand about the analysis of columns.
4. To help the student to understand about the effect of complex loading on aircraft structures.
5. To introduce to the student about the shear flow estimation in aircraft structures.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Demonstrate** structural mechanics principles/phenomenon using simple experiments. **(Manipulation)**
CO 2	**Observe** deformation of structural members or/and failure of materials under given loads. **(Imitation)**
CO 3	**Perform** comparative study between the obtained experimental results and theoretical values.**(Precision)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H			H	
CO 2	H								H	H			H	
CO 3	H								H	H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Verification of Maxwell's theorem and principle of superposition.
2	Column – Testing.
3	Testing of riveted joints.
4	Unsymmetrical Bending of a Beam.
5	Determination of Shear Centre in open Section.
6	Determination of Shear Centre in closed Section.
7	Combined bending and Torsion of a Hollow Circular Tube.
8	Constant Strength Beams.

9	Wagner beam – Tension field beam.
10	Material properties test of composite laminate.

References:

1. Aircraft Structures Lab Manual, Department of Aeronautical Engineering, 2015

BME4L1	MANUFACTURING ENGINEERING LABORATORY	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Manufacturing Engineering				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce student to various machine cutting operation
2. To train the student for using the lathe
3. To train the student for performing various operation using lathe
4. To train the student for performing drilling operations and boring operation
5.To train the student for using the surface grinding machine and milling machine

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Carry out** different machining operations on center lathe **(Imitation)**
CO 2	**Perform** drilling, reaming and boring processes. **(Precision)**
CO 3	**Observe** the working of Planner shaper miller and grinder. **(Imitation)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H			H		
CO 2	H								H	M		H		
CO 3	H								H			H		

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Study of centre, capstan and automatic lathes and their accessories.
2	Exercise on setting the work piece and the tool in the lathe.
3	Plane turning and step turning.
4	Taper turning and knurling.
5	Eccentric Turning.
6	Thread cutting and grooving.
7	Exercise on Drilling and reaming.
8	Drilling and boring.

9	Surface grinding
10	Study of milling and grinding machines.

References:

1. Machine Shop Lab Manual, Department of Mechanical Engineering, 2015

BAN4L2	COMPUTER AIDED DESIGNING AND DRAFTING	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Engineering Graphics, Machine Drawing				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with various computer software for engineering design
2. To familiarize the student with to the various options and types of designs that can be carried out using CATIA software
3. To train the student on the designing of basic mechanical parts
4. To train the student on the assembly of different mechanical parts
5. To train the student on the drafting of the part / model / assembly designed.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Master** the geometrical profile and modification tools. **(Precision)**
CO 2	**Create** 3-Dimensional models from 2-Dimensional geometries. **(Naturalization)**
CO 3	**Design** basic Aerospace components using CADD. **(Articulation)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H				H					H			H	
CO 2	H				H				H	H		M	H	
CO 3	H	M	M		H				H	H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Study of various software for engineering design and drafting.
2	Study of CATIA and its tools.
3	Exercise on 2D drawing.
4	Exercise on pad and groove.
5	Exercise on shaft, mirror and array.

6	Exercise on threading, bores and tapings.
7	Exercise on part assembly.
8	Exercise on drafting.
9	Exercise on surface modeling.
10	Exercise on kinematics.

References:

1. CADD Lab Manual, Department of Aeronautical Engineering, 2015

BAN501	AIRCRAFT STRUCTURES - II	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Fundamentals of Structural Mechanics, Aircraft Structures I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To Understand the basics concept of unsymmetrical bending.
2. To Understand the basic concept of shear flow in open and closed sections.
3. To Understand the buckling of plates and to solve the sheet panel problems.
4. To carry-out stress analysis in wing and fuselage.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Compute** the bending stress distribution in beams of symmetric and unsymmetrical sections. (**Apply**)
CO 2	**Calculate** the shear flow distribution in symmetrical and unsymmetrical thin-walled open section and its shear center. (**Apply**)
CO 3	**Calculate** the shear flow distribution in thin walled single and multi-cell structures subjected to combined loading. (**Apply**)
CO 4	**Compute** the crippling strength of thin plates and effective width of sheet stiffener panels. (**Apply**)
CO 5	**Analyze** the stress developed in aircraft wings and fuselage. (**Analyze**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO1 2	PSO1	PSO2
CO 1	H									H			H	
CO 2	H									H			H	
CO 3	H									H			H	
CO 4	H												H	
CO 5	H												H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**UNSYMMETRICAL BENDING**	**12**

Bending of symmetric beams subject to skew loads - bending stresses in beams of unsymmetrical sections – generalized 'k' method, neutral axis method, principal axis method- advantages and disadvantages.		
UNIT II	**SHEAR FLOW IN OPEN SECTIONS**	**12**
Thin walled beams – concept of shear flow – the shear centre and its determination – shear flow distribution in symmetrical and unsymmetrical thin-walled sections – structural idealization – shear flow variation in idealized sections.		
UNIT III	**SHEAR FLOW IN CLOSED SECTIONS**	**12**
Bredt - Batho theory – single-cell and multi-cell tubes subject to torsion – shear flow distribution in thin-walled single & multi-cell structures subject to combined bending torsion – with walls effective and ineffective in bending – shear center of closed sections.		
UNIT IV	**BUCKLING OF PLATES**	**12**
Bending of thin plates – rectangular sheets under compression - local buckling stress of thin walled sections – crippling strength by Needham's and Gerard's methods – thin-walled column strength – load carrying capacity of sheet stiffener panels – effective width – inter-rivet and sheet wrinkling failures - short panel failing strength.		
UNIT V	**STRESS ANALYSIS OF WING AND FUSELAGE**	**12**
Wing structural arrangements – factors influencing - wing stress analysis methods – determination of shear force and bending moment distribution over fuselage – Numerical problems – Tension field beam – general Wagner equation - Semi-tension field beams.		

TEXTBOOKS:

1. Megson T M G, 'Aircraft Structures for Engineering Students', Fifth Edition, Elsevier Aerospace Engineering Series,2007. (Units 1, 2, 3 & 5)
2. Peery, D.J., and Azar, J.J., Aircraft Structures, 2nd edition, McGraw – Hill, N.Y., 1999 (Unit 4)

REFERENCES:

1. Rivello, R.M., Theory and Analysis of Flight Structures, McGraw Hill, 1993.
2. Howard D Curtis, 'Fundamentals of Aircraft Structural Analysis', WCB-McGraw Hill, 1997
3. Bruhn. E.H., 'Analysis and Design of Flight Vehicles Structures', Tri-state off-set company, USA, 1985

WEBLINKS:

http://nptel.ac.in/courses/105106049/63
https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-21-techniques-for-structural-analysis-and-design-spring-2005/

BAN502	AERODYNAMICS II	L	T	P	C
	Total Contact Hours – 60	3	**1**	0	4
	Prerequisite – Fundamentals of Fluid Mechanics, Aerodynamics I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To make the student understand concepts and 1-d equations used for compressible flows.
2. To acquaint the student with the estimation of flow properties across normal shock, oblique shock and expansion waves.
3. To familiarize the student to the governing equations in compressible flows.
4. To educate the student on problems faced by high speed flow airfoils, wings and airplane configuration and to understand design modifications required to overcome problems.
5. To create awareness among the students about various experimental methods and measurement techniques.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Apply** the concepts of isentropic flow for problems related to variable area ducts. (**Apply**)
CO 2	**Calculate** the properties of flow through shock and expansion waves. (**Apply**)
CO 3	**Determine** the aerodynamic coefficients of compressible flows based on linearized flow theory. (**Apply**)
CO 4	**Categorize** various aircrafts intended for subsonic and supersonic regimes based on wing and fuselage design. (**Analyze**)
CO 5	**Describe** flow measurement and visualization techniques for high-speed flows. **(Understand)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	H											H	H	
CO 2	H											H	H	
CO 3	H		L									H	H	
CO 4	H				M					L		H	H	
CO 5	H				M							H	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT		
UNIT I	**FUNDAMENTAL ASPECTS OF COMPRESSIBLE FLOW**	**12**
Compressibility, Continuity, Momentum and Energy equation for steady one-dimensional flow, Compressible Bernoulli's equation, Area – Mach number – Velocity relation, Mach cone, Mach angle, One dimensional Isentropic flow through variable area duct, Isentropic relations - Critical conditions, Characteristic Mach number, Maximum discharge velocity.		
UNIT II	**SHOCKS AND EXPANSION WAVES**	**14**
Normal shock relations, Prandtl's relation, Hugonoit equation, Raleigh Supersonic Pitot tube equation, Moving normal shock waves, Oblique shocks, θβM relation, Shock Polar, Reflection of oblique shocks, Left running and Right running waves, Interaction of oblique shock waves, slip line, Rayleigh flow, Fanno flow, Expansion waves, Prandtl-Meyer expansion, Maximum turning angle, Simple and non-simple regions, Operating characteristics of convergent and convergent-divergent nozzles.		
UNIT III	**TWO-DIMENSIONAL COMPRESSIBLE FLOW**	**14**
Potential equation for 2-dimensional compressible flow, Linearization of potential equation,Small perturbation theory, Linearised Pressure Coefficient, Linearised subsonic flow, Prandtl-Glauert rule, Linearised supersonic flow, Method of characteristics, Wave drag coefficient.		
UNIT IV	**HIGH SPEED FLOW OVER AIRFOILS, WINGS AND AIRPLANE CONFIGURATION**	**10**
Critical Mach number, Drag divergence Mach number, Shock Stall, Shock- Boundary layer interaction, Supercritical Airfoil Sections, Transonic area rule, Swept wing, Airfoils for supersonic flows, Lift, drag, Pitching moment and Centre of pressure for supersonic profiles, Shock-expansion theory, wave drag, supersonic wings, Design considerations for supersonic aircrafts, Introduction to Hypersonic Flows, Numerical Analysis of one Dimensional flow.		
UNIT V	**EXPERIMENTAL METHODS**	**10**
Wind tunnels for Subsonic, transonic, Supersonic and hypersonic flows, Various Measurement techniques, Power requirement, Force and moment measurement, Wind tunnel balance, Wind tunnel corrections, Flow visualization techniques, Hot wire technique, Optical methods, Shock tube, Gun tunnels		

Text Books:

1. Anderson, J. D, Modern Compressible Flow, Third Edition, Tata McGraw-Hill & Co., 2012.
2. Rathakrishnan., E, Gas Dynamics, Prentice Hall of India, 2004.
3. Yahya S.M., Fundamentals of Compressible Flows, Third Edition, New Age International Publishers, 2003.

References:

1. Shapiro, A. H., Dynamics and Thermodynamics of Compressible Fluid Flow, Ronald Press, 1982.
2. Zucrow, M. J. and Anderson, J. D., Elements of Gas Dynamics, McGraw- Hill & Co., 1989.
3. Oosthuizen,P.H., &Carscallen,W.E., Compressible Fluid Flow, McGraw- Hill & Co., 19976. Perry, Aircraft Structures, McGraw-Hill, 1950.

BAN503	ADVANCED AEROSPACE PROPULSION	L	T	P	C
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Fundamentals of Aero – Thermodynamics, Aircraft Propulsion				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student about the various scramjet and ramjet engine propulsion.
2. To accustom the student about pulsejet propulsion and the different types of jet propulsion their importance.
3. To introduce to the student about the importance of solid propellant rockets.
4. To introduce to the student about the importance of liquid propellant rockets.
5. To help the student understand about the non-conventional propulsion techniques.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Explain** the working principle, modes of operation and performance parameters of Ramjet engine. **(Understand)**
CO 2	**Discuss** supersonic combustion andthe challenges involved in scramjet design. **(Understand)**
CO 3	**Explain** the operating principle of solid propellant rockets and selection of propellant grain**. (Understand)**
CO 4	**Describe** various feed systems, cooling methods in liquid propellant rockets. **(Understand)**
CO 5	**Explain** the working principle andthe practical limitations of hybrid rockets. **(Understand)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H												H	
CO 2	H												H	
CO 3	H									M			H	
CO 4	H									M			H	
CO 5	H												H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	RAMJET PROPULSION	14
Operating principle of ramjet engine – Components of ramjet engines and their efficiencies – Combustion in ramjet engine – Critical, subcritical and supercritical modes of operation -Ramjet engine and its performance characteristics – Ramjet design calculations – Flame stability problems in ramjet combustors –Integral ram rockets.		
UNIT II	**SCRAMJET PROPULSION**	**10**
Introduction to hypersonic vehicles, design challenges and supersonic combustion - problems associated with supersonic combustion– Types of scramjet combustors – Fuel injection schemes in scramjet combustors – Flame Stabilization		
UNIT III	**SOLID PROPELLANT ROCKETS**	**12**
Operating principle – Specific impulse of a rocket – Internal ballistics – Selection criteria of solid propellants – propellant grain design considerations – Progressive, Regressive and neutral burning in solid rockets.		
UNIT IV	**LIQUID PROPELLANT ROCKETS**	**12**
Liquid propellant rockets – selection of liquid propellants – various feed systems for liquid rockets –basics of cryogenic techniques – Cooling in liquid rockets and the associated heat transfer problems – advantages of liquid rockets over solid rockets - introduction to hybrid propulsion – advantages and limitations of hybrid propulsion - static testing of rockets and safety considerations		
UNIT V	**NON - CONVENTIONAL PROPULSION TECHNIQUES**	**12**
Pulse propulsion – combustion process in pulsejet engines – inlet charging process – Introduction to nozzleless propulsion and basic concepts - Electric rocket propulsion - Ion propulsion – Nuclear rocket – Types – Solar Sail - comparison of performance of these propulsion systems with chemical rocket propulsion systems.		
Text Books: 1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 8th Edition, 2010. 2. Thomas A Ward, "Aerospace Propulsion Systems", John Wiley & Sons Inc., New York,2010.		
References: 1. J D Mattingly, "Elements of Propulsion - Gas Turbines and Rockets ", AIAA Education Series, 2006. 2. David H. Heiser and David T. Pratt., "Hypersonic Air -breathing Propulsion", AIAA Education Series, 1999. 3. DanM.Goebel, Ira Katz, 'Fundamentals of Electric Propulsion', John Wiley & Sons Inc, New York, 2003.		

BAN504	FLIGHT MECHANICS	L	T	P	C

	Total Contact Hours – 60	3	**1**	0	4
	Prerequisite – Fundamentals of Aeronautics and Astronautics, Aerodynamics I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To understand aircraft performance relating to steady level
2. To understand aircraft performance relating to Range, Endurance, climb & Glide
3. To acquire knowledge about Takeoff, Landing and Turning performance
4. To understand the principles of stability and control relating to longitudinal stability
5. To understand the principles of stability and control relating to directional and lateral stability

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Calculate** thrust and power required for propeller driven and jet powered aircraft at steady level flight. (**Apply**)
CO 2	**Evaluate** the Range, Endurance, glide and climb performances. **(Evaluate**)
CO 3	**Estimate** the take-off, landing, turning performance using V-n diagram. (**Evaluate**)
CO 4	**Describe** the characteristics of longitudinal stability. **(Understand)**
CO 5	**Evaluate** the lateral and directional stability characteristics. (**Evaluate**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	H												H	
CO 2	H												H	
CO 3	H												H	
CO 4	H									H			H	
CO 5	H									H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**STEADY LEVEL FLIGHT**	**12**

International Standard Atmosphere, TAS, IAS and EAS, Streamlined and Bluff body – Skin friction Drag, Pressure Drag and Induced Drag – Drag Polar – Various drags of an airplane – Methods of Drag Reduction - Effect on Drag Polar. Steady level flight, Thrust required and Power required, Thrust available and Power available for propeller driven and jet powered aircraft, Effect of altitude, conditions for minimum drag and minimum power required

UNIT II	RANGE, ENDURANCE, CLIMB AND GLIDE PERFORMANCE	12

Range and Endurance of Propeller and Jet aircrafts, Shallow and steep angles of climb, Rate of climb, Climb hodograph, Maximum Climb angle and Maximum Rate of climb- Effect of design parameters for propeller and jet aircrafts, Absolute and service ceiling, Cruise climb, Gliding flight, Glide hodograph

UNIT III	TAKE OFF, LANDING AND TURNING PERFORMANCE	10

Take-off and landing performance, Turning performance, bank angle and load factor, Constraints on load factor, Pull up and pull down maneuvers, maximum turn rate, V-n diagram.

UNIT IV	LONGITUDINAL STABILITY	14

General concepts, Static and dynamic stability, Stability and Controllability, Requirements of control surfaces, criteria for longitudinal static stability, contribution to stability by wing, tail, fuselage, wing fuselage combination, Total longitudinal stability, Neutral point-Stick fixed and Stick free aspects, Free elevator factor, static margin, Hinge moment, Power effects on stability-propeller and jet aircrafts, longitudinal control, Movement of centre of gravity, elevator control power, elevator angle to trim, elevator angle per g, maneuver point, Stick force gradient and stick force per g, Aerodynamic balancing
Aircraft Equations of motion, small disturbance theory, Estimation of longitudinal stability derivatives Routh's discriminant, solving the stability quartic, Phugoid motion, Factors affecting the period and damping.

UNIT V	LATERAL AND DIRECTIONAL STABILITY	12

Directional stability-yaw and sideslip, contribution to static directional stability by wing, fuselage, vertical tail, Power effects on directional stability-propeller and jet aircrafts, Rudder lock and Dorsal fin, Directional control, rudder control power, rudder requirements, adverse yaw, asymmetric power condition, spin recovery, Lateral stability-Dihedral effect, contribution of various components, lateral control, aileron control power, strip theory, roll control by spoilers, aileron reversal, aileron reversal speed

Text Books:

1. Anderson, Jr., J.D. Aircraft Performance and Design, McGraw-Hill International Edition, 2012.
2. Houghton,E.L. and Carruthers, N.B. Aerodynamics for engineering students, Edward Amold Publishers, 2000

References:

1. Nelson, R.C." Flight Stability & Automatic Control", McGraw Hill, 2005.
2.Pamadi, B.N. Performance, Stability, Dynamics, and Control of Airplanes, AIAA Education Series, 2004
3. McCormick, B.W. "Aerodynamics, Aeronautics & Flight Mechanics", John Wiley, 1995.
4. Babister, A.W. "Aircraft Stability and response", Pergamon Press, 1996.
5. Etkin, B., "Dynamics of Flight Stability and Control", John Wiley, New York, 1982.
6. Perkins C.D. &Hage R.E. "Airplane performance, stability and control", John Wiley & Sons 1976.

BME505	MANUFACTURING ENGINEERING	L	T	P	C

	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce student about various metal working process
2. To impart theoretical knowledge about the metal cutting and machining process.
3. Introduce students about various special purpose machine and milling machine.
4. Introducing students about various drilling, boring and surface finish operations.
5. Introduce students about various non-conventional process and high energy rate forming process.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** various metal forming process and different types of welding.(**Understand**)
CO 2	**Calculate** the forces involved in metal cutting process and **Estimate** the tool life,machining time and economics. (**Apply**)
CO 3	**Describe** types of lathe and their construction. (**Understand**)
CO 4	**Explain** the process of shaping, planing and milling operations. (**Understand**)
CO 5	**Discuss** the process involved in drilling, boring, broaching, surface finishing. (**Understand**)
CO 6	**Describe** the working principle of various Non-traditional machining techniques. (**Understand**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	H													
CO 2	H										L			
CO 3	H													
CO 4	H									M				
CO 5	H													
CO 6	H									M		L		
Category	**Professional Core (PC)**													
Approval	**37th Academic Council Meeting held in May 2015.**													

COURSE CONTENT		
UNIT I	**METAL WORKING PROCESS**	**8**
Mechanical working of metals –hot and cold working –rolling, extrusion, spinning, wire-drawing, press working. Welding – different types of gas and arc welding process, soldering and brazing. Casting – different types, furnaces, casting defects and inspection		
UNIT II	**THEORY OF METAL CUTTING AND MACHINING PROCESSES**	**12**
Introduction, mechanics of metal cutting-chip formation, Merchant's circle theory cutting force calculations, tool materials. Influence of tool angles, tool life, cutting fluids, machining time calculations, Metal cutting economics, problem in merchant circle, tool life, machining time and economics. Lathe – introduction, types, construction, mechanisms and attachments for various operations, nomenclature of single point cutting tool. Capstan and turret lathes various mechanisms, tool and loading arrangement. Automatic lathes - single spindle and multi spindle mechanisms, CNC lathes.		
UNIT III	**SHAPER, PLANER AND MILLING PROCESS**	**8**
Shaper, planer and slotter: types, specifications, mechanisms, holding devices, difference between shaper and planer. Milling machine – types and specification, mechanisms, holding devices, milling operations. Milling tool nomenclature, indexing types-simple, compound and differential		
UNIT IV	**DRILLING, BORING, BROACHING, SURFACE FINISHING PROCESS**	**8**
Drilling, Boring- Specification, Nomenclature of drilling and reaming tool and its specification. Broaching: Specification, types, mechanisms, nomenclature of broaching tool. Grinding process, Types of grinding machines, Grinding Wheels, Honing, Super finishing, Polishing, Metal spraying, Galvanizing, Electroplating.		
UNIT V	**NON-TRADITIONAL MACHINING PROCESSES AND HIGH ENERGY RATE FORMING PROCESSES**	**9**
Non-traditional machining techniques, classification, Abrasive jet machining, Electrical Discharge Machining, E. D wire cutting, Electro chemical machining, Electron Beam Machining, Laser Beam Machining, Ultrasonic Machining. Explosive forming, Electro hydraulic, Electromagnetic forming, Dynapack machine.		
Text Books: 1. P.C. Sharma., A text book of Production Technology, S.Chand& Company ltd, 2007. 2. P.N.Rao. Manufacturing Technology-Foundry Forging and Welding, TMH publishing co, 2009.		
References: 1. W.A.J. Chapman., Workshop Technology. Vol I, II& III, 1975, ELBS. 2. Roy A Lindberg, Process and Material Manufacture, PHI, 1995. 3. Kalpakjan, Manufacturing Engineering and Technology, Addison Wesley, 2005. 4. Hajra Chowdary S.K, The fundamentals of work shop technology Vol. I & II, Media publishers, 1997.		

BAN5V1	VALUE ADDED PROGRAM I	L	T	P	C

	Total Contact Hours – 30	0	0	2	1
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student about personal value, responsibility in the society and about self-confidence and self esteem
2. To introduce about goal setting, time management and planning
3. To boost the creativity, lateral thinking of the students
4. To familiarize the student on teamwork, interpersonal skills, leadership skills and ability to manage stressed situations
5. To help the student understand about decision making and self-assessment

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Demonstrate**Team work and leadership quality. (**Manipulation**)
CO 2	**Demonstrate**communication and interpersonal skills. (**Manipulation**)
CO 3	**Express**the need of social responsibilities. (**Articulation**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1						H		H	H					
CO 2						H		H	H					
CO 3						H	L	H	H					

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	An activity to make a goal setting..
2	An activity to describe the importance of team work.
3	An activity to make a time management chart.
4	An activity for personal grooming.
5	An activity to enhance self-confidence and self-esteem.
6	An activity to make SWOT analysis.
7	An activity to describe the planning process.
8	An activity to create environmental awareness.

9	An activity to describe the responsibilities of students in society.
10	An activity to showcase the impact of engineers on society.

References:

1. Value Added Program Booklet, Department of Aeronautical Engineering, 2015

BAN5L1	AERODYNAMICS LABORATORY	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Fundamentals of Fluid Mechanics, Aerodynamics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student to the various experimental processes to carry out structural analysis.
2. To familiarize to the student about the analysis of beams.
3. To enable the student to understand about the analysis of columns.
4. To help the student to understand about the effect of complex loading on aircraft structures.
5. To introduce to the student about the shear flow estimation in aircraft structures.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Carryout** flow analysis over various aerodynamic models. (**Imitation**)
CO 2	**Demonstrate** the usage of mechanical and electronic instruments in data acquisition. (**Manipulation**)
CO 3	**Conduct** experiments at various orientation of models to characterize the flow. (**Articulation**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H			H	
CO 2	H								H	H			H	
CO 3	H								H	H		M	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Calibration of subsonic wind tunnel.
2	Pressure distribution over smooth cylinder
3	Pressure distribution over rough cylinder.
4	Pressure distribution over symmetric airfoil.
5	Pressure distribution over cambered airfoil.
6	Pressure distribution over a wing.
7	Force measurement on Airfoil using wind tunnel balance.
8	Pressure distribution over a building model.

9	Aerodynamic studies of automotive models.
10	Flow visualization at subsonic velocity using (a) Smoke (b) Oil

References:

1. Aerodynamics Lab Manual, Department of Aeronautical Engineering, 2015

BAN5L2	AERO DESIGN AND MODELING LABORATORY	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Fundamentals of Aeronautics and Astronautics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To design and fabricate gliders, catapult and power gliders.
2. To design and fabricate single, double and pivoted double crank flapping wing mechanism.
3. To design and fabricate wing, vertical and horizontal stabilizer using balsa wood.
4. To design and fabricate fuselage and control surfaces using polystyrene and glass fibers.
5. To estimate discharge rate of Li-Po battery, propeller thrust and assembling Remote Control Aircraft.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Design** and fabricate the Aircraft Structural components with appropriate materials. (**Naturalization**)
CO 2	**Conduct** flight testing of powered glider and RC plane. (**Precision**)
CO 3	**Observe** Performance characteristics of Glider and RC plane. (**Imitation**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H		H						H	H			H	
CO 2	H		H						H	H			H	
CO 3	H						M		H	H		M	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Design and fabrication of gliders using balsa wood.
2	Design and fabrication of power gliders.
3	Design and fabrication of single crank flapping wing mechanism.
4	Design and fabrication of double crank flapping wing mechanism.
5	Design and fabrication of pivoted double crank flapping wing mechanism.
6	Design and fabrication of wing using balsa wood.
7	Design and fabrication of horizontal and vertical stabilizer using balsa wood.
8	Estimation the discharge rate of Li-Po battery for different thrust setting.

9	Estimating the propeller thrust for different voltage setting.
10	Assembling of Remote-Control Aircraft.

References:

1. Aero Design and Modeling Lab Manual, Department of Mechanical Engineering, 2015

BAN5L3	COMPUTER AIDED ANALYSIS	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Aircraft Structures, Aerodynamics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with various computer software for engineering analysis
2. To familiarize the student with to the various options and types of analysis that can be carried out using ANSYS software
3. To train the student on basic structural analysis
4. To train the student on basic thermal analysis
5. To train the student on basic fluid flow analysis

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Design** the structural components under static and dynamic loading. **(Precision)**
CO2	**Observe** temperature distribution for structure under thermal loading. **(Imitation)**
CO 3	**Carry out** the flow analysis over aerodynamic shapes. **(Imitation)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H				H				H	H		H	H	
CO 2	H				H				H	H		H	H	
CO 3	H	M			H				H	H		H	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Study of ANSYS and its tools
2	Stress analysis of beams with different loading conditions.
3	Stress analysis of a plate with circular hole.
4	Stress analysis of an axisymmetric component.
5	Vibration analysis of cantilever beam.
6	Simple conduction example.
7	Thermal mixed boundary example.

8	Flow field analysis of jets.
9	Flow field simulation over an airfoil.
10	Fluid – Structure interaction.

References:

1. CAA Lab Manual, Department of Aeronautical Engineering, 2015

BSS601	VALUE EDUCATION AND PROFESSIONAL	L	T	P	C

	ETHICS				
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Designed by – Department of Humanities and Social Sciences				

OBJECTIVES

1. To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
2. To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the meaning and philosophy of life and the qualities an individual must possess. (**Understand**)
CO 2	**Explain** the individual responsibility towards family and society. (**Understand**)
CO 3	**Discuss** the methods to maintain proper physical and mental health. (**Understand**)
CO 4	**Summarize** the importance of safety during social experimentation. (**Understand**)
CO 5	**Express** the rights and responsibilities of engineer on global issues. (**Understand**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1								H						
CO 2								H	H		L	M		
CO 3								H				M		
CO 4							M	H	H					
CO 5							M	H	H	L				

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES**	**9**

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II	SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE)	9
Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man: - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftiness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.		
UNIT III	**MIND CULTURE & TENDING PERSONAL HEALTH**	**9**
Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelizing the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases		
UNIT IV	**ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS'S RESPONSIBILITIES FOR SAFETY**	**9**
Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Challenger, case study. Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies.		
UNIT V	**ENGINEER'S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES**	**9**
Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination. Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership		

Text Books:

1.Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications (Unit 1 – III).

2.Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata Mcgraw Hill, Newyork 2005 (Units IV & V)

References:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook on Professional Ethics and Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004(for Units IV-V)

BAN601	AEROSPACE STRUCTURAL MATERIALS AND COMPOSITES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aircraft Structures – I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with various types of aerospace composite materials.
2. To develop the understanding of composite mechanics.
3. To learn different theory of laminate design.
4. To learn different theory of failure analysis.
5. To have a clear understanding of composite fabrication process.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** various materials used in aerospace applications. (**Understand**)
CO 2	**Compute** the properties of isotropic, anisotropic and orthotropic materials. (**Apply**)
CO 3	**Calculate** the properties of laminated composites along natural and arbitrary axis. (**Apply**)
CO 4	**Determine** the stiffness matrix, stress and strain of laminated composite plate with different orientations. (**Apply**)
CO 5	**Interpret** the properties and failure modes in composite plates and sandwich panels. (**Apply**)
CO 6	**Describe** the manufacturing process of fibers and fabrication methods of composites. (**Understand**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H												H	
CO 2	H											M	H	
CO 3	H									M		M	H	
CO 4	H												H	
CO 5	H												H	
CO 6	H									M			H	
Category	**Professional Core (PC)**													

Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	**INTRODUCTION TO AEROSPACE MATERIALS**	**9**
Introduction – Monocoque and semi monocoque structure – Wrought Aluminum Alloys – Cast Aluminum Alloy – Plastics and Rubber – Introduction to FRP, Glass and Carbon Composites– Fibers and Resins – Thermoplastics and Thermoset– Super Alloys. Emerging Trends in Aerospace Materials.		
UNIT II	**MICROMECHANICS**	**9**
Micro mechanics – Mechanics of materials approach, elasticity approach to determine material properties – Fiber Volume ratio – Mass fraction – Density of composites-Generalized Hooke's Law - Elastic constants for anisotropic, orthotropic and isotropic materials. Numerical problems.		
UNIT III	**MACROMECHANICS**	**9**
Macro Mechanics – Stress-strain relations with respect to natural axis, arbitrary axis – Determination of material properties - Experimental characterization of lamina. Numerical problems.		
UNIT IV	**LAMINATION THEORY AND FAILURE ANALYSIS**	**9**
Governing differential equation for a unidirectional lamina and general laminate, angle ply and cross ply laminate, Failure criteria for composites-Failure modes of sandwich panels – Numerical problems.		
UNIT V	**FABRICATION METHODS**	**9**
Various open and closed mould processes, Manufacture of fibers, Types of resins, properties and applications, Netting analysis-Basic design concepts of sandwich construction - Materials used for sandwich construction.		

Text Books:

1. Jones, R.M., "Mechanics of Composite Materials", Taylor & Francis, II Edition, 2000.
2. Madhuji Mukhapadhyay, "Mechanics of Composite Materials and Structures", University Press, 2004

References:

1. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 1995.
2. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1989.
3. Autar K Kaw, "Mechanics of Composite Materials", CRC Press, 1997.
4. Calcote, L R. "The Analysis of laminated Composite Structures", Von – Nostrand Reinhold Co., New York 1998.
5. Allen Baker, "Composite Materials for Aircraft Structures", AIAA Series, Second Edition, 1999.

BAN602	FINITE ELEMENT METHODS	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Fundamentals of Fluid Mechanics, Structural Mechanics, Aerothermodynamics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with basic numerical methods for analyzing structural components.
2. To develop the understanding of finite element modeling and analysis of one-dimensional system.
3. To develop the understanding of finite element modeling and analysis of two-dimensional system.
4. To develop the understanding of finite element modeling and analysis of three-dimensional system
5. To acquaint with the application of finite element method to aerospace structures.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Compare** various functional approximation methods for structural problems. (**Analyze**)
CO 2	**Calculate** the nodal field variables for one dimensional structure. (**Apply**)
CO 3	**Determine** the stiffness matrix and stress developed in two dimensional structures. (**Apply**)
CO 4	**Calculate** the nodal displacements and stress for axi-symmetric structures. (**Apply**)
CO 5	**Analyze t**he static and dynamic behavior of structures. (**Analyze**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									M			H	
CO 2	H											M	H	
CO 3	H											M	H	
CO 4	H									M			H	
CO 5	H				L								H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION**	**12**

Introduction to FEA - historical background - Review of various approximate methods – Rayleigh Ritz method, Weighted residual methods - Convergence criteria - Fundamentals of Finite Element Modeling – Element Division - Numbering Scheme - Examples of Finite Element Modeling

UNIT II	ONE DIMENSIONAL SYSTEMS	12

Direct stiffness method – spring element- Derivation of the stiffness matrix- Example of a spring assemblage- Assembly of global stiffness matrix-Types of boundary conditions- The Potential energy approach –Examples - bar element – Coordinate systems and Shape Functions- The Potential Energy Approach- Assembly of Global Stiffness Matrix and Load Vector - Boundary Conditions- Temperature Effects – Heat transfer problems in 1D bar and wall

UNIT III	TWO DIMENSIONAL SYSTEMS	12

Beam element – element stiffness – load vector – global stiffness matrix – boundary conditions – solution, Plane truss structure - Coordinate Transformation – Local & Global Coordinate- The Element Stiffness Matrix- Stress Calculations- Temperature Effects –Examples. Plane stress & strain – Constant Strain Triangle (CST)- Potential Energy Approach - Element Stiffness; Force Terms, Stress Calculations- Temperature Effects- Examples

UNIT IV	THREE DIMENSIONAL SYSTEMS	12

Axisymmetric formulation – Element stiffness matrix and force vector – Body forces and temperature effects – Stress calculations – Boundary conditions and Nodal Solution; Mapping and Numerical Integration— Applications to cylinders under internal or external pressures – Rotating discs - Isoparametric Representation- Four noded quadrilateral for axisymmetric problems

UNIT V	APPLICATIONS OF FEM TO AEROSPACE STRUCTURES	12

Linear static analysis - nonlinear static analysis – dynamic analysis-simple harmonic motion-damping consideration-forced vibration - Case studies and problems using software packages and programming.

TEXTBOOKS:

1. Tirupathi. R. Chandrapatha and Ashok D. Belegundu", Introduction to Finite Elements in Engineering", Prentice Hall India, Fourth Edition, 2011.

REFERENCES:

1. Reddy J.N.,"An Introduction to Finite Element Method ",McGraw Hill , 3rd edition, 2005.
2. Krishnamurthy, C.S., "Finite Element Analysis", Tata McGraw Hill, 2nd 2001.
3. Bathe, K.J. and Wilson, E.L., "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985.
4. Rao. S.S., "Finite Element Methods in Engineering", Butterworth and Heinemann, Fourth Edition, 2005.
5. Daryl L. Logan, "A First Course in the Finite Element Method", 5th Edition, PWS Publishing Company, Boston, 2010.

WEBLINKS:

https://nptel.ac.in/courses/112104116/

BAN603	CONTROL ENGINEERING	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Basic Electrical and Electronics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To provide students an understanding on various physical systems, development of flight control system and their important. Also Introduce students the concept of electrical analogies to mechanical system
2. Introduce students the concept of feedback control system, Block diagram reduction technique and signal flow graph
3. To impart knowledge on various signals, system response on respective signals and time response of first order and second order system. Also, to provide knowledge on steady state errors
4. To provide knowledge on concept of stability, Routh Hurwitz criteria for stability. Make student to develop Stability analysis using Bode plot, Root locus technique
5. To provide students brief knowledge on digital control system, Digital controllers. To introduce z- plane and z- transform techniques.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Analyze** mathematical model for mechanical and Electrical systems. **(Analyze)**
CO 2	**Analyze** time response of the system with various test inputs and steady state errors. (**Analyze**)
CO 3	**Analyze** the frequency response of the system and Correlate frequency - time domain specifications. (**Analyze**)
CO 4	**Predict** the stability of the system using Root Locus and Routh Hurwitz stability criterion. (**Evaluate**)
CO 5	**Discuss** the basic components of Digital Control System. **(Understand)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H												H	
CO 2	H									M			H	
CO 3	H												H	
CO 4	H									M			H	

CO 5	H												H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**SYSTEM AND REPRESENTATION**	**9**

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical systems – Transfer function – Block diagram reduction techniques.

UNIT II	**TIME RESPONSE**	**9**

Time response – Time domain specifications – Types of test input- I and II order system response – Error coefficients – Generalized error series – Steady state error- P, PI, PID modes of feedback control – Time response analysis.

UNIT III	**FREQUENCY RESPONSE**	**9**

Frequency response – Bode plot- polar plot – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

UNIT IV	**CONCEPT OF STABILITY**	**9**

Characteristics equation – Root Locus construction - Routh Hurwitz stability criterion

UNIT V	**SAMPLED DATA SYSTEMS**	**9**

Sampled data control systems- functional elements – sampling process- z-transforms-properties inverse z transforms – ZOH and First Order Hold process- pulse transfer functions – step response – Introduction to digital control system, Digital Controllers and Digital PID controller

Text Books:

1. OGATO, Modern Control Engineering, Fifth Edition, Prentice-Hall of India Pvt.Ltd., New Delhi, 2010.
2. Azzo, J.J.D. and C.H. Houpis, Feedback control system analysis and synthesis, McGraw-Hill international 3rs Edition, 1998.

References:

1. Kuo, B.C. Automatic control systems, Prentice-Hall of India Pvt.Ltd., New Delhi, 2009.
2. Houpis, C.H. and Lamont, G.B. Digital control Systems, McGraw Hill Book co., New York, U.S.A. 1995.
3. Naresh K Sinha, Control Systems, New Age International Publishers, New Delhi, 1998.

BAN6V1	VALUE ADDED PROGRAM II	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To boost up the technical writing skills of the student
2. To enhance the presentation skills of the student
3. To familiarize the student on attractive resume writing
4. To familiarize the student on Interviews and Group Discussions
5. To advance the problem-solving ability of the student

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Acquire** written communication & its importance in current scenario. (**Understand**)
CO 2	**Develop** Individual or in-group class presentations skills pertaining to the applications of concepts, theories or issues in human development. (**Apply**)
CO 3	**Develop** analytical problem-solving skills. (**Apply**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1								H	H	H				
CO 2								H	H	H				
CO 3								H	H	H				

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	A business letter to a company asking for Quotation.
2	A cover letter, resume, CV for applying a Job.
3	A sample Email communication for the given situation.
4	A model Technical report writing.
5	Group discussion on technical topics.
6	Group discussion on social awareness.

7	Group discussion on current affairs.
8	An activity to develop reasoning skills..
9	An activity to develop analytical skills.
10	An activity to develop critical thinking.

References:

1. Value Added Program II Preparatory Material, Department of Aeronautical Engineering, 2015

BAN6L1	AIRCRAFT SYSTEM LABORATORY	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Aircraft Systems and Instrumentation.				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. Appreciate the need of various aircraft systems, components, accessories and its functions.
2. Understand the importance of aircraft system maintenance and checks.
3. Understand the jacking procedure, levelling and symmetric checks done in the aircraft.
4. Understand the rigging procedure of the aircraft, Understand the operation of Brake torque load test and fuel clogging test
5. Develop the skills of trouble shooting and rectification of snags.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Observe** Aircraft ground operations. (**Imitation**)
CO 2	**Conduct** Checks to ensure the airworthiness of aircraft. (**Precision**)
CO 3	**Refine** the performance of aircraft systems. (**Articulation**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H				H
CO 2	H								H	H				H
CO 3	H								H	H				H

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Aircraft systems observations during Ground run.
2	Aircraft “Mooring” procedure.
3	Aircraft “Symmetry Check” procedure.
4	Procedure to find the centre of gravity of Aircraft.
5	“Study of aircraft fuel system components.

6	“Brake Torque Load Test” on wheel brake units.
7	Maintenance and rectification of snags in hydraulic systems.
8	Rectification of snags in aircraft fuel systems.
9	Tyre pressure checking and Oleo leg pressure procedure.

References:

1. Aircraft Systems Lab Manual, Department of Aeronautical Engineering, 2015

BAN6L2	PROPULSION LABORATORY	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Aerodynamics I & II, Aircraft Propulsion				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. Understand the need of various incompressible circular and non-circular jets.
2. Understand the importance of velocity in supersonic circular and noncircular jets.
3. Understand the determination of wall jet velocity profile in the aircraft.
4. Understand the need of operation of a ramjet engine.
5. Develop the studies of liquid fuel atomizer and pre-mixed flame.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Demonstrate** the various procedures and techniques for the experiments. (**Manipulation**)
CO 2	**Observe** the data using the different measuring devices and techniques. (**Imitation**)
CO 3	**Follow** the mathematical concepts/equations to obtain quantitative results. (**Imitation**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H		H	H	
CO 2	H								H	H		H	H	
CO 3	H								H	H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Estimation of spread rate in incompressible circular jets.
2	Estimation of spread rate in incompressible non- circular jets.
3	Estimation of centre line velocity decay in supersonic circular jets.
4	Estimation of centre line velocity decay in supersonic non-circular jets.
5	Determination of Wall jet velocity profile.
6	Supersonic Jet Pattern Analysis using Schlieren Technique.
7	Study of free convective heat transfer over a flat plate.
8	Study of forced convective heat transfer over a flat plate.

9	Operation of a subsonic Ramjet engine.
10	Determine the calorific value of Fuel using Bomb Calorimeter.

References:

1. Propulsion Lab Manual, Department of Aeronautical Engineering, 2015

BAN6L3	AIRCRAFT DESIGN PROJECT I	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Fundamentals of Aeronautics and Astronautics, Flight Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To familiarize the student to the different configurations of airplanes and on the comparison of the parameters of different airplanes to arrive at a proper selection of main parameters to design a new aircraft
2. To enable the student to be able to estimate the weight of the aircraft according to the main parameters selected
3. To enable the student to select an appropriate powerplant and estimate the wing geometry according to the results of weight estimation
4. To enable the student to calculate tail dimensions and to estimate the total drag of the airplane and also to perform a stability analysis of the airplane
5. To make the student able to draft a three-view diagram of the designed airplane.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Acquire** the design parameters of various aircrafts necessary for the suitable preliminary design. **(Manipulation)**
CO 2	**Acquire** aerodynamic and geometric parameters for detailed aircraft design. **(Manipulation)**
CO 3	**Integrate** performance and stability parameters for different phases of flight. **(Precision)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H		H	H	
CO 2	H								H	H		H	H	
CO 3	H								H	H		H	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Comparative configuration study of different types of airplanes.
2	Comparative study on specification and performance details of aircraft.
3	Preparation of comparative data sheets.
4	Work sheet layout procedures.
5	Comparative graphs preparation.

6	Selection of main parameters for the design.
7	Preliminary weight estimations.
8	Selection of main parameters.
9	Power plant selection.
10	Aerofoil selection.
11	Wing and stabilizers selection.
12	Control surfaces designing.
13	Drag estimation.
14	Detailed performance calculations and stability estimates.
15	Preparation of layouts of balance diagram and three view drawings.

References:

1. Aircraft Performance and Design, “John D Anderson”, Tata McGraw Hill Publications
2. Analysis and Design of Flight Vehicle Structures, E F Bruhn
3. CADD and CAA Lab Manuals, Department of Aeronautical Engineering, 2015

BAN701	COMPUTATIONAL FLUID DYNAMICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Numerical methods, Fundamentals of Fluid Dynamics, Aerodynamics I & II				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To make the student be familiar with the various fluid flow analysis technique.
2. To give insight of various computational technique for fluid flow analysis.
3. To acquaint the student with various challenges involved in computational techniques.
4. To get exposure regarding its applications and recent developments.
5. To learn advanced computing techniques like parallel computing, vector computing etc.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Solve** the well posed and ill posed problems. (**Apply**)
CO 2	**Apply** appropriate Finite Difference schemes for solving PDE. (**Apply**)
CO 3	**Analyze** various explicit and implicit methods for a converging solution. (**Analyze**)
CO 4	**Solve** the steady state diffusion and convection problems using finite volume method. (**Apply**)
CO 5	**Identify** suitable turbulence model for fluid flow problems. (**Understand**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									H			H	
CO 2	H											H	H	
CO 3	H												H	
CO 4	H									H		H	H	
CO 5	H											H	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	FUNDAMENTAL CONCEPTS	10
Basics of computational fluid dynamics – Governing equations of fluid dynamics – Substantial Derivative-Non conservative and conservative form of Continuity, Momentum and Energy equations -Well posed and ill posed problems.		
UNIT II	**INTRODUCTION TO FINITE DIFFERENCE METHOD EQUATIONS**	**9**
Classification of PDEs-Reduction of system of second order PDEs-Boundary Conditions-Mathematical behavior of PDEs on CFD-Elliptic, Parabolic, Hyperbolic Equations. Derivation of Finite Difference Equations- Use of Finite Difference method.		
UNIT III	**FINITE DIFFERENCE METHOD FOR DIFFUSION**	**8**
Explicit Methods-The FTCS method, Richardson method, DuFort& Frankel method-Implicit methods-Laasonen method, Crank Nicolson method, Beta formulation. Terminologies in Finite difference equations-Types of error-Error analysis-Consistency analysis-Von-Neuman stability analysis.		
UNIT IV	**FINITE VOLUME METHOD FOR DIFFUSION AND CONVECTION**	**10**
Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems -Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness.		
UNIT V	**TURBULENCE MODELLING**	**8**
Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models. Large eddy simulation- Direct numerical simulation.		

Text Books:

1. Jiyuan Tu, Guan,HengYeoh, Chaoqun Liu, “Computational Fluid Dynamics A Practical Approach” Springer Verlag,2012.
2. J. D.Anderson, “Computational Fluid Dynamics”, McGraw Hill International, 2012.

References:

1. H.K. Versteeg and W. Malalsekera “An Introduction to Computational Fluid Dynamics, The Finite Volume Method”, Longman Scientific & Technical, 2007.
2. T. J. Chung, “Computational Fluid Dynamics”, Cambridge University Press, 2002.
3. C. Hirch, “Numerical Computation of Internal and External Flows” Volume-2, John Wiley and Sons, 1994.

BAN702	AVIONICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Basic Electricals and Electronics, Aircraft Systems and Instrumentation.				
	Course Designed by – Department of Aeronautical Engineering.				

OBJECTIVES

1. To provide the students an understanding on need for avionics in civil and military industry, avionics subsystems, integrated systems and design approaches
2. Introduce students about digital computer, digital numbering, digital arithmetic, logic gates, combinational logic circuits, microprocessor & memories and interface to it with analogue system
3. To introduce avionics system architecture- Data buses, MIL,ARINC standards
4. To provide idea of different cockpits, cockpit displays, panels, I/O technologies
5. To impart brief knowledge on various avionics systems. Reliability, maintainability and certification

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the needs for avionics in different fields of aviation. **(Understand)**
CO 2	**Explain** the architecture of microprocessor and combinational logic circuits. **(Understand)**
CO 3	**Discuss** Avionics system architecture and various data-buses. **(Understand)**
CO 4	**Compare** various display technologies used in civil and military cockpits. **(Understand)**
CO 5	**Discuss** the working principles of various avionic sub-systems. **(Understand)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H													H
CO 2	H									M				H
CO 3	H													H
CO 4	H													H
CO 5	H									M				H

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT		
UNIT I	**INTRODUCTION TO AVIONICS**	**9**
Need for avionics in civil and military aircraft and space systems – Integrated avionics and weapon systems – Typical avionics subsystems - Design approaches and recent advances - Application Technologies.		
UNIT II	**PRINCIPLE OF DIGITAL SYSTEMS**	**9**
Digital computer – Digital number system- number systems and codes-Fundamentals of logic and combinational logic circuits –Digital arithmetic – interfacing with analogue systems - Microprocessors – Memories.		
UNIT III	**DIGITAL AVIONICS ARCHITECTURE**	**9**
Avionics system architecture – Databuses – MIL-STD-1553B – ARINC – 420 – ARINC – 629.		
UNIT IV	**FLIGHT DECKS AND COCKPITS**	**9**
Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS.		
UNIT V	**INTRODUCTION TO AVIONICS SYSTEMS**	**9**
Communications systems- Navigation systems – Flight control systems – Radar – Electronic Warfare – Utility systems Reliability and maintainability – Certification.		

Text Books:

1. Middleton, D.H., Ed., Avionics systems, Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.
2. Spitzer, C.R. Digital Avionics Systems, Prentice-Hall, Englewood Cliffs, N.J., U.S.A. 1987.

References:

1. Malvino, A.P. and Leach, D.P. Digital Principles and Applications, Tata McGraw Hill, 1990.
2. Gaokar, R.S. Microprocessors Architecture-Programming and Applications,Prentice Hall, 2002..

BAN703	HEAT TRANSFER	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Aero – Thermodynamics, Fluid Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student about the fundamentals of heat transfer.
2. To introduce to the student about the heat transfer analysis of conduction problems.
3. To introduce to the student about the heat transfer analysis of convection problems.
4. To introduce to the student about the heat transfer analysis of radiation problems.
5. To help the student understand about the various heat transfer problems in the aerospace applications.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Solve** one dimensional steady state heat conduction problems. (**Apply**)
CO 2	**Estimate** heat transfer rate ofsemi-infinite and infinite solids. (**Evaluate**)
CO 3	**Estimate** heat transfer coefficient for flow over a flat plate and circular pipe. (**Evaluate**)
CO 4	**Calculate** radiative heat transfer of black and gray surfaces. (**Apply**)
CO 5	**Compare** different types of heat exchangers and Evaluate their performance. (**Analyze**)
CO 6	**Solve** heat transfer problems related to aerospace applications. (**Apply**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									M			H	
CO 2	H												H	
CO 3	H									M			H	
CO 4	H												H	
CO 5	H												H	
CO 6	H				L								H	
Category	**Professional Elective (PE)**													

Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
(Use of Heat and Mass Transfer Data Book is permitted)		
UNIT I	**FUNDAMENTALS OF HEAT TRANSFER**	**9**
Modes of heat transfer: Conduction – Convection – Radiation – One dimensional steady state heat conduction: Composite Medium – Critical thickness – Effect of variation of thermal Conductivity – Extended Surfaces.		
UNIT II	**CONDUCTION HEAT TRANSFER**	**9**
Unsteady state. Heat Conduction: Lumped System Analysis – Heat Transfer in Semi-infinite and infinite solids – Use of Transient – Temperature charts – Application of numerical techniques.		
UNIT III	**CONVECTIVE HEAT TRANSFER**	**9**
Introduction – Free convection in atmosphere - free convection on a vertical flat plate – Empirical relation in free convection – Forced convection – Laminar and turbulent - convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. Empirical relations, application of numerical techniques in problem solving.		
UNIT IV	**RADIATIVE HEAT TRANSFER AND HEAT EXCHANGERS**	**9**
RADIATIVE HEAT TRANSFER: Concept of black body-Intensity of radiation-Laws of Black body Radiation-Radiation from nonblack surfaces- real surfaces – Radiation between surfaces-Radiation shape factors-Radiation shields. HEAT EXCHANGERS: Types-overall heat transfer coefficient- LMTD- NTU method of heat exchanger Analysis.		
UNIT V	**HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING**	**9**
Heat transfer problems in gas turbine, rocket thrust chambers and Re-entry vehicles –numerical problems using MATLAB.		

Text Books:

1. Sachdeva, S.C. “Fundamentals of Engineering, Heat and Mass Transfer, Wiley Eastern Ltd. Fourth Edition, New Delhi, 2012.
2. Holman, J.P., "Heat Transfer ", McGraw Hill Book Co., Inc., New York, TenthEdition.,2009.

References:

1. Sutton, G.P., "Rocket Propulsion Elements ", John Wiley and Sons, 8th Edition.2010.
2. Lienhard J. H., “A Heat Transfer Text Book”, Phlogiston Press, U.S.A., 2008.
3. Ozisik M.N.,”Heat Transfer A Basic Approach”, The McGraw-Hill Company, reprint 1995.

BAN7L1	AIRFRAME AND AERO ENGINE REPAIR LAB	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To know the basic concepts of the maintenance and repair of both piston and jet aero engines and the procedures followed for overhaul of aero engines.
2. To practice the procedures of dismantling of piston engine and jet engine, study of components, accessories of both engines and handling safety precautions.
3.To demonstrate the various inspection methods such as visual inspection dimensional checks and testing methods especially NDT have studied clearly and
4. Ability to inspect surface defects, internal defects, by using dye penetrant method and identification of defects on jet engine components.
5. To know about the reassembly procedure of piston engines, jet engines and starting procedure of piston engines.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Demonstrate** the various procedures and techniques for the Airframe repair (**Manipulation**)
CO 2	**Demonstrate** the procedures and techniques followed in Aero Engine inspection . (**Manipulation**)
CO 3	**Perform** engine dismantling and Assembling **(Precision)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H						H		H	H				H
CO 2	H						H		H	H				H
CO 3	H						H		H	H				H

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Dismantling and reassembling a piston engine.
2	Piston Engine - cleaning, visual inspection, NDT checks.
3	Piston Engine Components - dimensional checks.
4	Study of carburetor, fuel pump, spark plug and ignition system.

5	Jet Engine – identification of components & defects.
6	Engine starting procedures.
7	Aircraft wood gluing by single scarf and double scarf joint point.
8	Fabric and Riveted patch repairs.
9	Tube bending and flaring.
10	Sheet metal forming.

References:

1. Airframe and Aero Engine Repair Lab Manual, Department of Aeronautical Engineering, 2015

BAN7L2	AVIONICS LABORATORY	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Basic Electricals and Electronics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To learn and practice about basic digital electronic circuits like Adder, subtractor, multiplexer, demultiplexer, encoder, decoder etc.
2. To learn about timer, shift register and comparator circuits.
3. To understand the 8-bit and 16-bit operation and to learn mnemonic's coding for 8-bit and 16-bit circuit.
4. To understand the concept of interface programming and analog to digital conversion.
5. To learn stability analysis and design using MATLAB.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Demonstrate** decoding and encoding operations in digital electronics. (**Manipulation**)
CO 2	**Perform** logical operation and storing the data in microprocessor. **(Precision)**
CO 3	**Design** avionics control system using MATLAB. (**Articulation)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H				H
CO 2	H								H	H				H
CO 3	H	M			M				H	H		M		H

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Addition/Subtraction of binary numbers.
2	Multiplexer/Demultiplexer Circuits.
3	Encoder/Decoder Circuits.
4	Timer Circuits, Shift Registers, Binary Comparator Circuits.
5	Addition and Subtraction of 8-bit and 16-bit numbers.
6	Sorting of Data in Ascending & Descending order.
7	Sum of a given series with and without carry.

8	Greatest in a given series & Multi-byte addition in BCD mode.
9	Stability analysis using Root locus, Bode Plot techniques.
10	Design of lead, lag and lead – lag compensator for aircraft dynamics.

References:

1. Avionics Lab Manual, Department of Aeronautical Engineering, 2015

BAN7L3	AIRCRAFT DESIGN PROJECT II	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Flight Mechanics, Aircraft Structures I & II, Aerodynamics I & II, Aircraft Design Project I, Computer Aided Design and Analysis				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about the various kinds of loads acting on an airplane and about the detailed structural design of an aircraft
2. To enable the student to be able to estimate the loads on aircraft's wing and fuselage
3. To enable the student to able to perform a detailed design of the aircraft's wing and fuselage components
4. To enable the student to make a detailed design report and a layout of aircraft drawings
5. To enable the student to model the designed aircraft and perform a flow analysis and structural analysis

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Observe** safety flying critical flying load limits. **(Imitation)**
CO 2	**Design** of fuselage and wing structural members. **(Articulation)**
CO 3	**Integrate** all the design parameters to assemble an aircraft. **(Articulation)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H	H	H						H	H		H	H	
CO 2	H	H	H		H				H	H		H	H	
CO 3	H	H	H		H				H	H		H	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	V-n diagram for the design study.
2	Gust and maneuverability envelopes.
3	Critical loading performance and final V-n graph calculation.
4	Structural design study – Theory approach.
5	Load estimation of wings.
6	Load estimation of fuselage.
7	Balancing and Maneuvering loads on tail plane, Aileron and Rudder loads.

8	Detailed structural layouts.
9	Design of various components of wings, fuselage.
10	Preparation of a detailed design report with drawings.
11	Preparation of model using computer aided design packages.
12	Preparation of structural analysis report for wing.
13	Preparation of structural analysis report for Fuselage.
14	Preparation of flow analysis report for wing.
15	Preparation of flow analysis report for fuselage.

References:

1. Aircraft Performance and Design, “John D Anderson”, Tata McGraw Hill Publications
2. Analysis and Design of Flight Vehicle Structures, E F Bruhn
3. CADD and CAA Lab Manuals, Department of Aeronautical Engineering, 2015

BAN7P1	Project Phase 1	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with theoretical and experimental studies related to aeronautical science.
2. To enable the student to get involved in key area of research in the branch of study.
3. To perform the literature studies and survey that will help in formulating the problem statement.
4. To enable the student to understand the concept of the acquired statement to get the idea about the work.
5. To work according to the acquired idea and to develop report in the form as specified in the guidelines.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Observe** the current market scenario to develop new or modify the existing product. **(Imitation)**
CO 2	**Complete** the concept design of the project. **(Manipulation)**
CO 3	**Point out** the methodology for implementation of design. **(Manipulation)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H							H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H		H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H		H	H	H	H	H	H	H

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

The objective of the Project Phase 1 is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Each student shall finally produce a comprehensive report covering background information, literature survey and problem statement. This final report shall be in typewritten form as specified in the guidelines.

BAN8P1	PROJECT WORK	L	T	P	C
	Total Contact Hours – 60	0	0	18	9
	Prerequisite – Basic Subjects, Aerodynamics, Aircraft Structures, Aircraft Propulsion, Flight Mechanics, Engineering Mathematics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVE :

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be in typewritten form as specified in the guidelines.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Tell** the value of achieving perfection in projects implementation & completion. **(Imitation)**
CO 2	**Build** the skills, competencies and point of view of designed concepts. **(Naturalization)**
CO 3	**Replicate** professional skills in Presentation, Technical report writing, critical thinking and decision making. **(Manipulation)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H							H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H		H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H		H	H	H	H	H	H	H

BAN8C1	COMPREHENSION	L	T	P	C
	Total Contact Hours – Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses up to eighth semester				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To provide a complete review of Aeronautical/Aerospace Engineering topics covered up to eighth semesters, so that a comprehensive understanding is achieved.
2. It will also help students to face job interviews, competitive examination and also to enhance the employment potential.
3. To provide overview of all topics covered and to assess the overall knowledge level up to eighth semester.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Recollect** the core engineering concepts. **(Remember)**
CO 2	**Acquire** Presentation Skills to face job interviews. **(Apply)**
CO 3	**Write** competitive examinations for successful career. **(Apply)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H													
CO 2	H								H	M				
CO 3	H								H					

BANE01	**BASICS OF AIRCRAFT MAINTENANCE AND REPAIR**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with the fundamental aspects of aircraft maintenance and repair.
2. To understand the maintenance and repair aspects of aircraft structures.
3. To understand the maintenance and repair aspects of primary aircraft systems.
4. To understand the maintenance and repair aspects of engine and fuel systems.
5. To understand the maintenance and repair aspects auxiliary systems and instruments.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** the fundamentals aspects of aircraft maintenance and repair. **(Understand)**
CO 2	**Describe** the repair and maintenance procedures of aircraft structures. **(Understand)**
CO 3	**Explain** the trouble shooting procedures involved in primary aircraft systems. **(Understand)**
CO 4	**Explain** the maintenance procedures of engine and fuel system. **(Understand)**
CO 5	**Summarize** the maintenance procedures of auxiliary and instruments. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**FUNDAMENTAL ASPECTS OF AIRCRAFT MAINTENANCE AND REPAIR**	**9**

Importance of aircraft maintenance and repair – CAR stipulations- Hazardous materials and safety practices- Earlier aircrafts with wood structures – Maintenance of fabric covered airplanes – Aircraft painting and markings

UNIT II	**MAINTANENACE AND REPAIR OF AIRCRAFT STRUCTURES**	**9**

Aircraft tubing repair – Special welding repairs – Soldering and brazing – Sheet metal inspection and repair – Repair practices – Rivet – Repair design – Maintenance and repair of Plastic materials – Composite materials – Inspection and repair of composite material.

UNIT III	**MAINTENANCE OF PRIMARY AIRCRAFT SYSTEM**	**9**

Importance of various aircraft system – Hydraulic system maintenance practices – Service, flushing and inspection –Trouble shooting and maintenance of Hydraulic and Pneumatic System – Inspection and maintenance of Control system – Inspection and maintenance of landing gear.

UNIT IV	MAINTENANCE OF ENGINE AND FUEL SYSTEM	9
Aircraft engine maintenance – Fuel system inspection – Inspection and repair of fuel tank – Trouble shooting.		
UNIT V	**MAINTENANCE OF AUXILIARY SYSTEM AND INSTRUMENTS**	**9**
Oxygen system, service and maintenance – Installation and maintenance of instruments – Testing instruments and systems – checking of a typical vacuum system.		

Text Books:

1. Kroes Watkins Delp," Aircraft Maintenance and Repair", McGraw Hill, 7th edition,New York, 2013.

References:

1. A&P Mechanics, "Aircraft Hand Book", F A A Himalayan Book House, New Delhi, 1996.
2. A&P Mechanics, "General Hand Book", F A A Himalayan Book House, New Delhi, 1996.

BANE02	ROCKETS AND MISSILES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aerodynamics, Aircraft Stability and Control, Avionics, Aircraft Structural Materials and Composites				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVE: To learn about the aerodynamics and stability of Rockets and Missiles.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** combustion mechanisms in solid and liquid propellant rockets**. (Understand)**
CO 2	**Compute** the forces and moments acting on rockets and missile while passing through atmosphere. **(Apply)**
CO 3	**Analyze** the trajectory of rockets and missiles in free space and gravitational field. **(Analyze)**
CO 4	**Summarize** different thrust vector control techniques and stage separation inrockets. **(Understand)**
CO 5	**Apply** suitable materials used for their construction. **(Apply)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**ROCKET SYSTEMS**	**9**

Ignition system in rockets – types of igniters and igniter design considerations – injection system and propellant feed systems of liquid rockets and their design considerations – design considerations of liquid rocket thrust chambers – combustion mechanisms of liquid and solid propellants.

UNIT II	**AERODYNAMICS OF ROCKETS AND MISSILES**	**9**

Airframe components of rockets and missiles – forces acting on a missile while passing through atmosphere – classification of missiles – slender body aerodynamics – method of describing forces and moments – lift force and lateral moment –lateral aerodynamic damping moment – longitudinal moment – drag estimation – body upwash and body downwash in missiles – rocket dispersion.

UNIT III	**ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD**	**9**

One dimensional and two-dimensional rocket motions in free space and homogeneous gravitational fields – description of vertical, inclined and gravity turn trajectories – determination of range and altitude – simple approximations to burn out velocity and altitude – estimation of culmination time and altitude.

UNIT IV	**STAGING AND CONTROL OF ROCKETS AND MISSILES**	**9**

Design philosophy behind multistaging of launch vehicles and ballistic missiles – multistage vehicle optimization – stage separation techniques in atmosphere and in space – stage separation dynamics and lateral separation characteristics – various types of thrust vector control methods including secondary

injection thrust vector control – numerical problems on stage separation and multistaging.		
UNIT V	**MATERIALS FOR ROCKETS AND MISSILES**	**9**
Selection criteria of materials for rockets and missiles – materials for various airframe components and engine parts – materials for thrust control devices – various adverse conditions faced by aerospace vehicles and the requirement of materials to perform under these conditions.		
Total Periods: 45		
Text Books: 1.Martin J L Turner, Rocket and Spacecraft Propulsion, Springer-Praxis Publishing, 2001 2.Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 7th Edition, 2001		

BANE03	EXPERIMENTAL STRESS ANALYSIS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aircraft Structures I & II				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint with the basics of measurement.
2. To understand the principle of extensometers, electrical resistance strain gauges and their application in stress analysis.
3. To understand the principle of photo elasticity and their application in stress analysis.
4. To learn brittle coating and moiré methods in stress analysis.
5. To acquaint with the non-destructive testing methods.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the working principle of different extensometers and their uses. **(Understand)**
CO 2	**Compute** the strain in loaded structures based on measurement of change in resistance using strain gauges. (**Apply**)
CO 3	**Discuss** the techniques used for determination of stress in photo elastic materials. **(Understand)**
CO 4	**Explain** the concepts of more technique and brittle coating techniques. **(Understand)**
CO 5	**Describe** the different type of NDT methods. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	MEASUREMENTS AND EXTENSOMETERS	9

Principles of measurements, Accuracy, Sensitivity and range of measurements, Mechanical, Optical, Acoustical and Electrical extensometers and their uses, Advantages and disadvantages.

UNIT II	ELECTRICAL RESISTANCE STRAIN GAUGES	9

Principle of operation and requirements, Types and their uses, Materials for strain gauge, Calibration and temperature compensation, cross sensitivity, Rosette analysis, Wheatstone bridge and potentiometer circuits for static and dynamic strain measurements, strain indicators.

UNIT III	PHOTOELASTICITY	9

Two-dimensional photo elasticity, Photo elastic materials, Concept of light - photoelastic effects, stress optic law, Transmission and Reflection polariscopes, Interpretation of fringe pattern, Compensation and separation techniques, Introduction to three-dimensional photo elasticity.

UNIT IV	BRITTLE COATING AND MOIRE METHODS	9

Introduction to Moiré techniques, Brittle coating methods and Holography		
UNIT V	**NON – DESTRUCTIVE TESTING**	**9**
Fundamentals of NDT, Radiography, Ultrasonics, Eddy Current testing, Fluorescent Penetrant Testing, Acoustic Emission Technique		

TEXTBOOKS:

1. Sadhu Singh, "Experimental Stress Analysis", Khanna Publishers, 2009.

REFERENCES:

1. Hetenyi, M., "Hand book of Experimental Stress Analysis", John Wiley and Sons Inc., New York, 1972.
2. Max Mark Frocht," Photo Elasticity", John Wiley and Sons Inc., New York, 1968
3. A.J.Durelli, "Applied Stress Analysis", Prentice Hall of India Pvt Ltd., New Delhi, 1970
4. Srinath, L.S., Raghava, M.R., Lingaiah, K., Garagesha, G., Pant B., and Ramachandra, K., "Experimental Stress Analysis", Tata McGraw Hill, New Delhi, 1984.
5. James F. Doyle ,"Modern Experimental Stress Analysis ",John Wiley & Sons, 2004.
6. Ramesh, K., " Experimental Stress Analysis", Indian Institute of Technology Madras, India,E-book,2009.

WEBLINKS:

https://onlinecourses.nptel.ac.in/noc18_me39/preview

BANE04	EXPERIMENTAL AERODYNAMICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Fluid Mechanics, Aerodynamics I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To understand the methods of low speed wind tunnel testing
2. To understand the methods of high speed wind tunnel testing
3. To acquire knowledge about measurement of pressure, velocity and temperature in flow fields
4. To understand the principles of flow visualization and analogue methods
5. To understand the principles of data acquisition and uncertainty analysis

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** calibration procedures using various instruments and **Determine**aerodynamic coefficients.(**Apply**)
CO 2	**Explain**various types of high-speed wind tunnels and discuss their design parameters.**(Understand)**
CO 3	**Describe**measurement techniques for flow properties.**(Understand)**
CO 4	**Explain** different flow visualizations technique in subsonic and supersonic regimes.**(Understand)**
CO 5	**Discuss**data acquisition and error analysis.**(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**LOW SPEED WIND TUNNEL TESTING**	**9**

Low speed wind tunnels-Power losses in wind tunnel, energy ratio, Calibration, Flow angularity, Yaw Sphere, Yaw meter, Turbulence sphere, Pressure sphere, Wind tunnel balances, boundary correction, calculation of CL and CDforairfoils

UNIT II	**HIGH SPEED WIND TUNNEL TESTING**	**9**

High Speed wind tunnels- Blow down, Induction Type Tunnels, Losses in supersonic tunnels, Second throat, running time estimation, Hypersonic, transonic tunnels, Shock tunnels, Gun tunnels

UNIT III	**MEASUREMENT TECHNIQUES**	**9**

Pressure measurement, Hot wire anemometer, laser Doppler anemometer for turbulence and velocity Measurements-Temperature measurement, Measurement of wall shear stress, Rotameters and Ultrasonic flow meters.

UNIT IV	**FLOW VISUALIZATION AND ANALOGUE METHODS**	**9**

Smoke tunnel, Tuft method, chemical coating, interferometer, Schlieren and Shadowgraph method Heleshaw Apparatus, Hydraulic analogy, limitations of analogy		
UNIT V	**DATA ACQUISITION AND UNCERTAINTY ANALYSIS**	**9**
Measurement systems, data acquisition, signal conditioning, multiplexing, data conversion, uncertainty analysis		
Text Books: 1. Rathakrishnan. E "Instrumentation, Measurement and Experiments in Fluids", CRCPress, London, 2007		
References: 1. Rae W.H and Pope. A "Low speed wind tunnel testing" John Wiley Publication, 1999 2. Pope. A andGoin. L "High speed wind tunnel testing" John Wiley, 1985		

BANE05	HELICOPTER MAINTENANCE	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aircraft Systems and Instrumentation				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint with the basic fundamental of helicopter concept.
2. To understand the concept of inspection and maintenance of main rotor system.
3. To understand the concept of inspection and maintenance of main rotor transmission.
4. To understand the concept of inspection and maintenance of power plant and tail rotor.
5. To acquaint with airframes and related systems

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Explain** the basic components and working of helicopter.**(Understand)**
CO 2	**Explain** the balancing of main rotor and **Discuss** the maintenance procedures in control rigging.**(Understand)**
CO 3	**Discuss** the main rotor transmission coupling and maintenance steps involved. **(Understand)**
CO 4	**Discuss** installation and modification of fixed wing powerplant. **(Understand)**
CO 5	**Describe** maintenance procedure of power plant and tail rotor system. **(Understand)**
CO 6	**Explain** the maintenance procedures involved in fuselage and airframe systems. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

(Use of Heat and Mass Transfer Data Book is permitted)

UNIT I	HELICOPTER FUNDAMENTALS	6

Basic components of helicopters and working – Ground handling, bearing – Gears.

UNIT II	MAINTENANCE OF MAIN ROTOR SYSTEM	12

Head maintenance – blade alignment – Static main rotor balance – Vibration – Tracking – Span wise dynamic balance – Blade sweeping –Electronic balancing – Dampener maintenance – Counter weight adjustment – Auto rotation adjustments – Mast & Flight Control Rotor - Mast – Stabilizer, dampeners – Swash plate flight control systems collective – Cyclic – Push pull tubes – Torque tubes – Bell cranks – Mixer box – Gradient unit control boosts – Maintenance & Inspection control rigging.

UNIT III	MAINTENANCE OF MAIN ROTOR TRANSMISSION	12

Engine transmission coupling – Drive shaft – Maintenance clutch – Free wheeling units – Spray clutch – Roller unit – Torque meter – Rotor brake – Maintenance of these components – vibrations – Mounting systems – Transmissions.		
UNIT IV	**MAINTENANCE OF POWERLANT AND TAIL ROTOR**	**9**
Fixed wing power plant modifications – Installation – Different type of power plant maintenance. Tail rotor system – Servicing tail rotor track – System rigging.		
UNIT V	**AIRFRAME AND RELATED SYSTEMS**	**6**
Fuselage maintenance – Airframe Systems – Special purpose equipment.		

TEXTBOOKS:

1. Jeppesen, "Helicopter Maintenance", Jeppesens and Sons Inc., 2000.

REFERENCES:

1. "Civil Aircraft Inspection Procedures", Part I and II, CAA, English Book House, New Delhi, 1998.
2. Larry Reithmier, "Aircraft Repair Manual", Palamar Books Marquette, 1992.

WEBLINKS:

http://www.aviationmaintenance.edu/programs/

BANE06	SPACE MECHANICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about the basic concepts in space mechanics and about the laws that govern motion in space
2. To enable the student to decide on the locations for satellite injections in to the orbit and the various perturbations on satellites in space
3. To acquaint the student about the interplanetary trajectories and to select/design appropriate trajectory according to mission requirements
4. To introduce to the student about the trajectories for ballistic missiles
5. To familiarize the student about the different types of materials used in spacecrafts

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss**the basic concepts and laws applicable to attracting bodies in the universe.**(Understand)**
CO 2	**Determine**orbital parameters of Satellite injection and**Discuss** methods of satellite perturbations. (**Apply**)
CO 3	**Explain**two- and three-dimensional interplanetary trajectories and launch of interplanetary spacecrafts. **(Understand)**
CO 4	**Estimate** the ballistic missile trajectory. (**Evaluate**)
CO 5	**Discuss** the materials required for the construction of spacecraft and the impact of space environment on spacecraft materials.**(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

(Use of Heat and Mass Transfer Data Book is permitted)

UNIT I	BASIC CONCEPTS AND THE GENERAL N- BODY PROBLEM	6

The solar system – reference frames and coordinate systems – terminology related to the celestial sphere and its associated concepts – Kepler's laws of planetary motion and proof of the laws – Newton's universal law of gravitation - the many body problem- Lagrange-Jacobi identity – the circular restricted three body problem – libration points – the general N-body problem two body problems – relations between position and time.

UNIT II	SATELLITE INJECTION AND SATELLITE PERTURBATIONS	12

General aspects of satellite injection – satellite orbit transfer – various cases – orbit deviations due to injection errors – special and general perturbations – Cowell's method and Encke's method – method of variations of orbital elements – general perturbations approach.

UNIT III	INTERPLANETARY TRAJECTORIES	12

Two-dimensional interplanetary trajectories – fast interplanetary trajectories – three dimensional interplanetary trajectories – launch of interplanetary spacecraft – trajectory estimation about the target planet – concept of sphere of influence – Lambert's theorem

UNIT IV	BALLISTIC MISSILE TRAJECTORIES	9

Introduction to ballistic missile trajectories – boost phase – the ballistic phase – trajectory geometry – optimal flights – time of flight – re-entry phase – the position of impact point – influence coefficients.

UNIT V	MATERIALS FOR SPACECRAFT	6

Space environment – peculiarities of space environment – effect of space environment on materials of spacecraft structure – materials required for the construction of space craft – TPS for re-entry space vehicles.

Text Books:

1.Cornelisse, J.W., "Rocket Propulsion and Space Dynamics", J.W. Freeman &Co., Ltd, London, 1982
2. Parker, E.R., "Materials for Missiles and Spacecraft", Mc Graw Hill Book Co. Inc., 1982.

References:

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 7th Edition, 2001.

BASE05	**GUIDANCE AND CONTROL**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite – Basic Electricals and Electronics, Aircraft Stability and Control				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVE: To provide the students the basic knowledge of guidance and control

COURSE OUTCOMES

CO 1	**Explain** the equations governing the aircraft dynamics and the process of liberalizing them.
CO 2	**Discuss** the guidance schemes and requirements for aircrafts and missiles
CO 3	**Apply** the principle of stability and control augmentation systems.
CO 4	**Analyze** the oscillatory modes and methods of suppressing them
CO 5	**Design** the controller for lateral, longitudinal and directional control of aircrafts.

UNIT I	**INTRODUCTION**	**4**

Introduction to Guidance and control - Definition, Historical background.

UNIT II	**AUGMENTATION SYSTEMS**	**7**

Need for automatic flight control systems, Stability augmentation systems, control augmentation systems, Gain scheduling concepts.

UNIT III	**LONGITUDINAL AUTOPILOT**	**12**

Displacement Autopilot-Pitch Orientation Control system, Acceleration Control System, Glide Slope Coupler and Automatic Flare Control and Flight path stabilization, Longitudinal control law design using back stepping algorithm.

UNIT IV	**LATERAL AUTOPILOT**	**10**

Damping of the Dutch Roll, Methods of Obtaining Coordination, Yaw Orientation Control system, turn compensation, Automatic lateral Beam Guidance. Introduction to Fly-by-wire flight control systems, Lateral control law design using back stepping algorithm.

UNIT V	**MISSILE AND LAUNCH VEHICLE GUIDANCE**	**12**

Operating principles and design of guidance laws, homing guidance laws- short range, Medium range and BVR missiles, Launch Vehicle- Introduction, Mission requirements, Implicit guidance schemes, Explicit guidance, Q guidance schemes.

TEXTBOOKS:

1. Blake Lock, J.H "Automatic control of Aircraft and missiles" John Wiley Sons, New York, 1990.

REFERENCES:

1. Stevens B.L & Lewis F.L, "Aircraft control & simulation"', John Wiley Sons, New York, 1992.
2. Collinson R.P.G, "Introduction to Avionics", Chapman and Hall, India, 1996.
3. Garnel.P. &East.D.J, "Guided Weapon control systems", Pergamon Press, Oxford, 1977.
4. Nelson R.C "Flight stability & Automatic Control", McGraw Hill, 1989.
5. Bernad Etikin, "Dynamic of flight stability and control", John Wiley, 1972.
6. Jan Roskam, "Airplane Performance, Stability and Control", DAR Corporation, 1997.

BANE07	THEORY OF VIBRATIONS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Mechanics, Flight Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To know about the role of Vibrations, vibration analysis and ideas about Aero elasticity in engineering and industry.
2. To make thorough understanding of single degree of freedom, Two degrees of freedom and multi degrees of freedom systems and deriving equations to solve for natural frequency.
3. To understand the Newton second Law, Energy method and know how to use it to solve single degree of freedom systems.
4. To understand the approximate methods to solve vibration engineering problems in Two degree and multi degree of freedom systems.
5. To understand the collars triangle and various aero elastic phenomena in the aircraft structural components.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Compute** the natural frequency of SDOF systems under free and forced vibrations. **(Apply)**
CO 2	**Determine** the frequency of vibrating body using instruments. **(Apply)**
CO 3	**Calculate** principle mode of vibration for MDOF systems. **(Apply)**
CO 4	**Calculate** the natural frequency of continuous systems. **(Apply)**
CO 5	**Calculate** natural frequency of MDOF systems using approximate methods. **(Apply)**
CO 6	**Discuss** the problems in aeroelastic instability and its prevention. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**SINGLE DEGREE OF FREEDOM SYSTEMS**	**9**

Vibration Terminologies, Simple harmonic motion, Newton's law, D'Alembert's principle, Energy methods, Free vibrations, Damped vibrations, Forced Vibrations with and without damping, support excitation,Transmissibility, Vibration measuring instruments.

UNIT II	**MULTI DEGREES OF FREEDOM SYSTEMS**	**9**

Two degrees of freedom systems, static and dynamic couplings, Vibration absorbers, Principal co-ordinates, principal modes and orthogonal condition, Eigen value problems, Lagrangean equations and applications.

UNIT III	**CONTINUOUS SYSTEMS**	**9**

Vibration of elastic bodies, vibration of strings, Longitudinal –lateral and Torsional vibrations.		
UNIT IV	**APPROXIMATE METHODS**	**9**
Approximate methods-Rayleigh‟s method, Dunkerleys method, Holzer method, Matrix iteration method		
UNIT V	**ELEMENTS OF AEROELASCTICITY**	**9**
Vibrations due to coupling of bending and torsion, collars triangle, aero elastic instabilities and their prevention, Wing divergence,reversal of aileron control, Flutter and its prevention.		

Text Books:

1. Y.C. Fung, "An Introduction to the Theory of Aeroelasticity", John Wiley & Sons Inc., New York, 2008.
2. Thomson W T, 'Theory of Vibration with Application' - CBS Publishers, 1990.

References:

1. Timoshenko S., Vibration Problems in Engineering – John Wiley and Sons, New York, 1993.
2. Bisplinghoff R.L., Ashely H and Hogman R.L., Aeroelasticity – Addision Wesley Publication, New Tork, 1983.
3. R.H. Scanlan and R.Rosenbaum, "Introduction to the study of Aircraft Vibration and Flutter", Macmillan Co., New York, 1981.
4. R.D.Blevins, "Flow Induced Vibrations", Krieger Pub Co., 2001

BASE06	**SPACE VEHICLE DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite – Elements of Aerospace Structures				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVE: To introduce to the student about the design of a space vehicle

COURSE OUTCOMES

CO 1	Describe the fundamentals of space systems
CO 2	Demonstrate various space mission program
CO 3	Examine the challenges in space environment
CO 4	Classify the method of selection to launch vehicle and methods for re entry
CO 5	Determine the structural parameters in space system design

UNIT I	**FUNDAMENTAL ASPECTS OF SPACE SYSTEMS ENGINEERING 9**
Space Systems Engineering – Definition, Requirements of Systems Engineering, Design Team, Tradeoffs, Top level requirements, Functional requirements, Functional Block diagram, Tradeoff analysis, Communication Systems and Power systems, Technology Tradeoffs	
UNIT II	**SPACE MISSIONS 9**

Space Missions - Low Earth Orbit, Flight Tests, Earth Observation, Space observation, Medium Altitude Earth Orbit, Geosynchronous Earth Orbit, Communications Satellites, Weather satellites, Lunar and Deep space missions – Inner and outer planetary missions, Observation of small bodies – comets and asteroids, Orbit Design Considerations, Advanced Mission concepts- Large Space structures, Space stations, space colonies, Use of lunar and asteroid materials, Nuclear waste disposal

UNIT III ENVIRONMENTAL CONSTRAINTS 9

Natural and Manmade environments, Earth environment – corrosion due to humidity, Clean room, problems in transporting, Launch environment, Shuttle Vibration, Atmospheric environment – wind shear constraint, density shear, Effect of Polar mesospheric clouds during re – entry, Space and Upper Atmosphere environment – Effect of vacuum on materials, Space plasma and spacecraft charging, Magnetic field, Weightlessness and microgravity, Radiation – Van Allen Radiation belt, Micrometeoroids, Orbital debris, Thermal environment

UNIT IV LAUNCH VEHICLE SELECTION AND ATMOSPHERIC ENTRY 9

Solid vs Liquid propellant, Hybrid propulsion, Space shuttle payload accommodations, expendable launch vehicles, Atmospheric entry – Requirements, fundamentals of entry flight mechanics, ballistic entry, gliding entry, skip entry, Cross-Range entry, Entry heating, free molecular heating, Thermal protection, Entry vehicle design

UNIT V STRUCTURAL DESIGN CONSIDERATIONS 9

Vehicle center of mass, Vehicle moment of inertia, structural loads, load alleviation, modal analysis, fracture mechanics, stress levels and safety factors, large structures, structural materials, films and fabrics

TEXTBOOKS:

1. Michael D.Griffin and James R. French, " Space Vehicle design" AIAA Education Series, Second Edition, 2004

REFERENCES:

1. NickolayZosimovych, " Commercial Launch Vehicle Design" , LAP LAMBERT Academic Publishing , 2016

WEBLINKS:

https://www.uclaextension.edu/engineering/engineering-short-courses/course/space-launch-vehicle-design-and-system-engineering

BANE08	HELICOPTER AERODYNAMICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Aeronautics and Astronautics, Aerodynamics I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint with the basics of rotating wing concept.
2. To understand the concept of hovering flight dynamics.
3. To understand the concept of forward flight dynamics.
4. To analyze the climb and descent performance.
5. To acquaint with ground effect machines.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** various helicopter configurations and their working principles. **(Understand)**
CO 2	**Estimate** the rotor performance parameters for hover flight. **(Evaluate)**
CO 3	**Discuss** the forward flight dynamic performance parameters. **(Understand)**
CO 4	**Discuss** the power required for climb and descent. **(Understand)**
CO 5	**Discuss** the working principle and applications of hovercraft. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	INTRODUCTION TO ROTATING WING CONCEPT	9

Evolution of helicopter-Helicopter configurations - Configurations based on Torque reaction – Jet rotors and compound helicopters –Methods of Control, rotor blade pitch control, –Collective pitch and and

Cyclic pitch – Lead – Lag and flapping hinges.

UNIT II	HOVERING FLIGHT DYNAMICS	9

Actuator disc theory-Blade Element Theory-ideal twist Induced & profile power-Figure of merit-Thrust and power coefficients-calculation of drag, torque, power-Ground effect in hover- Estimation of hover ceiling.

UNIT III	FORWARD FLIGHT DYNAMICS	9

Forward flight performance-Parasite drag and Power-Stall limitations-flapping-cyclic Pitch - Autorotation in hover and in forward flight-Dead man's curve.

UNIT IV	CLIMB AND DESCENT PERFORMANCE	9

Vertical flight-flow patterns surrounding the rotor-Power required in climb and descent- Descent speed calculations-Take-off techniques.

UNIT V	GROUND EFFECT MACHINES	9

Types – Hover height, lift augmentation and power calculations for plenum chamber and peripheral jet machines – Drag of hovercraft on land and water –Applications of hovercraft.

Text Books:

1. Gupta. L "Helicopter Engineering", Himalayan Books, 1996
2. Seddon. J "Basic Helicopter Aerodynamics" AIAA education series, 1990.

References:

1. Gessow A & Myers G.C "Aerodynamics of Helicopter" Mac Millan& Co, 1987
2. Saunders "Dynamics of Helicopter flight", John Wiley, 1975
3. Newman. S "Foundation of Helicopter Flight" Halsted Press, 1994

BANE09	AIRCRAFT ENGINE REPAIR AND MAINTENANCE	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aircraft Propulsion, Basic aircraft maintenance and repair				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To know about the hydraulic, pneumatic, brake and landing gear systems principle, function of components, types and operation of typical system.
2. To study and differentiate conventional and modern aircraft control systems and engine control systems
3. To study about layout, components, functions of fuel, lubrication, starting, ignition systems of piston and jet engines.
4. To understand air-conditioning, air cycle, vapor cycle, oxygen, deicing, anti icing and fire protection systems of aero plane.
5. To study construction and operation of flight, navigation instruments and engine instruments installed in the aero plane.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the inspection and troubleshooting procedure for piston engine components. **(Understand)**
CO 2	**Explain** the inspection and troubleshooting methods of aircraft propeller. **(Understand)**
CO 3	**Discuss** the overhauling and testing procedure for aircraft reciprocating engine. **(Understand)**
CO 4	**Describe** the checks and maintenance procedures followed in gas turbine engines and **select** appropriate trouble shooting technique. **(Understand)**
CO 5	**Discuss** the overhauling procedure of aircraft gas turbine engine. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	INSPECTIONS AND TROUBLE SHOOTING OF PISTON ENGINES	9
Need for Inspection, maintenance and trouble shooting in Piston engine – Inspection of all components – Daily and routine checks – Overhaul procedures – Compression testing of cylinders – Special inspection schedules – Engine fuel, control and exhaust systems – Engine mount and super charger – Details of carburetion and injection systems for small and large engines – Ignition system components – Spark plug – Maintenance and inspection check to be carried out.		
UNIT II	**INSPECTION AND TROUBLE SHOOTING OF PROPELLER**	**9**
Propeller theory - operation, construction assembly and installation -Pitch change mechanism-Propeller axially system- Damage and repair criteria - General Inspection procedures - Checks on constant speed propellers - Pitch setting, Propeller Balancing, Blade cuffs, Governor/Propeller operating conditions.		
UNIT III	**OVERHAULING OF PISTON ENGINES**	**9**
Symptoms of failure - Fault diagnostics - Case studies of different piston engine systems - Rectification during testing equipments for overhaul: Tools and equipments requirements for various checks and alignment during overhauling - Tools for inspection - Tools for safety and for visual inspection - Methods and instruments for non destructive testing techniques - Equipment for replacement of parts and their repair. Engine testing: Engine testing procedures and schedule preparation - Online maintenance		
UNIT IV	**INSPECTION AND TROUBLE SHOOTING OF GAS TURBINE ENGINE**	**9**
Gas turbine engine inspection & checks – Use of instruments for online maintenance – Maintenance procedures of gas turbine engines – Trouble shooting and rectification procedures – Component maintenance procedures – Systems maintenance procedures. Special inspection procedures: Foreign Object Damage – Blade damage – etc. Gas turbine testing procedures – test schedule preparation – Storage of Engines – Preservation and de-preservation procedures.		
UNIT V	**OVERHAULING OF GAS TURBINE ENGINES**	**9**
Gas turbine Engine Overhaul procedures – Inspections and cleaning of components – Repairs schedules for overhaul – Balancing of Gas turbine components. Trouble Shooting - Procedures for rectification – Condition monitoring of the engine on ground and at altitude – engine health monitoring and corrective methods.		

Text Books:

1. KROES & WILD, “Aircraft Power plants”, 7th Edition – McGraw Hill, New York, 1994.

References:

1. TURBOMECA, “Gas Turbine Engines”, The English Book Store, New Delhi, 1995.
2. UNITED TECHNOLOGIES PRATT & WHITNEY, “The Aircraft Gas turbine Engine and its Operation”, The English Book Store, New Delhi.

BANE10	CRYOGENIC ROCKET PROPULSION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Thermodynamics, Advanced aerospace propulsion				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student the basics of cryogenic systems and associated processes.
2. To acquaint the student with the propellants used in cryogenic technology.
3. To introduce the various equipment and accessories used in cryogenic rocket propulsion.
4. To familiarize the student to the different flow circuits and parts in a cryogenic engine.
5. To enable the student to understand about various challenges in implementing cryogenic rocket technology.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** the basic components of cryogenic systems. **(Understand)**
CO 2	**Explain** the types of cryogenic propellant used and their storage and handling. **(Understand)**
CO 3	**Discuss** cryo equipment and accessories of cryogenic engine system. **(Understand)**
CO 4	**Discuss** various subsystem involved in the operation of cryogenic engine and their design aspects. **(Understand)**
CO 5	**Discuss** the challenges in cryogenic rocket technology. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	INTRODUCTION TO CRYOGENIC SYSTEMS	9

Cryogenic systems and basic components, Properties of Cryogenic fluids, Liquefaction systems, ideal, Cascade, Linde Hampson and Claude cycles and their derivatives; Refrigerators: Stirling, Gifford-McMahon cycles and their derivatives. Cryogenic Insulations: Foam, Fibre, powder and Multilayer.

UNIT II	CRYO FUEL SYSTEMS	9

Cryogenic and semi – cryogenic propellants - Hydrogen - properties, and pretreatment - Liquefaction of hydrogen - Linde, Claude and helium - hydrogen condensing cycles, Ortho-para conversion. Storage and handling of liquefied hydrogen

UNIT III	CRYO EQUIPMENT AND ACCESSORIES	9

Mechanical and Thermal Properties of engineering materials at low temperatures; Compressors: types, construction and characteristics; Expansion machines:characteristics of reciprocating and turbine expanders, design of J-T expander; Heat exchangers: types, design approaches and selection criteria, Design of cryogenic storage vessels, transfer devices, insulation system, valves; Characteristics of cryogenic pumps, Instrumentation in cryogenic systems

UNIT IV	CRYOGENIC ENGINES	9

Fluid circuits of various cryogenic engines and semi-cryogenic engines; Design of regeneratively cooled combustion chamber, film cooling, dump cooling, transpiration cooling and radiation cooling. Design of expansion nozzle- characteristics, Design of injector–hydraulic characteristics; Engine thrust and mixture ratio control, Igniters, Propellant tanks.

UNIT V	CHALLENGES IN CRYOGENIC ROCKET TECHNOLOGY	9

Problems in storage and handling of cryogenic propellants: safety aspects, Thermal protectionsystems for stage tanks, Thermal stratification- destratification, Geysering effect – geysering elemination, Zero “g” problems – restart mechanism.

TEXTBOOKS:

1. “A text book of Cryogenics”, “Valery V. Kostionk”, Discovery Publishing House, 2010. (Units 1 to 3)
2. “Operation of a Cryogenic Rocket Engine”, “Kitsche, Wolfgang”, Springer Publications, 2011. (Units 4 & 5)

REFERENCES:

1. “Rocket Propulsion Elements”, “Sutton G. P., Bibliarz”

WEBLINKS:

https://nptel.ac.in/courses/112101004/

BANE11	THEORY OF PLATES AND SHELLS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint with the classical plate theory.
2. To analyze the plates of various shapes.
3. To learn the concept of Eigen value analysis.
4. To learn various numerical approximation method for plate analysis.
5. To acquaint the concept of shell structures.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Explain** the classical plate theory subjected to Axi-symmetric loading. **(Understand)**
CO 2	**Use** Navier's method and Levy's method to obtain solution for rectangular plates under different boundary conditions. **(Apply)**
CO 3	**Illustrate** the stability and free vibration analysis of rectangular plates. **(Understand)**
CO 4	**Apply** various approximate methods on rectangular plates for stability analysis. **(Apply)**
CO 5	**Describe** the concepts of shell type structures and bending theories for circular cylindrical shells. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**CLASSICAL PLATE THEORY**	**9**
Classical Plate Theory – Assumptions – Differential Equations – Boundary Conditions – Axi-Symmetric Loading.		
UNIT II	**PLATES OF VARIOUS SHAPES**	**9**
Navier's Method of Solution for Simply Supported Rectangular Plates – Levy's Method of Solution for		

Rectangular Plates under Different Boundary Conditions – Annular Plates – Plates of other shapes.		
UNIT III	**EIGEN VALUE ANALYSIS**	**9**
Stability and Free Vibration Analysis of Rectangular Plates.		
UNIT IV	**APPROXIMATE METHODS**	**9**
Rayleigh – Ritz, Galerkin Methods– Finite Difference Method – Application to Rectangular Plates for Static, Free Vibration and Stability Analysis.		
UNIT V	**SHELLS**	**9**
Basic Concepts of Shell Type of Structures – Membrane and Bending Theories for Circular Cylindrical Shells.		

Text Books:

1. Timoshenko, S.P. Winowsky. S., and Kreger, Theory of Plates and Shells, McGraw Hill Book Co., 1990.
2. Varadhan. T. K. & Bhaskar.K., "Analysis of Plates – Theory and Problems", Narosa Publishing House, 2000

References:

1. Flugge, W. Stresses in Shells, Springer – Verlag, 1985.
2. Timoshenko, S.P. and Gere, J.M., Theory of Elastic Stability, McGraw Hill Book Co.1986.
3. Harry Kraus, 'Thin Elastic Shells', John Wiley and Sons, 1987.
4. Llyod Hamilton, Donald, "Beams, Plates and Shells", McGraw Hill, 1976.
5. Ansel Ugural, Stresses in Plates & Shells, McGraw Hill, 1981
6. Reddy.J.N., "Theory & Analysis of Elastic Plates", CRC, I Edition, 1999

BANE12	HYPERSONIC AERODYNAMICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aerodynamics I & II				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To study the environment around hypersonic vehicles created by strong shock waves.
2. To introduce students to real gas effects caused by high temperature conditions.
3. To study pressure and heat transfer phenomena at the stagnation point of a hypersonic vehicle.
4. To study the distribution of pressure around a general vehicle shape.
5. To study the distribution of heat transfer and skin friction around a general vehicle shape.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Recall** the concepts of compressible flows and differentiate between supersonic and hypersonic flows. **(Remember)**
CO 2	**Discuss** simple solution methods of hypersonic inviscid flows. **(Understand)**
CO 3	**Discuss** the basics of viscous hypersonic flows. **(Understand)**
CO 4	**Describe** the shock shear layer interaction in hypersonic flows. **(Understand)**
CO 5	**Discuss** basics of high temperature flows. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**FUNDAMENTALS OF HYPERSONIC AERODYNAMICS**	**9**

Introduction to hypersonic aerodynamics-differences between hypersonic aerodynamics and supersonic aerodynamics-concept of thin shock layers-hypersonic flight paths – hypersonic similarity parameters-shock wave and expansion wave relations of inviscid hypersonic flows.

UNIT II	**SIMPLE SOLUTION METHODS FOR HYPERSONIC IN VISCID FLOWS**	**9**

Local surface inclination methods-Newtonian theory-modified Newtonian law-tangent wedge and tangent cone and shock expansion methods-approximate theory-thin shock layer theory.

UNIT III	VISCOUS HYPERSONIC FLOW THEORY	9

Boundary layer equation for hypersonic flow-hypersonic boundary layers-self similar and non self similar boundary layers-solution methods for non self similar boundary layers aerodynamic heating.

UNIT IV	VISCOUS INTERACTIONS IN HYPERSONIC FLOWS	9

Introduction to the concept of viscous interaction in hypersonic flows-strong and weak viscous interactions-hypersonic viscous interaction similarity parameter-introduction to shock wave boundary layer interactions.

UNIT V	INTRODUCTION TO HIGH TEMPERATURE EFFECTS	9

Nature of high temperature flows-chemical effects in air-real and perfect gases-Gibb's free energy and entropy-chemically reacting mixtures-recombination and dissociation.

TEXTBOOKS:

1. Ethirajan Rathakrishnan., "High Enthalpy Gas Dynamics", John Wiley and Sons, 2015

REFERENCES:

1. John. D. Anderson. Jr., "Hypersonic and High Temperature Gas Dynamics", AIAA Series, New York, 2006.
2. John. D. Anderson. Jr., "Modern compressible flow with historical perspective", McGraw Hill Publishing Company, New York, 1996.
3. John. T Bertin, "Hypersonic Aerothermodynamics", published by AIAA Inc.,Washington. D.C., 1994.

WEBLINKS:

https://nptel.ac.in/courses/101103003/

BANE13	AN INTRODUCTION TO COMBUSTION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Aerothermodynamics, Aircraft Propulsion				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint with the basics of combustion.
2. To understand the combustion process in aircraft piston engines.
3. To understand the combustion process in gas turbine engines.
4. To understand the combustion process in scramjet engines.
5. To understand the combustion process in rocket engines.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Explain** thermo chemical reaction associated with combustion process and the various parameters affecting burning velocity. **(Understand)**
CO 2	**Select** apt fuel for optimum combustion in piston engines. **(Analyze)**
CO 3	**Compare** the ramjet and gas turbine combustion chamber design. **(Understand)**
CO 4	**Analyze** the challenges associated with supersonic combustion. **(Analyze)**
CO 5	**Discuss** combustion process in solid, liquid propellant rockets and hybrid rockets. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	INTRODUCTION TO COMBUSTION	9

Thermochemical equations – heat of reaction- first, second and third order reactions – premixed flames – diffusion flames – measurement of burning velocity – various methods – effect of various parameters on burning velocity – flame stability – deflagration – detonation – Rankine-Hugoniot curves – radiation by flames

UNIT II	COMBUSTION IN AIRCRAFT PISTON ENGINES	9
Introduction to combustion in aircraft piston engines – various factors affecting the combustion efficiency - fuels used for combustion in aircraft piston engines and their selection – detonation in piston engine combustion and the methods to prevent the detonation		
UNIT III	**COMBUSTION IN GAS TURBINE ENGINES**	**9**
Combustion in gas turbine combustion chambers - recirculation – combustion efficiency, factors affecting combustion efficiency, fuels used for gas turbine combustion chambers – combustion stability – ramjet combustion – differences between the design of ramjet combustion chambers and gas turbine combustion chambers- flame holders types – numerical problems.		
UNIT IV	**COMBUSTION IN SCRAMJET ENGINES**	**9**
Introduction to supersonic combustion – need for supersonic combustion for hypersonic air-breathing propulsion- supersonic combustion controlled by diffusion, mixing and heat convection – analysis of reactions and mixing processes - supersonic burning with detonation shocks - various types of supersonic combustors.		
UNIT V	**COMBUSTION IN ROCKET ENGINES**	**9**
Solid propellant combustion - double and composite propellant combustion – various combustion models – combustion in liquid rocket engines – single fuel droplet combustion model – combustion hybrid rockets		

Text Books:

1.Stephen R turns, ”An Introduction to Combustion”, Tata Mc. Graw Hill Publishing Co., Ltd., New Delhi, Reprint 2013.

2. Lefebvre AG and Dilip R ballal, “Gas Turbine Combustion”, CRC press ,Third Edition, 2010.

References:

1.Warnatz J, Maas U and Dibble RW,”Combustion”,Springer, Fourth Edition,2006.

2. Beer, J.M., and Chiger, N.A. “Combustion Aerodynamics”, Applied Science Publishers Ltd., London, 1981.

3. Sharma, S.P., and Chandra Mohan, “Fuels and Combustion”, Tata Mc. Graw Hill Publishing Co., Ltd., New Delhi, 1987

BANE14	**PRINCIPLES OF TURBO MACHINERY IN AIR BREATHING ENGINES**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aircraft Propulsion				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To familiarize the student on the working principle of air breathing engines
2. To enable the student to be able to design axial flow compressors and fans based on the operating requirements
3. To student should be able to design axial flow turbines based on the operating requirements
4. To acquaint the student about the designing procedure for centrifugal compressors
5. To enable the student to design radial flow turbines based on operating conditions

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Recall** basic thermodynamic laws and working principles of Gas Turbines. **(Remember)**
CO 2	**Discuss** the operating principle of centrifugal compressor using velocity triangle. **(Understand)**
CO 3	**Describe** the operating principle of axial flow compressor using velocity triangle. **(Understand)**
CO 4	**Discuss** the basic theory of axial and radial Turbine. **(Understand)**
CO 5	**Discuss** Turbine blade cooling**(Understand)**
CO6	**Describe** Turbine Compressor matching.**(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION TO TURBOMACHINERIES**	**9**

Turbomachinery- definition, Classification of Turbomachines, Power absorbing and power producing turbomachines, Centrifugal compressor-components, Axial compressor-components, Single stage and multi stage, subsonic and transonic axial compressors, Radial turbine-components, Axial turbine-single and multistage, Review of basic laws-conservation of mass, momentum and energy, Euler‟s turbo machine equation, simple gas turbine cycle, Variation of thrust and SFC with Mach number and altitude for typical turbojet engine

UNIT II	**CENTRIFUGAL COMPRESSORS**	**13**
Work done and pressure rise, impeller, velocity triangle, slip factor, power input factor, Coriolis acceleration, diffuser, compressibility effects, inlet Mach number for impeller and diffuser, prewhirl, Compressor characteristics,non-dimensional quantities, stage pressure ratio, Instability-surge, rotating stall, choking		
UNIT III	**AXIAL FLOW COMPRESSORS**	**9**
Basic operation, stator, rotor, velocity triangle, factors affecting stage pressure ratio, de Haller number, diffusion factor, degree of reaction, radial equilibrium of fluid element, basic design process, estimation of number of stages, considerations in blade design, blade cascade, compressibility effects, axial compressor characteristics		
UNIT IV	**AXIAL AND RADIAL TURBINES**	**9**
Elementary theory of axial flow turbines, blade loading coefficient, flow coefficient, degree of reaction, rotor blade loss, Vortex theory-Free vortex design, constant nozzle angle design, choice of blade profile, pitch and chord, rotor blade stresses, Firtree root, limiting factors in turbine design, Radial flow turbine		
UNIT V	**MATCHING OF COMPONENTS AND BLADE COOLING**	**9**
Component characteristics-compressor, turbine, off-design operation, load characteristics, equilibrium running, matching of two turbines in series, turbine blade cooling		

Text Books:

1. Ganesan. V, “Gas Turbines”, Tata McGraw Hill Education, 3rd Edition, 2010 (Units 1 to 4)
2. Cohen H, Rogers GFC, and Saravanamuttoo HIH, “Gas Turbine Theory” Addison Wesley Longman Limited, 1998 (Unit 5)

References:

1. El-Wakil, M M; Powerplant Technology, 1984, McGraw-Hill Pub.
2. NASA-SP-290, Axial Flow turbines, 2002 (re-release), NTIS, USA.
3. J H Horlock, Axial flow compressors, Butterworths, 1958, UK.
4. J H Horlock, Axial Flow Turbines, Butterworths, 1965, UK.
5. B Lakshminarayana; Fluid Mechanics and Heat Transfer in turbomachineries,1995, USA.
6. Nicholas Cumpsty, Compressor Aerodynamics, 2004, Kreiger Publications, USA.
7. Johnson I.A., Bullock R.O. NASA-SP-36, Axial Flow Compressors, 2002 (re-release), NTIS.
8. Ahmed F. El-Sayed; Aircraft Propulsion and Gas Turbine Engines; CRC press, 2008.
9. Philip G.Hill and Carl Peterson, " Mechanics and Thermodynamics of Propulsion" International Student Edition, Addison Wesley Longman,Inc, Second Edition, 1999
10.Walsh, P.P. and Fetcher,P., “ Gas Turbine Performance” Wiley India Pvt.Ltd., Second Edition,2004

BANE15	NANO SCIENCE TECHNOLOGY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Physics, Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Memorize** the fundamentals of nanoscale materials and the scope of nanoscience and technology. **(Remember)**
CO 2	**Describe** the types of nanostructures and quantum size effects in nanostructures. **(Understand)**
CO 3	**Discuss** the synthesis of nanomaterials and methods of nanomaterials preparation. **(Understand)**
CO 4	**Define** the Mechanical, optical, electronic, magnetic, thermal and chemical properties of nanomaterials. **(Understand)**
CO 5	**List** the physical properties of nanostructured materials. **(Apply)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**

Introduction to nanoscale materials - atomic & molecular size. Scientific revolutions-nanotechnology application area. Scope of nanoscience and technology

UNIT II	**NANOSTRUCTURES AND DIMENSIONS**	**9**

Classification of nanostructures-zero, one, two and three dimensional nanostructures. Size Dependency inNanostructures-quantum size effects in nanostructures.

UNIT III	**NANOMATERIAL SYNTHESIS**	**9**

Synthesis of nanomaterials-top down and bottom up approach. Method of nanomaterials preparation – wet chemical synthesis-mechanical grinding-gas phase synthesis.

UNIT IV	NANOMATERIAL PROPERTIES	9
Surface to volume ratio. Surface properties of nanoparticles. Mechanical, optical, electronic, magnetic, thermal and chemical properties of nanomaterials. Size dependent properties-size dependent absorption spectra.Shape impact.		
UNIT V	**PHYSICAL PROPERTIES OF NANOSTRUCTURED MATERIALS**	**9**
Quantum dots-optical properties and applications. Carbon nanotubes-physical properties and applications. Magnetic behavior of nanomaterials. Electronic transport in quantum wires.		

TEXTBOOKS:

1. T. Pradeep, "Nano the Essential Nanoscience and Nanotechnology", Tata McGraw hill, 2007.

REFERENCES:

1. Charles P. Poole, Frank J. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2003.
2. Mark A. Ratner, Daniel Ratner, "Nanotechnology: A gentle introduction to the next Big Idea", Prentice Hall
P7R:1st Edition, 2002.
3. J. Dutta, H. Hoffmann, "Nanomaterials", Topnano-21, 2003.
4. Mick Wilson, Kamali Kannargare., Geoff Smith, "Nano technology: Basic Science and Emerging technologies", Overseas Press, 2005.

WEBLINKS:

https://www.edx.org/learn/nanotechnology

BANE16	**UNMANNED AERIAL VEHICLE**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Aeronautics and Astronautics, Flight Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** theunmanned aircraft systems and their selection criteria. **(Understand)**
CO 2	**Explain** the aerodynamics and airframe configurations of UAV. **(Understand)**
CO 3	**List** the different types of UAVs and their performance parameters. **(Apply)**
CO 4	**Discuss** the various communication and navigation systems used in UAVs. **(Understand)**
CO 5	**Describe** the concept behind the operation of Horizontal Takeoff and landing of aircrafts. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION TO UNMANNED AIRCRAFT SYSTEMS**	**9**
The Systemic Basis of UAS-System Composition- Conceptual Phase-Preliminary Design-Selection of the System- Some Applications of UAS		
UNIT II	**AERODYNAMICS AND AIRFRAME CONFIGURATIONS**	**9**
Lift-induced Drag - Parasitic Drag - Rotary-wing Aerodynamics - Response to Air Turbulence - Airframe Configurations Scale Effects - Packaging Density – Aerodynamics - Structures and Mechanisms - Selection of power-plants - Modular Construction - Ancillary Equipment		
UNIT III	**CHARACTERISTICS OF AIRCRAFT TYPES**	**9**

Long-endurance, Long-range Role Aircraft – Medium-range, Tactical Aircraft - Close-range/Battlefield Aircraft - MUAV Types - MAV and NAV Types - UCAV - Novel Hybrid Aircraft Configurations - Research UAV		
UNIT IV	**COMMUNICATIONS NAVIGATION**	**9**
Communication Media - Radio Communication - Mid-air Collision (MAC) Avoidance - Communications Data Rate and Bandwidth Usage - Antenna Types NAVSTAR Global Positioning System (GPS) - TACAN - LORAN C - Inertial Navigation - Radio Tracking - Way-point Navigation		
UNIT V	**CONTROL AND STABILITY**	**9**
HTOL Aircraft - Helicopters - OTE/OTE/SPH - Convertible Rotor Aircraft - Payload Control - Sensors –culmon filter- Autonomy		

Text Books:

1. Reg Austin., Unmanned Aircraft Systems, John Wiley and Sons., 2010

References:

1. Milman & Halkias, “Integrated Electronics”, McGraw Hill, 1999.
2. Malvino & Leach, “Digital Principles & Applications”, McGraw Hill, 1986
3. Collinson R.P.G, “Introduction to Avionics”, Chapman and Hall, India, 1996
4.BernadEtikin,“Dynamic of flight stability and control“, John Wiley, 1972

BANE17	BOUNDARY LAYER THEORY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Maths				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint with the fundamentals of viscous flow.
2. To learn the different regime of viscous flow and its solution.
3. To understand the concept of laminar boundary layer.
4. To understand the concept of turbulent boundary layer.
5. To acquaint the concept of compressible boundary layer.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Recall** the fundamental equations of viscous flow and basics of boundary layer theory. **(Understand)**
CO 2	**Discuss** the solutions of simplified viscous flow equations. **(Understand)**
CO 3	**Discuss** theequations and methods used for solving the flow field of laminar boundary layer over a flat plate. **(Understand)**
CO 4	**Describe** the basics of Turbulent boundary layer. **(Understand)**
CO 5	**Describe** the basics of Compressible boundary layer. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	FUNDAMENTAL EQUATIONS OF VICOUS FLOW	9

Fundamental equations of viscous flow, Conservation of mass, Conservation of Momentum-Navier-Stokes equations, Energy equation, Mathematical character of basic equations, Dimensional parameters in viscous flow, Non dimensionalising the basic equations and boundary conditions, vorticity

considerations, creeping flow, boundary layer flow

UNIT II	SOLUTIONS OF VICOUS FLOW EQUATIONS	9

Solutions of viscous flow equations, Couette flows, Hagen-Poisuelle flow, Flow between rotating concentric cylinders, Combined Couette-Poiseuille Flow between parallel plates, Creeping motion, Stokes solution for an immersed sphere, Development of boundary layer, Displacement thickness, momentum and energy thickness.

UNIT III	LAMINAR BOUNDARY LAYER EQUATIONS	9

Laminar boundary layer equations, Flat plate Integral analysis of Karman – Integral analysis of energy equation – Laminar boundary layer equations – boundary layer over a curved body-Flow separation-similarity solutions, Blasius solution for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature profiles for constant plate temperature –Reynold's analogy, Integral equation of Boundary layer – Pohlhausen method – Thermal boundary layer calculations

UNIT IV	TURBULENT BOUNDARY LAYEREQUATIONS	9

Turbulence-physical and mathematical description, Two-dimensional turbulent boundary layer equations — Velocity profiles – The law of the wall – The law of the wake – Turbulent flow in pipes and channels – Turbulent boundary layer on a flat plate – Boundary layers with pressure gradient, Eddy Viscosity, mixing length , Turbulence modeling

UNIT V	COMPRESSIBLE BOUNDARY LAYERSEQUATIONS	9

Compressible boundary layer equations, Recovery factor, similarity solutions, laminar supersonic Cone rule, shock-boundary layer interaction

Text Books:

1. White, F. M., Viscous Fluid Flow, McGraw-Hill & Co., Inc., New York, 2005.

References:

1. Schlicting, H., Boundary Layer Theory, McGraw-Hill, New York, 2000.
2. Reynolds, A, J., Turbulent Flows Engineering, John Wiley and Sons, 1980.

BANE18	FATIGUE AND FRACTURE MECHANICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To familiarize the student about the basic terminologies of fatigue and fracture mechanics.
2. To enable the student to grasp the various statistical tools used in fatigue analysis.
3. To acquaint the student about the physical processes taking place during fatigue.
4. To introduce to the student about the mechanism taking place during fracture.
5. To make the student realize about the importance of fatigue and fracture mechanics in aerospace industry.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Calculate** the stress concentration in structures subjected to fatigue loads. (**Analyze**)
CO 2	**Describe** statistical methods to determine the strain in structures under fatigue loading. (**Understand**)
CO 3	**Describe** various stages of failures due to fatigue load. (**Understand**)
CO 4	**Determine** stress in cracked structures. (**Apply**)
CO 5	**Design** composite material-based structures subjected to fatigue load which are fail-safe. **(Create)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	FATIGUE OF STRUCTURES	9

S.N. curves - Endurance limits - Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors - Plastic stress concentration factors - Notched S.N. curves.

UNIT II	STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR	9

Low cycle and high cycle fatigue - Coffin - Manson's relation - Transition life - cyclic strain hardening and

softening - Analysis of load histories - Cycle counting techniques -Cumulative damage - Miner's theory - Other theories.

UNIT III	PHYSICAL ASPECTS OF FATIGUE	9

Phase in fatigue life - Crack initiation - Crack growth - Final Fracture - Dislocations - fatigue fracture surfaces.

UNIT IV	FRACTURE MECHANICS	9

Strength of cracked bodies - Potential energy and surface energy - Griffith's theory - Irwin - Irwin extension of Griffith's theory to ductile materials - stress analysis of "cracked bodies - Effect of thickness on fracture toughness - stress intensity factors for typical geometries.

UNIT V	FATIGUE DESIGN AND TESTING	9

Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.

TEXTBOOKS:

1. Matej Billy, "Cyclic Deformation and Fatigue of Metals", Elsevier Science Ltd., 1993. (Units 1 to 3)
2. Prashant Kumar, Elements of Fracture Mechanics, Tata McGraw Hill, New Delhi, India, 2009. (Unit 4)
3. Barrois W, Ripely, E.L., "Fatigue of aircraft structure", Pergamon press. Oxford, 1983 (Unit 5)

REFERENCES:

1. K. R.Y. Simha, Fracture Mechanics for Modern Engineering Design, Universities Press (India) Limited, 2001
2. D. Broek, Elementary Engineering Fracture Mechanics, Kluwer Academic Publishers, Dordrecht, 1986.
3. T.L. Anderson, Fracture Mechanics - Fundamentals and Applications, 3rd Edition, Taylor and Francis Group, 2005

WEBLINKS:

https://ocw.mit.edu/courses/materials-science-and-engineering/3-35-fracture-and-fatigue-fall-2003/

BANE19	HIGH TEMPERATURE MATERIALS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with the fundamentals of creep.
2. To make the student understand about design with creep resistance.
3. To familiarize the student about fracture, cracks and their mechanics.
4. To introduce to the student about oxidation and corrosion in hot environments.
5. To acquaint the student with various super alloys and other materials.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** the effect of creep on the functional life of components. **(Understand)**
CO 2	**Explain** the creep resistance of ductile and brittle materials. **(Understand)**
CO 3	**Describe** the effect of different alloys and oxidesmaterials behaviour from low temperature to high temperature **. (Understand)**
CO 4	**Discuss** the fracture mechanism maps for different alloys and oxides**. (Understand)**
CO 5	**Describe** the process of oxidation and different oxidations prevention techniques. **(Understand)**
CO 6	**Discuss** the various types of super alloys and its strengthening mechanisms. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**CREEP**	**9**

Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate.

UNIT II	DESIGN FOR CREEP RESISTANCE	9
Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship.		
UNIT III	**FRACTURE**	**9**
Various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture, and ductile fracture due to micro void coalescence-diffusion controlled void growth; fracture maps for different alloys and oxides.		
UNIT IV	**OXIDATION AND HOT CORROSION**	**9**
Oxidation, Pilling, Bedworth ratio, kinetic laws of oxidation- defect structure and control of oxidation by alloy additions, hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, interaction of hot corrosion and creep, methods of combat hot corrosion.		
UNIT V	**SUPER ALLOYS AND OTHER MATERIALS**	**9**
Iron base, Nickel base and Cobalt base super alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase, embrittlement, solidification of single crystals, Intermetallics, high temperature ceramics.		

Text Books:

1. Raj. R., "Flow and Fracture at Elevated Temperatures", American Society for Metals, USA, 1985.
2. Hertzberg R. W., "Deformation and Fracture Mechanics of Engineering materials", 4th Edition, John Wiley, USA, 1996.
3. Courtney T.H, "Mechanical Behavior of Materials", McGraw-Hill, USA, 1990.

References:

1. Boyle J.T, Spencer J, "Stress Analysis for Creep", Butterworths, UK, 1983.
2. Bressers. J., "Creep and Fatigue in High Temperature Alloys", Applied Science, 1981.
3. McLean D., "Directionally Solidified Materials for High Temperature Service", The Metals Society, USA, 1985.

BANE20	WIND ENERGY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aerodynamics I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To familiarize the student about the fundamentals about wind energy and the various measurements associated with it
2. To acquaint the student with the aerodynamics of wind turbines
3. To introduce to the student about the components of wind turbines and the gear coupled generators
4. To introduce to the student about the direct rotor coupled generators
5. To accustom the student to the control systems and monitoring systems for wind turbines

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the wind energy basics and the wind rose diagram. **(Understand)**
CO 2	**List** the wind turbines types and to familiarize with the theory behind wind turbine operation. **(Remember)**
CO 3	**Explain** the measurement and instrumentation related to wind turbines (**Understand)**
CO 4	**Discuss** power generation, power transmission and monitoring of wind turbines **(Understand)**
CO 5	**Describe** the safety, maintenance and control aspects of wind turbines **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	WIND ENERGY FUNDAMENTALS & WIND MEASUREMENTS	9

Wind Energy Basics, Wind Speeds and scales, Terrain, Roughness, Wind Mechanics, Power Content, Class of wind turbines, Atmospheric Boundary Layers, Turbulence. Instrumentation for wind measurements, Wind data analysis, tabulation, Wind resource estimation, Betz's Limit, Turbulence Analysis

UNIT II	AERODYNAMICS THEORY & WIND TURBINE TYPES	9
Airfoil terminology, Blade element theory, Blade design, Rotor performance and dynamics, Balancing technique (Rotor & Blade), Types of loads; Sources of loads Vertical Axis Type, Horizontal Axis, Constant Speed Constant Frequency, Variable speed Variable Frequency, Up Wind, Down Wind, Stall Control , Pitch Control, Gear Coupled Generator type, Direct Generator Drive /PMG/Rotor Excited Sync Generator		
UNIT III	**GEAR COUPLED GENERATOR WIND TURBINE COMPONENTSAND THEIR CONSTRUCTION**	**9**
Electronics Sensors /Encoder /Resolvers, Wind Measurement : Anemometer & Wind Vane, Grid Synchronization System, Soft Starter, Switchgear [ACB/VCB], Transformer, Cables and assembly, Compensation Panel, Programmable Logic Control, UPS, Yaw & Pitch System : AC Drives, Safety Chain Circuits, Generator Rotor Resistor controller (Flexi Slip), Differential Protection Relay for Generator, Battery/Super Capacitor Charger & Batteries/ Super Capacitor for Pitch System, Transient Suppressor / Lightning Arrestors, Oscillation & Vibration sensing.		
UNIT IV	**DIRECT ROTOR COUPLED GENERATOR**	**9**
Excited Rotor Synch. Generator / PMG Generator, Control Rectifier, Capacitor Banks, Step Up / Boost Converter (DC-DC Step Up), Grid Tied Inverter, Power Management, Grid Monitoring Unit (Voltage and Current), Transformer, Safety Chain Circuits		
UNIT V	**MODERN WIND TURBINE CONTROL & MONITORING SYSTEM**	**9**
Details of Pitch System & Control Algorithms, Protections used & Safety Consideration in Wind turbines, Wind Turbine Monitoring with Error codes, SCADA & Databases: Remote Monitoring and Generation Reports, Operation &Maintenance for Product Life Cycle, Balancing technique (Rotor &Blade), FACTS control & LVRT & New trends for new Grid Codes.		

Text Books:

1. Kaldellis J.K, Standalone and Hybrid Wind Energy Systems, CRC Press, 2010
2. Mario Garcia –Sanz, Constantine H. Houpis, Wind Energy Systems,CRC Press 2012

References:

1.Freris, L.L., Wind Energy Conversion Systems, Prentice Hall, 1990
2. Spera, D.A., Wind Turbine Technology: Fundamental concepts of Wind Turbine Engineering, ASME Press, 1994.
3. Duffie, A and Beckmann, W. A., Solar Engineering of Thermal Processes, John Wiley, 1991.
4. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press,1996.

BANE21	SATELLITE TECHNOLOGY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Basic Electrical and Electronics, Engineering Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about different types of satellites and their functions
2. To accustom the student to the governing equations of motion and orbital mechanics
3. To acquaint the student to the structure of the satellites and the components used and their thermal protection
4. To familiarize the student about the control system for spacecraft
5. To enable the student to understand about the power system in a satellite and the various bus electronics used

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** the basics of satellites and its system's functions. **(Understand)**
CO 2	**Describe** the fundamentals of orbital mechanics and the coordinate systems. **(Understand)**
CO 3	**Analyze** the satellite structures and thermal protection systems. **(Analyze)**
CO 4	**Express** the attitude controls and its stabilization schemes. **(Understand)**
CO 5	**Summarize** various types of power systems and bus electronics. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION TO SATELLITE SYSTEMS**	**9**

Common satellite applications and missions – Typical spacecraft orbits – Definitions of spin the three axis stabilization-Space environment – Launch vehicles – Satellite system and their functions (structure, thermal, mechanisms, power, propulsion, guidance and control, bus electronics).

UNIT II	**ORBITAL MECHANICS**	**9**

Fundamental of flight dynamics – Time and coordinate systems – Orbit determination and prediction – Orbital maneuvers – GPS systems and application for satellite/orbit determination – Ground station network requirements.

UNIT III	**SATELLITE STRUCTURES & THERMAL CONTROL**	**9**

Satellite mechanical and structural configuration: Satellite configuration choices, launch loads, separation induced loads, deployment requirements – Design and analysis of satellite structures – Structural materials and fabrication – The need of thermal control: externally induced thermal environment – Internally induced thermal environment - Heat transfer mechanism: internal to the spacecraft and external heat load variations – Thermal control systems: active and passive methods.

UNIT IV	SPACECRAFT CONTROL	9

Control requirements: attitude control and station keeping functions, type of control maneuvers – Stabilization schemes: spin stabilization, gravity gradient methods, 3 axis stabilization – Commonly used control systems: mass expulsion systems, momentum exchange systems, gyro and magnetic torque - Sensors star and sun sensors, earth sensor, magnetometers and inertial sensors

UNIT V	POWER SYSTEM AND BUS ELECTRONICS	9

Solar panels: Silicon and Ga-As cells, power generation capacity, efficiency – Space battery systems – battery types, characteristics and efficiency parameters – Power electronics. Telemetry and telecommand systems: Tm & TC functions, generally employed communication bands (UHF/VHF, S, L, Ku, Ka etc), their characteristics and applications- Coding Systems – Onboard computer- Ground checkout Systems.

Text Books:

1. Spacecraft Thermal Control, Hand Book, Aerospace Press, 2002.
2. Introduction Space Flight, Francis J. Hale Prentice Hall, 1994.

References:

1. Analysis and Design of Flight Vehicle Structures, Tri-State off set company, USA, 1980.
2. Space Systems Engineering Rilay, FF, McGraw Hill, 1982.
3. Principles of Astronautics Vertregt. M., Elsevier Publishing Company, 1985
4.Space Communications Systems, Richard.F, Filipowsky Eugen I Muehllorf Prentice Hall, 1995
5. Space Vehicle Design, Michael D. Griffin and James R. French, AIAAEducation Series, 1991.

BANE22	**AIRCRAFT RULES AND REGULATIONS CAR I & II**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite – Professional Courses				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVE:

1. To familiarize the student about the CAR series A & B.
2. To familiarize the student about the CAR series C & D.
3. To familiarize the student about the CAR series E & F.
4. To familiarize the student about the CAR series L & M.
5. To familiarize the student about the CAR series T & X.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Identify** the aircraft airworthiness and to list the responsibilities of owners/operators. **(Understand)**
CO 2	**Discuss** the procedures involved in defect recording, monitoring, investigation, reporting and maintenance Programs. **(Understand)**
CO 3	**Explain** the procedures of approval for aircraft manufacturing and maintenance industries. **(Understand)**
CO 4	**Outline** the procedures followed to conduct AME examinations and license issue. **(Analyze)**
CO 5	**Discuss** the procedures followed in flight testing of aircrafts and the miscellaneous requirements. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**CAR SERIES "A" & "B"**	**9**

C.A.R series 'A' - procedure for civil air worthiness Requirements and responsibility operators vis-a-vis Air Worthiness directorate - Responsibilities of operators/owners; procedure of CAR issue, amendments etc; objectives and targets of airworthiness directorate; airworthiness regulations and safety oversight of engineering activities of operations.

C.A.R. series "B" – issue approval of cockpit check list, MEL, CDL - Deficiency list (MEL & CDL); preparation and use of cockpit check list and emergency check list.

UNIT II	**CAR SERIES "C" & "D"**	**9**

C.A.R. series 'C' - defect recording, monitoring, investigation and reporting - Defect recording, reporting, investigation, rectification and analysis; Flight report; Reporting and rectification of defects observed on aircraft; Analytical study of in-fight readings & recordings; Maintenance control by reliability Method.

C.A.R. series 'D'-aircraft maintenance Programs - Reliability Program (Engines); Aircraft maintenance

Program& their approval - On condition maintenance of reciprocating engines; TBO - Revision Program; Maintenance of fuel and oil uplift and consumption records - Light aircraft engines; Fixing routine maintenance periods and component TBOs - Initial & revisions.

UNIT III	CAR SERIES “E” & “F”	9

C.A.R. series 'E' - approval of organizations - Approval of organizations in categories A, B, C, D, E, F, & G; Requirements of infrastructure at stations other than parent base.
C.A.R. series 'F' - air worthiness and continued air worthiness - Procedure relating to registration of aircraft; Procedure for issue / revalidation of Type Certificate of aircraft and its engines / propeller; Issue / revalidation of Certificate of Airworthiness; Requirements for renewal of Certificate of Airworthiness

UNIT IV	CAR SERIES “L” & “M”	9

C.A.R. series 'L' - aircraft maintenance engineer – licensing - Issue of AME License, its classification and experience requirements, Complete Series 'L'.
C.A.R. series 'M' Mandatory Modifications / Inspections.

UNIT V	CAR SERIES “T” & “X”	9

C.A.R. series 'T' - flight testing of aircraft - Flight testing of (Series) aircraft for issue of C of A; Fight testing of aircraft for which C or A had been previously issued.
C.A.R. series 'X' - miscellaneous requirements - Registration Markings of aircraft; Weight and balance control of an aircraft; Provision of first aid kits & Physician's kit in an aircraft; Use of furnishing materials in an aircraft; Concessions; Aircraft log books; Document to be carried on board on Indian registered aircraft; Procedure for issue of taxy permit; Procedure for issue of type approval of aircraft components and equipment including instruments.

TEXTBOOKS:

1. " Aircraft Manual (India) ", The English Book Store, 17-1, Connaught Circus, New Delhi.

REFERENCES:

1. " Civil Aviation Requirements with latest Amendment (Section 2 Airworthiness) ", Published by DGCA, The English Book Store, 17-1, Connaught Circus, New Delhi.
2. "Aeronautical Information Circulars (relating to Airworthiness) ", from DGCA Advisory Circulars ", form DGCA.

WEBLINKS:

https://dgca.gov.in/digigov-portal/

BBA001	PRINCIPALS OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management Studies				

OBJECTIVES

1. To acquaint the student about the management, various types of management function and structure.
2. To give insight of various methods of management of organization and managerial aspects.
3. To acquaint the student with various functions of organizational behavior.
4. To get exposure regarding its applications and recent developments of group dynamics and trade union
5. To help the student understand about the professional ethics and social responsibilities.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the structure of management andthe functions of each department. **(Remember)**
CO 2	**Understand** business, trading, partnership and methods to overcome pitfalls. **(Understand)**
CO 3	**Analyze** the causes of accidents and the minimization methods. **(Analyze)**
CO 4	**Explain** Organizational behavior and factors influencing personality. **(Understand)**
CO 5	**Define** group, Communication, Barriers and factors contributing effective leadership. **(Understand)**
CO 6	**Summarize** the various ethics to be followed in different workplace. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	MANAGEMENT FUNCTIONS & STRUCTURE	9

Management – Definition – Basic Function – Contribution of Taylor &Fayol. Types of structure – Line, staff, Functional, Committee, and Project & Matrix – Structures. Departmentalization – Centralization – Decentralization – span of control. Management By Objectives –Management By Exception.

UNIT II	MANAGEMENT OF ORGANISATION	9

Forms of Business / Industrial Ownership – Sole Trader, Partnership, Company, Performance Appraisal – Basic Principles – Pitfalls – Methods to Overcome. Industrial Safety – Causes of Accidents – Cost of Accident – How to minimize Accidents. Plant Layout & Maintenance – Need, Types & Managerial Aspects.

UNIT III	ORGANISATIONAL BEHAVIOUR	9

OB – Definition – Nature & Scope – Contributing Disciplines – Importance of OB to Managers. Personality – Definition – Theories – Factors Influencing Personality. Motivation – Definition – Theories. Theory X & Y – Transactional Analysis. Morale & Job Satisfaction – Factors Influencing Job Satisfaction.

UNIT IV	GROUP DYNAMICS	9

Group – Definition – Types – Determinants of Group Cohesiveness – Communication – Process – Barriers – Effective Communication. Leadership Theories – Factors Contributing to Effective Leadership – Role of Trade Union in Organizations – Functions of Trade Union – Why Trade Union is required? – Types of Trade Union.

UNIT V	PROFESSIONAL ETHICS	9

Ethics in Workplace – Formulation of Ethics – Managerial Ethics – Managing Ethical Behaviour – Codes of Ethics – Encouraging Ethical Behaviour – Social Responsibility – Spirituality.

Text Books:

1. Gupta C.B., Management Theory and Practice, 14th Edition, Sultan Chand & Sons, 2009.
2. Dr. Prasad L.M., Principle & Practice of Management, 7th Edition, Sultan Chand & Sons, 2008.

References:

1. Aswathappa, Organizational Behaviour, 8th Edition, Himalaya Publishing House, 2010.
2. Dr. Prasad L.M., Organizational Behaviour, 4th Edition, Sultan Chand & Sons, 2008.
3. Harold Koontz, Principles of Management, 1st Edition, Tata McGraw Hill, 2004.

BANE23	AIRPORT MANAGEMENT	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about air transportation, various organizations involved and about the administrative structure in aviation.
2. To accustom the student about economic parameters in an aviation industry.
3. To introduce to the student about the processes involved in airline scheduling.
4. To acquaint the student about the various processes to ensure aircraft reliability.
5. To familiarize the student about the technologies used in aircraft maintenance.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**State** the Role of ICAO and IATA. **(Remember)**
CO 2	**Describe** aircraft forecasting and fleet planning and to do route analysis. **(Understand)**
CO 3	**Summarize** the flight operations and various methods of flight scheduling. **(Understand)**
CO 4	**Discuss** the condition monitoring maintenance and ageing aircraft maintenance production. **(Understand)**
CO 5	**List** the equipment and tools for aircraft maintenance. **(Apply)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**

Development of air transportation, comparison with other modes of transport – Role of IATA, ICAO – The general aviation industry airline – Factors affecting general aviation, use of aircraft, airport: airline management and organization – levels of management, functions of management, Principles of organization planning the organization – chart, staff departments & line departments.

UNIT II	**AIRLINE ECONOMICS**	**9**

Forecasting – Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. – Passenger fare and tariffs – Influence of geographical, economic & political factors on routes and route selection.

Fleet Planning: The aircraft selection process – Fleet commonality, factors affecting choice of fleet, route selection and Capitol acquisition – Valuation & Depreciation – Budgeting, Cost planning – Aircrew evaluation – Route analysis – Aircraft evaluation.

UNIT III	PRINCIPLES OF AIRLINES SCHEDULING	9

Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations, equipments and types of schedule – hub & spoke scheduling, advantages / disadvantages & preparing flight plans – Aircraft scheduling in line with aircraft maintenance practices.

UNIT IV	AIRCRAFT RELIABILITY	9

Aircraft reliability – The maintenance schedule & its determinations – Condition monitoring maintenance – Extended range operations (EROPS) & ETOPS – Ageing aircraft maintenance production.

UNIT V	TECHNOLOGY IN AIRCRAFT MAINTENANCE	9

Airlines scheduling (with reference to engineering) – Product support and spares – Maintenance sharing – Equipments and tools for aircraft maintenance – Aircraft weight control – Budgetary control.

On board maintenance systems – Engine monitoring – Turbine engine oil maintenance – Turbine engine vibration monitoring in aircraft – Life usage monitoring – Current capabilities of NDT – Helicopter maintenance – Future of aircraft maintenance.

Text Books:

1. FEDRIC J.H., “Airport Management”, 2000.
2. C.H. FRIEND, “Aircraft Maintenance Management”, 2000.

References:

1. Gene Kropf, “Airline Procedures”.
2. Wilson & Bryon, “Air Transportation”.
3. Philip Locklin D, “Economics Of Transportation”.
4. “Indian Aircraft Manual” – Dgca Pub.
5. Alexander T Wells, “Air Transportation”, Wadsworth Publishing Company, California, 1993

BANE24	AEROSPACE BIO – MEDICAL AND LIFE SUPPORT ENGINEERING	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Basic Electrical and Electronics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To apply engineering methods to the study of astronaut adaptation to reduced gravity environments.
2. To use analytical techniques, such as structural idealizations, control theory, electrical circuit, and mechanical system analogs to model astronaut performance.
3. To enable quantitative assessment of the effectiveness of countermeasures.
4. To consider the socio-political implications for advanced technological R&D (e.g., space policy, health policy, international collaboration).
5. To teach, perform outreach, and demonstrate mastery of a chosen engineering concept.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Explain** physiological problems associated with human in space flight. **(Understand)**
CO 2	**Interpret** the equations of motion for human organ systems during space flight. **(Understand)**
CO 3	**Prepare** mechanical and electrical models of human systems for studying astronaut performance. **(Apply)**
CO 4	**Discuss** the life support systems onboard the space flight. **(Understand)**
CO 5	**Discover** life activities and specialties of space suit. **(Apply)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**
Physiological problems associated with human space flight – review of terminologies		
UNIT II	**BIO – MECHANICS IN SPACE FLIGHT**	**9**
Bone Mechanics, Muscle Mechanics, Musculoskeletal Dynamics, and the Cardiovascular System during space flight – their equations of motion		
UNIT III	**BIO – MECHANICAL MODELING**	**9**
Structural idealizations – mechanical and electrical modeling of muscle groups – musculoskeletal groups – joints, electrical analogies to model astronaut performance		
UNIT IV	**LIFE SUPPORT SYSTEMS**	**9**

Onboard environment control systems – waste product management and recycling system – bio – monitoring and control		
UNIT V	**EXTRA – VEHICULAR ACTIVITY**	**9**
Extra Vehicular activity – challenges – specialties of space suits – life support system for EVA		

Text Books:

1. "Space Physiology", Beckers, Frank, Bart Verheyden, Andre E Aubert, Wiley Encylopaedia of Bio – medical engineering, John Wiley and Sons, Inc., 2006
2. "Fundamentals of Space Life Sciences", Diamandis, Peter H. Edited by Susanne Churchill. Malabar, FL: Krieger Publishing Co., 1997.

References:

1. "Human Anatomy Manual: The Skeleton", Gatesville, TX, Medical Plastics Laboratory, Inc., 1997
2. Gomi, Hiroaki, and Mitsuo Kawato. "Equilibrium-Point Control Hypothesis Examined by Measured Arm Stiffness during Multijoint Movement." Science 272, no. 5258 (1996): 117-120.
3. Aubert, A.E., F. Beckers, and B. Verheyden. "Cardiovascular Function and Basics of Physiology in Microgravity." Acta Cardiol 60, no. 2 (2005): 129-151.
4. Flash, T. "The Control of Hand Equilibrium Trajectories in Multi-joint Arm Movements." Biological Cybernetics 57 (1987): 257-274.
5. Bizzi, E., W. Chapple, and N. Hogan. "Mechanical Properties of Muscles: Implications for Motor Control." Trends in Neurosciences 5, no. 11 (1982): 395-398.
6. Shenkman, Boris S., and Inessa B. Kozlovskaya. "Results of Studies of the Effects of Space Flight Factors of Human Physiological Systems and Psychological Status, and Suggestions of Future Collaborative Activities between the NSBRI and the IBMP." Section 3: Muscles. State Research Center of Russian Federation Institute for Biomedical Problems Report, Moscow, 2000.
7. Stuster, J., C. Bachelard, and P. Suedfeld. "The Relative Importance of Behavioral Issues during Long-duration ICE Missions." Aviat. Space Env. Med. (September 2000): A17-A25.
8. Brubakk, A. "Man in Extreme Environments." Aviat. Space Env. Med. (September 2000): A126-A130.

BBA008	TOTAL QUALITY MANAGEMENT	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Designed by – Department of Management Studies				

OBJECTIVES

1. To acquaint the student about the management, various types of management function and structure.
2. To give insight of various methods of management of organization and managerial aspects.
3. To acquaint the student with various functions of organizational behavior.
4. To get exposure regarding its applications and recent developments of group dynamics and trade union
5. To help the student understand about the professional ethics and social responsibilities.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Develop** action plans for customer centric business on the basis of various quality philosophies.**(Apply)**
CO 2	**Apply** total quality management techniques for design and manufacture of highly reliable products and services.**(Apply)**
CO 3	**Develop** statistical process control charts for monitoring the health of manufacturing systems. **(Apply)**
CO 4	**Solve** various industrial problems using Six Sigma and related techniques.**(Apply)**
CO 5	**Establish** quality management system and environmental management system for product and service industries.**(Apply)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	INTRODUCTION	9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II	TQM PRINCIPLES	9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership –Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III	STATISTICAL PROCESS CONTROL (SPC)	9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV	TQM TOOLS	9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA –Stages of FMEA.

UNIT V	QUALITY SYSTEMS	9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System –Elements, Implementation of Quality System, Documentation, Quality Auditing, TS16949, ISO 14000 – Concept, Requirements and Benefits.

Text Books:

1. Dale H. Besterfiled, et al., "Total Quality Management", Pearson Education, Inc.2003. (Indian reprint 2004). ISBN 81-297-0260-6.

References:

1. Evans. J. R. & Lindsay. W,M "The Management and Control of Quality", (5th Edition),South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991.
3. Oakland.J.S. "Total Quality Management", Butterworth Hcinemann Ltd., Oxford,1989.
4. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks",New Age International 1996.
5. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991.

BANE25	INDUSTRIAL AERODYNAMICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aerodynamics I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about the aerodynamics taking place in the atmosphere
2. To familiarize the student about the aerodynamics of flow over bluff bodies and its effect on those bodies
3. To acquaint the student about the various mechanisms and procedures by which energy can be extracted from the wind
4. To accustom the student about the aerodynamics of flow around buildings, towers and bridges and also about ventilation and architectural aerodynamics
5. To familiarize the student about the loads on a structure due to wind and the resulting vibrations and their calculations

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** weather terminology and terrain structure.**(Understand)**
CO 2	**Compare** the flow characteristics over automobile bodies for drag reductions**(Analyze)**
CO 3	**Discuss** the concepts of wind turbines and its applications**(Understand)**
CO 4	**Discuss** the codes of practice and analyze properties of externals and internal flows over buildings **(Understand)**
CO 5	**Discuss** the concepts of induced vibrations and their effect over launch vehicles and civil structures (**Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**ATMOSPHERIC BOUNDARY LAYER**	**9**

Atmospheric circulation-Local winds-Terrain types-Mean velocity profiles-Power law and logarithm law- wind speeds-Turbulence profiles-Roughness parameters-simulation techniques in wind tunnels

UNIT II	**BLUFF BODY AERODYNAMICS**	**9**

Boundary layers and separation-Two dimensional wake and vortex formation-Strouhal and Reynolds numbers-Separation and reattachments-Power requirements and drag coefficients of automobiles-Effects of cut back angle-aerodynamics of trains.

UNIT III	**WIND ENERGY COLLECTORS**	**9**

Horizontal and vertical axis machines-energy density of different rotors-Power coefficient-Betz coefficient by momentum theory.		
UNIT IV	**BUILDING AERODYNAMICS**	**9**
Pressure distribution on low rise buildings-wind forces on buildings-Environmental winds in city blocks-special problems of tall buildings-building codes-ventilation and architectural aerodynamics		
UNIT V	**FLOW INDUCED VIBRATIONS**	**9**
Vortex shedding, lock & effects of Reynolds number on wake formation in turbulent flows- across wind galloping-wake galloping-along wind galloping of circular cables-oscillation of tall structures and launch vehicles under wind loads-stall flutter.		

Text Books:

1. Blevins R.D "Flow Induced Vibrations", Van Nostrand, 1990
2.Sovran, M(ed) "Aerodynamic drag mechanism of bluff bodies and road vehicles",Plenum Press, N.Y, 1990

References:

1. Sachs P "Wind Forces in Engineering", Pergamon Press, 1988
2. Scorer R.S "Environmental Aerodynamics", Ellis Harwood Ltd, England, 1978
3. Calvert N.G "Wind Power Principles", Charles Griffin & Co London, 1979.

BANE26	MECHANICS OF HETEROGENEOUS	L	T	P	C

	MATERIALS				
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Physics I, Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about the various heterogeneous materials.
2. To accustom the student to the mechanics of heterogeneous materials.
3. To acquaint the student to the structure of particulate, fibrous and cellular solids and their properties.
4. To familiarize the student about the hierarchical structure in heterogeneous materials.
5. To enable the student to understand various design considerations in application of heterogeneous materials.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Summarize** various material structures and different crystal properties. **(Understand)**
CO 2	**Predict** the stiffness and strength of different directions. **(Understand)**
CO 3	**Memorize** the properties of Particulate, fibrous and cellular solids. **(Remember)**
CO 4	**Define** the various aspects of hierarchical structure of heterogeneous materials. **(Remember)**
CO 5	**Explain** the eutectic structure and gradient effects. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**

Material heterogeneity. Survey of laminated, fibrous, particulate, cellular and porous, platelet structures. Single crystal properties and polycrystal properties. Heterogeneity of biological materials and designed heterogeneity. Strength of fibers. Constituent materials. Griffith's experiments, stress concentrations. Concept of equivalent homogeneity. Micro and nanotructures.

UNIT II	**STRUCTURE OF HETEROGENEOUS MATERIALS**	**9**

Unidirectional fibrous media. Bounds on physical properties: Voigt and Reuss bounds; Hashin-Shtrikman. Prediction of stiffness and strength for different directions. Symmetry and physical properties. Crystal symmetry classes. Generalized Hooke's law of elasticity. Modulus and compliance matrices. Anisotropy and dielectric and piezoelectric properties. Thermal expansion. Experimental methods.

UNIT III	**PARTICULATE, FIBROUS AND CELLULAR SOLIDS**	**12**

Structure. Particulate materials. Dental composites, metal matrix composites, asphalt. Toughened polymers via compliant inclusions. Stiffness vs. volume fraction. Self healing polymers. Attainment of the Hashin-Shtrikman bounds. Unidirectional fibrous materials; stiffness, strength, thermal expansion. Fibrous solids with short-fibers. Nano-tubes as fibers. Platelet reinforcement. Shear lag model. Laminates. Polycrystalline aggregates. Piezoelectric composites. Metal matrix composites. Structure property relations of cellular solids. Lightweight cellular solids. Foams, structural honeycombs, sandwich structures. Polymer lattice structures. Syntactic foams. Poisson's ratio of composites and foams. Applications.

UNIT IV	HIERARCHICAL STRUCTURE	6

Structure within structure. Bone, wood, tendon and other materials of biological origin. Fibrous aspects of bone structure. Tendon and ligament as fibrous biological materials. Biological cellular solids. Cellular architecture of bone, wood, bamboo.

UNIT V	DESIGN CONSIDERATIONS	9

Fracture mechanics, stress concentrations, free-edge effects. In situ composites; eutectic structure. Gradient effects. Role of microstructure size. Generalized continuum models; Cosserat elasticity. Toughness: empirical criteria; causal mechanisms. Spongy impact absorber, bone cement.

Text Books:

1. L. J. Gibson, and M. F. Ashby, Cellular Solids, Cambridge, (1999).
2. M. F. Ashby and D. R. H. Jones, Engineering Materials, 2nd ed. Butterworth, (1998).

References:

1. J. F. Nye, Physical Properties of Crystals, Oxford, (1976).
2. B. D. Agarwal and L. J. Broutman, Analysis and Performance of Fiber Composites, J. Wiley, 2nd ed. (1990).

REGULATION 2015

B.TECH - AEROSPACE ENGINEERING

CURRICULUM AND SYLLABUS

SEMESTER I						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
Theory						
BEN101	HS	English-I	2	1	0	3
BMA101	BS	Mathematics –I	3	0	0	3
BPH 101	BS	Engineering Physics – I	3	0	0	3
BCH101	BS	Engineering Chemistry – I	3	0	0	3
BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
BSS101	HS	Personality Development	1	1	0	2
BBT 102	BS	Biology for Engineers	2	0	0	2
BCE101	ES	Basic Civil Engineering	2	0	0	2
BME101	ES	Engineering Graphics-E	2	2	0	4
Practical						
BCM1L1	ES	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	2	1
BSS1L4/ 1L5/IL6	HS	NCC/NSS/NSO to be conducted during week ends				1
E- Civil, Mechanical, Aeronautical Branches						

Total No. of Contact Hours: 27 **Total No. of Credits: 27**

** Engineering graphics – Final examination will be evaluated by internal faculty.

* Laboratory classes on alternate weeks. The lab examinations will be held only in the second semester (including the first semester experiments also).

SEMESTER II						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN 201	HS	English-II	2	1	0	3
BMA201	BS	Mathematics- II	3	1	0	3
BPH 201	BS	Engineering Physics – II	3	0	0	3
BCH201	BS	Engineering Chemistry – II	3	0	0	3
	HS	Foreign/Indian Language	3	0	0	3
BME202	ES	Engineering Mechanics	2	1	0	3
BEE201	ES	Basic Electrical and Electronics Engineering	2	0	0	2
Practical						
BCS2L2	ES	Computer Practices Lab	0	0	2	1
BEE2L1	ES	Basic Electrical and Electronics Engineering Practices	0	0	2	1
BPC2L1*	BS	Physics and Chemistry Laboratory	0	0	2/2	1
BSS2L7	HS	Yoga to be conducted during week ends				1
# Any one of the following courses: BFR201 – French, BGM201 – German, BJP201- Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 – Tamil						
*Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)						

Total No. of Contact Hours: 26 **Total No. of Credits: 24**

SEMESTER III							
SL. NO	**SUBJECT CODE0**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1	BMA301	BS	Mathematics – III	3	1	0	4
2	BAN301	PC	Fundamentals of Aeronautics and Astronautics	3	0	0	3
3	BAN302	PC	Fundamentals of Fluid Mechanics	3	1	0	4
4	BAN303	PC	Fundamentals of Aero - Thermodynamics	3	1	0	4
5	BAN304	PC	Fundamentals of Structural Mechanics	3	1	0	4
6	BAN305	PC	Mechanics of Machines	3	0	0	3
PRACTICALS							
7	BCE3L1	ES	Fluid Mechanics and Machineries Laboratory	0	0	4	2
8	BCE3L2	ES	Strength of Materials Laboratory	0	0	4	2
9	BME3L1	ES	Machine Drawing	0	0	4	2

Total No. of Contact Hours: 34Total No. of Credits: 28

SEMESTER IV

SL. NO	**SUBJECT CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1	BMA402	BS	Numerical Methods	3	1	0	4
2	BAN401	PC	Aircraft Structures – I	3	1	0	4
3	BAN402	PC	Aerodynamics – I	3	1	0	4
4	BAN403	PC	Aircraft Propulsion	4	0	0	4
5	BAN404	PC	Aircraft Systems and Instrumentation	3	0	0	3
6	BCE407	HS	Environmental Studies	3	0	0	3
PRACTICALS							
7	BAN4L1	PC	Aircraft Structures Laboratory	0	0	4	2
8	BME4L1	ES	Manufacturing Engineering Laboratory	0	0	2	1
9	BAN4L2	PC	Computer Aided Design and Drafting	0	0	2	1

Total No. of Contact Hours: 30Total No. of Credits: 26

SEMESTER V							
SL. NO	**SUBJECT CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1	BAN501	PC	Aircraft Structures – II	3	1	0	4
2	BAN502	PC	Aerodynamics – II	3	1	0	4
3	BAN503	PC	Advanced Aerospace Propulsion	4	0	0	4
4	BAN504	PC	Flight mechanics	3	1	0	4
5	BME505	ES	Manufacturing Engineering	3	0	0	3
6	-	CE	Core Elective – I	3	0	0	3
PRACTICALS							
7	BAN5L1	PC	Aerodynamics Laboratory	0	0	4	2
8	BAN5L2	PC	Aero Design and Modeling Laboratory	0	0	2	1
9	BAN5L3	PC	Computer Aided Analysis	0	0	2	1
10	BAN5C1	PR	Comprehension – I	0	0	0	1

Total No. of Contact Hours: 32Total No. of Credits: 27

SEMESTER VI							
SL. NO	**SUBJECT CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1	BSS601	HS	Value Education and professional Ethics	3	0	0	3
2	BAN601	PC	Aerospace Structural Materials and Composites	3	0	0	3
3	BAN602	PC	Finite Element Methods	3	1	0	4
4	BAN603	PC	Control Engineering	3	0	0	3
5	-	CE	Core Elective – II	3	0	0	3
6	-	NE	Non – Major Elective – I	3	0	0	3
PRACTICALS							
7	BAN6V1	PR	Value Added Program	0	0	2	1
8	BAN6L1	PC	Aircraft System Laboratory	0	0	4	2
9	BAN6L2	PC	Propulsion Laboratory	0	0	4	2
10	BAN6L3	PC	Aircraft Design Project – I	0	0	4	2

Total No. of Contact Hours: 33Total No. of Credits: 26

SEMESTER VII							
SL. NO	**SUBJECT CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1	BAN701	PC	Computational Fluid Dynamics	3	0	0	3
2	BAN702	PC	Avionics	3	0	0	3
3	BAN703	PC	Heat Transfer	3	0	0	3
4	-	CE	Core Elective – III	3	0	0	3
5	-	NE	Non – Major Elective – II	3	0	0	3
6	-	OE	Open Elective – I	3	0	0	3
PRACTICALS							
7	BAN7L1	PC	Airframe and Aero Engine Repair Lab	0	0	2	1
8	BAN7L2	PC	Avionics Laboratory	0	0	2	1
9	BAN7L3	PC	Aircraft Design Project – II	0	0	4	2
10	BAN7P1	PR	Project Phase 1	0	0	4	2

Total No. of Contact Hours: 30 Total No. of Credits: 24

SEMESTER VIII							
SL. NO	**SUBJECT CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1	-	NE	Non – Major Elective – III	3	0	0	3
2	-	OE	Open Elective – II	3	0	0	3
PRACTICALS							
3	BAN8P1	PR	Project Work	0	0	18	9
4	BAN8C1	PR	Comprehension	0	0	0	1

Total No. of Contact Hours: 24Total No. of Credits: 16

TOTAL NO. OF CREDITS FOR THE PROGRAM : 198

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No.	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	6	7	-	3	-	3	-	-	19	9.6
2	Basic Sciences (BS)	11	10	4	4	-	-	-	-	29	14.7
3	Engineering Sciences (ES)	10	7	6	1	3	-	-	-	27	13.7
4	Professional Core (PC)	-	-	18	18	20	16	13	-	85	42.9
5	Core Electives (CE)	-	-	-	-	3	3	3	-	9	4.5
6	Non major Electives (NE)	-	-	-	-	-	3	3	3	9	4.5
7	Open Electives (OE)	-	-	-	-	-	-	3	3	6	3
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	-	-	1	1	2	10	14	7
	Total Credit	27	24	28	26	27	26	24	16	198	100
	Total Contact Hour	27	26	34	33	30	32	30	24	236 Hrs	

LIST OF ELECTIVES

Code No.	Course Title	L	T	P	C
BASE01	Theory of Elasticity	3	0	0	3
BANE02	Rockets and Missiles	3	0	0	3
BASE02	Electric Propulsion	3	0	0	3
BASE03	Launch Vehicle Aerodynamics	3	0	0	3

List of Core Elective (CE) I:

List of Core Elective (CE) II:

Code No.	Course Title	L	T	P	C
BASE04	Space Mechanics	3	0	0	3
BASE05	Guidance and Control	3	0	0	3
BANE07	Theory of Vibrations	3	0	0	3
BASE06	Space Vehicle Design	3	0	0	3

List of Core Elective (CE) III:

Code No.	Course Title	L	T	P	C
BASE07	Spacecraft Attitude Dynamics and Control	3	0	0	3
BANE10	Cryogenic Rocket Propulsion	3	0	0	3
BASE08	Space Mission Design and Analysis	3	0	0	3
BANE12	Hypersonic Aerodynamics	3	0	0	3

List of Non Major Elective (NE) I:

Code No.	Course Title	L	T	P	C
BANE13	An Introduction to Combustion	3	0	0	3
BASE09	Solar Thermal Energy	3	0	0	3
BANE15	Nano Science and Technology	3	0	0	3
BANE16	Unmanned Aerial Vehicle	3	0	0	3

List of Non Major Elective (NE) II:

Code No.	Course Title	L	T	P	C
BANE17	Boundary Layer Theory	3	0	0	3
BANE18	Fatigue and Fracture Mechanics	3	0	0	3
BANE19	High Temperature Materials	3	0	0	3

List of Non Major Elective (NE) III:

Code No.	Course Title	L	T	P	C
BASE10	High Temperature Gas Dynamics	3	0	0	3
BASE11	Spacecraft Power Systems	3	0	0	3
BANE14	Principles of Turbomachinery in Airbreathing Engines	3	0	0	3

List of Open Elective (OE) I:

Code No.	Course Title	L	T	P	C
BBA001	Principles of Management and Organizational Behavior	3	0	0	3
BASE12	Systems Engineering	3	0	0	3
BANE24	Aerospace Bio – Medical and Life Support Engineering	3	0	0	3

List of Open Elective (OE) II:

Code No.	Course Title	L	T	P	C
BBA008	Total Quality Management	3	0	0	3
BANE25	Industrial Aerodynamics	3	0	0	3
BANE26	Mechanics of Heterogeneous Materials	3	0	0	3

BMA301	MATHEMATICS III	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Mathematics I & II				
	Course Designed by – Department of Mathematics				

OBJECTIVES

1. To introduce Fourier series analysis that is important to many applications in engineering apart from its use in solving boundary value problems.
2. To acquaint the student with Fourier transform techniques used in wide variety of situations.
3. To introduce the effective mathematical tools for the solutions of partial differential equationsthat model several physical processes.
4. To develop Z transform techniques for discrete time systems.
5. To develop the Fourier transform techniques and convolution theorem.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Classify** the different methods for solving partial differential equations. **(Understand)**
CO 2	**Apply** Fourier series solution method for engineering problems.**(Apply)**
CO 3	**Analyze**the solutions ofone dimensional and two dimensional boundary value problems in partial differential equations. **(Analyze)**
CO 4	**Apply**the concept of Laplace transform to various engineering problems.**(Apply)**
CO 5	**Evaluate** theengineering problems using inverse Laplace techniques.**(Evaluate)**
CO 6	**Apply** Fourier transform to engineering problems.**(Apply)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H	H										H		
CO 2	H	H			H							H		
CO 3	H	H	H		H							H		
CO 4	H	H	H		H							H		
CO 5	H	H	H	L	H							H		
CO 6	H	H	H	L								H		
Category	**Basic Sciences (BS)**													

Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	**PARTIAL DIFFERENTIAL EQUATIONS**	**12**
Formation of PDE by eliminating arbitrary constants, functions – Solutions of first order PDE – Standard types-homogeneous linear PDE of second order with constant coefficients - Lagrange's Linear PDE – Method of grouping, multiplier methods.		
UNIT II	**FOURIER SERIES**	**12**
Dirichlet's conditions – General Fourier series – Half-range Sine and Cosine series – Parseval's identity – Harmonic Analysis.		
UNIT III	**BOUNDARY VALUE PROBLEMS**	**12**
Classifications of second order linear partial differential equation – Solutions of one-dimensional wave equation and one-dimensional heat equation.		
UNIT IV	**LAPLACE TRANSFORMS**	**12**
Laplace transform of simple functions – Transform of elementary functions – Basic properties – initial and final value theorem – Transform of derivatives and integrals – transform of periodic functions – inverse Laplace transforms –Convolution theorem (excluding proof) – Solution of linear ODE of second order with constant coefficients and solutions of simultaneous first order differential equations with constant coefficients using Laplace transformation techniques.		
UNIT V	**FOURIER TRANSFORMS**	**12**
Fourier integral theorem – Fourier transform pair-Sine and Cosine transforms – Properties – Transform of simple function – Convolution theorem – Parseval's identity.		

Text Books:

1. Grewal, B.S., Higher Engineering Mathematics, Khanna Publications, 2007.

References:

1. Glyn James, Advance Modern Engineering Mathematics, Pearson Education, 2007.
2. Kreyszig. E, Advanced Engineering Mathematics, (8^{th} edition), John Wiley & Sons, Singapore, 2000.
3. Kandasamy P et al, Engineering Mathematics, Vol. II & III (4^{th} revised edition), S. Chand & Co., New Delhi, 2000.
4. Narayanan S., Manicavachagom Pillay T. K., Ramanaiah G., Advanced Mathematics for Engineering Students, Volume II & III (2^{nd} edition), S. Viswanathan Printers and Publishers, 1992.
5. Venkataraman M. K., Engineering Mathematics – Vol. III – A & B (13^{th} edition), National Publishing Co., Chennai, 1998.
6. Julius S. Bendat and Allan G **BANE20**. Piersol., Random Data: Analysis and Measurement Procedures (4^{th} edition), Wiley Series in Probability and Statistics, 2010.
7. *https://www.wolfram.com/**mathematica**/*

BAN301	FUNDAMENTALS OF AERONAUTICS AND ASTRONAUTICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering.				

OBJECTIVES

1. To equip students with the knowledge about the development of aircrafts and spacecraft through historical reviews and about their basic configurations.
2. To accustom students the various basic aerodynamic terms and about the generation of aerodynamic forces.
3. To introduce students about the basic types of aircraft constructions and materials and the various loads acting on it.
4. To familiarize the studentsabout the different kinds of propulsion for aircrafts and materials for gas turbine engines
5. To acquaint the students about space vehicles, re- entry, heat transfer and basics of satellite technology

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the basic components of airplane and various flight vehicles. (**Remember**)
CO 2	**Summarize** the variation of aircraft performance at various altitudes. (**Understand**)
CO 3	**Explain** the structural components of airplane and materials used for aircraft construction. (**Understand**)
CO 4	**Describe** the working of different types of aircraft engines and their performances. (**Understand**)
CO 5	**Discuss** the theory behind rocket propulsion and the problems associated with hypersonic vehicle operation. **(Understand)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									M			H	
CO 2	H				L								H	
CO 3	H									M		H	H	
CO 4	H											H	H	
CO 5	H											H	H	

Category	Professional Core (PC)	
Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	INTRODUCTION TO FLIGHT	8
Brief history of Aviation-Hot air balloon and heavier than air flying machines-early airplane configurations-Modern Airplanes-Components of airplane and their functions-Rotary wing aircrafts-Space vehicles.		
UNIT II	FUNDAMENTALS OF AERONAUTICS	11
International Standard Atmosphere-Pressure, Temperature and Density altitude, Basic Aerodynamics - Continuity, Momentum and Energy equations, Bernoulli's equation-Mach number-subsonic, transonic, sonic and supersonic flow regimes, Measurement of pressure and airspeed- IAS,EAS and TAS. Airfoil geometry and nomenclature-infinite and finite wing sections-lift, drag and moment coefficients-angle of attack-aspect ratio-Reynolds number-induced drag and parasite drag-airfoil characteristics, Elements of Aircraft performance, stability and control.		
UNIT III	AIRCRAFT STRUCTURE AND MATERIALS	8
Structural components of an airplane- monocoque and semi monocoque structure –materials for structural components – composite materials and their significance in Aviation Technology		
UNIT IV	AIRCRAFT PROPULSION	10
Propeller Engine – Gas Turbine Engine – Turbo prop, Turbo jet, Turbo fan Engines- specific fuel consumption-variation of thrust and power with speed and altitude – materials for engine components.		
UNIT V	SPACE VEHICLES & ASTRONAUTICS	8
Basics of Rocket Technology-escape velocity-reentry vehicles-heat transfer problems of space vehicles-ablative cooling-Satellite technology– Hypersonic vehicles, Elements of Astronautics.		
Total Periods: 45		

Text Books:

1. Anderson, J. D., Introduction to Flight,TataMcGraw-Hill Higher Education, 6th edition 2010.
2. Kermode, A. C, Barnard, R. H and Philpott, D. R, Mechanics of Flight, Pearson education, 2012.

References:

1. Shevell, R. C., Fundamentals of Flight., Prentice hall (2nd edition), 1989.
2. Steven, A. Brandt, Randall J. Stiles, John J. Bertin and Ray Whitford, Introduction to Aeronautics: A Design Perspective, AIAA Education series (2nd edition),2004.
3. Torenbeek, E and Wittenberg, H, Flight Physics: Essentials of Aeronautical Disciplines and Technology, with Historical Notes, Springer, 2009.
4. *www.grc.nasa.gov/WWW/k-12/airplane/*

BAN302	FUNDAMENTALS OF FLUID MECHANICS	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Engineering Physics,Engineering Mechanics, Mathematics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce students about properties of fluid and its classification.
2. To teach Students about fluid statics and dynamics.
3. Significance of similarity and model studies
4. To know about boundary layer concepts and its applications to pipe design.
5. To learn about pumps and turbine design.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Recall** the concepts of fluids, properties of fluids and its classification. (**Remember**)
CO 2	**Calculate** the flow properties using the fundamental equations of fluid motion. (**Apply**)
CO 3	**Solve** problems based on dimensional analysis and fluid flow analysis. (**Apply**)
CO 4	**Examine t**he pipe line system for minimum head loss. (**Apply**)
CO 5	**Calculate** the performance and operating characteristics of turbines and pumps. **(Apply)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H												H	
CO 2	H												H	
CO 3	H											L	H	
CO 4	H									H			H	
CO 5	H									H			H	
Category	**Professional Core (PC)**													

Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	**INTRODUCTION**	**10**
Fluid –definition-Fluid properties-Newton's law of viscosity-Classification of fluids-fluid statics-Hydrostatic forces on submerged surfaces- Stability of floating bodies		
UNIT II	**FLUID FLOW ANALYSIS AND FLOW MEASUREMENT**	**14**
Ideal and real flow-Concept of continuum-Eulerian and Lagrangian approaches-Velocity field-Pathline, Streakline, Streamline- Stream tube- Fluid acceleration-Continuity, momentum differential equations-Navier Stokes equation- Stream function – Vorticity –Irrotationality- Potential function-Potential flow-Laplace equation-Bernoulli's equation and its applications-Venturi meter-Orificemeter, Flow Rate and Velocity Measurement.		
UNIT III	**DIMENSIONAL ANALYSIS**	**10**
Buckingham Pi Theorem-Non dimensional numbers and their significance-Flow similarity and model studies.		
UNIT IV	**FLOW THROUGH PIPES**	**12**
Laminar and turbulent flow- Boundary layer flow – Boundary layer thickness - Reynolds number and its significance-Laminar fully developed pipe flow-Hagen-Poiseuille flow-Coefficient of friction-Head loss – Darcy-Weisbach equation-Hydraulic gradient- Total energy lines-Moody's diagram-Turbulent flow through pipes.		
UNIT V	**FLUID MACHINERY**	**14**
Classification of fluid machines-Reciprocating and centrifugal pumps-impulse and reaction turbines-Working principle of Pelton, Francis and Kaplan turbines-Velocity triangles-fans and blowers.		
Total Periods: 60		

Text Books:

1. Frank M White, Fluid Mechanics, The McGraw Hill companies. (7^{th} edition), 2011.
2. Rathakrishnan, E, Fundamentals of Fluid Mechanics, Prentice-Hall (3^{rd} edition), 2012.

References:

1. Yunus A Cengel and John M Cimbala, Fluid mechanics: Fundamentals and Applications, Tata McGraw Hill (2^{nd} edition), 2010.
2. Irving H Shames, Mechanics of Fluids, The McGraw Hill companies (4^{th} edition), 2003.
3. Yuan, S.W, Foundations of Fluid Mechanics, Prentice-Hall, 1967.
4. *reu.eng.ua.edu › Programs*
5. *www.**fluidmechanics**.co.uk/*

BAN303	FUNDAMENTALS OF AERO – THERMODYNAMICS	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Physics, Basics of Mechanical Engineering				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVE: To make the student understand about the basics of engineering thermodynamics, various laws and their applications, prediction of thermodynamic performance of various engines, and other thermal devices.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Apply** the fundamental laws of thermodynamics and its thermodynamic relations. (**Apply**)
CO 2	**Compute** the air standard efficiencies using P-V and T-S diagram of various air power cycles. (**Apply**)
CO 3	**Calculate** the efficiency of various Vapor power cycles (**Apply**)
CO 4	**Estimate** the COP of refrigeration and air-conditioning systems. (**Analyze**)
CO 5	**Calculate** the efficiency of jet propulsion cycles. (**Apply**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H												H	
CO 2	H											M	H	
CO 3	H									M		M	H	
CO 4	H												H	
CO 5	H									M			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**BASIC THERMODYNAMICS**	**16**

Systems, Zeroth law, First law - Steady flow energy equation - Heat and work transfer in flow and non-flow processes - Second law, Kelvin-Planck statement - Clausius statement – Reversibility and irreversibility - Concept of Entropy, Clausius inequality, Principle of increase of entropy – Absolute entropy – Availability - Entropy change in non-flow processes

UNIT II	AIR POWER CYCLES	12

Carnot, Otto, Diesel, Dual, Stirling and Ericsson cycle - Air standard efficiency – Mean effective pressure – Actual and theoretical PV diagram of two stroke and four stroke IC engines.

UNIT III	VAPOUR POWER CYCLES	12

Introduction – Rankine cycle – Means of increase of efficiency of the Rankin cycle – Ideal reheat and regenerative Rankine cycle – Second law analysis of vapour power cycles – Cogeneration.

UNIT IV	REFRIGATION AND AIR – CONDITIONING	10

Principles of refrigeration and Psychometric - Vapour compression - Vapour absorption types - Co-efficient of performance, Properties of refrigerants – Basic Principle and types of Air conditioning.

UNIT V	THERMODYNAMICS OF AIRCRAFT PROPULSION CYCLES	10

Isentropic flow through passages – Brayton cycle – Brayton cycle with intercooling, reheat and regeneration – Ideal jet propulsion cycles. Basics of heat transfer.

Text Books:

1. Rathakrishnan E., Fundamentals of Engineering Thermodynamics, Prentice-Hall India, 2012.
2. Nag.P.K.,Engineering Thermodynamics, Tata McGraw-Hill, New Delhi, 2007.

Reference Books:

1. Yunus A Cengel and Michael A Boles., Thermodynamics- an Engineering approach, McGraw Hill Education (7^{th} edition), 2012.
2. Holman.J.P.,Thermodynamics, McGraw-Hill (3^{rd} edition), 2007.
3. Gordon J. Van Wylen and Richard E. Sonntag and Claus Borgnakke., Fundamentals of Classical Thermodynamics – Vol 1, Wiley Eastern, 1994.
4. Arora C.P., Thermodynamics, Tata McGraw-Hill, New Delhi, 2003.
5. Merle C Potter and Craig W Somerton., Thermodynamics for Engineers, Schaum's Outline Series, Tata McGraw-Hill (2^{nd} edition), 2009.
6. *www.thermocalc.com/*
7. *www.grc.nasa.gov/WWW/cdtb/**software**/t-mats.html*

BAN304	FUNDAMENTALS OF STRUCTURAL MECHANICS	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Engineering Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To provide the students, an understanding about the basics of strength of materials
2. To acquaint the student with the procedures for estimating the stresses acting in beams
3. To impart knowledge on estimation of deflections of various types of beams under different loading conditions
4. To develop the basic understanding of torsion of structural members
5. To develop the basic understanding about the bi-axial state of stress and basics of elasticity

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Compute** the stress developed in statically determinate and indeterminate structures subjected to axial load. (**Apply**)
CO 2	**Sketch** shear force and bending moment diagram for a given beam. (**Apply**)
CO 3	**Determine** the deflection of beams using various methods (**Apply**)
CO 4	**Compute** the shear stress developed in circular shafts and springs subjected to torsional and axial load. (**Apply**)
CO 5	**Determine** the principal stresses developed in structural components using Mohr's Circle. (**Apply**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									H			H	
CO 2	H				M								H	
CO 3	H											M	H	
CO 4	H											M	H	
CO 5	H				M					H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT		
UNIT I	**INTRODUCTION TO STRENGTH OF MATERIALS**	**16**
Introduction to mechanics of deformable bodies - Material selection criteria – stress – strain – Stress and strain diagram – Hook's law - Elastic constants – definition of engineering constants: elastic moduli – Young's modulus, Bulk Modulus& Volumetric Strain, Poisson's ratio, Shear Modulus, relation between three elastic moduli and Poison's ratio, Statically determinate and indeterminate problems in tension and compression – Thermal stress – Impact loading – Composite bars		
UNIT II	**STRESSES IN BEAMS**	**10**
Shear force and bending moment diagrams for simply supported, cantilever beams and overhanging beams– bending stress variation in beams of symmetric sections, neutral axis		
UNIT III	**DEFLECTION OF BEAMS**	**10**
Double integration, Macaulay's method, moment area method, conjugate beam method, method of superposition, Maxwell's reciprocal theorem.		
UNIT IV	**TORSION**	**10**
Torsion of solid and hollow circular shafts – Shear stress variation – Power transmission in shafts – Open and closed-coiled helical springs – Stresses in helical springs.		
UNIT V	**BI – AXIAL STRESSES AND ELEMENTS OF ELASTICITY**	**14**
Stresses in thin cylindrical and spherical shell under internal pressure and volumetric strain– Principle stresses and maximum shear stresses– Combined loading – Mohr's circle and its construction – concept of theory of elasticity, basic assumptions, coordinate transformation, plane stress and plane strain conditions, stress tensor		
Text Books: 1. Gere & Timoshenko, Mechanics of Materials, McGraw Hill, 1993 2. William Nash, Strength of Materials, Tata McGraw Hill, 2004		
Reference Books: 1. F. P. Beer, E.R. Johnston, and J.T. Dewolf, Mechanics of Materials, McGraw-Hill (4^{th} edition), 2006 2. Dym,C.L., and Shames,I.H., Solid Mechanics, McGraw Hill, Kogakusha, 1973. 3. Stephen Timoshenko, Strength of Materials, Vol I & II, CBS Publishers and Distributors, Third Edition. 4. R.K.Rajput, Strength of Materials, S. Chand and Co., 1999. 5. Timoshenko,S. and Young,D.H., Elements of Strength of Materials, T.VanNostrand Co. Inc., Princeton, N.J., 1977. 6. *www.mdsolids.com/* *7.* *https://www.actuspotentia.com/MechMat.shtml*		

BAN305	MECHANICS OF MACHINES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To impart students with the knowledge about motion, masses and forces in machines.
2. To enable students to apply fundamental of mechanics to machines which include engines, linkages etc.,
3. To impart students with the knowledge about various power transmitting devices such as gears, belts etc.
4. To facilitate students to understand the concept of balancing of rotating and reciprocating masses.
5. To give awareness to students on the phenomenon of vibration and its effects.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the working of different mechanisms along with inversion and their corresponding velocity and acceleration diagrams. (**Apply**)
CO 2	**Determine** the Power transmission in machine elements using fundamentals of friction. (**Apply**)
CO 3	**Sketch** the Cam profile for various follower motions. (**Apply**)
CO 4	**Determine** the unbalanced forces acting on rotating and reciprocating parts in engine. **(Apply)**
CO 5	**Classify** the types of vibration and the frequencies of vibrating systems. **(Understand)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H				H					H			H	
CO 2	H												H	
CO 3	H				H					H			H	
CO 4	H				H					H			H	
CO 5	H												H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	MECHANISMS	8
Machine Structure – Kinematic link, pair and chain – Grueblers criteria – Constrained motion – Degrees of freedom –Kutzbach criterion - Slider crank and crank rocker mechanisms – Inversions – Applications –Kinematic analysis of simple mechanisms – Determination of velocity and acceleration.		
UNIT II	**FRICTION**	**9**
Friction in screw and nut – Pivot and collar – Thrust bearing – Plate and disc clutches – Belt (Flat and Vee) and rope drives. Ratio of tensions – Effect of centrifugal and initial tension – Condition for maximum power transmission – Open and crossed belt drive.		
UNIT III	**GEARING AND CAMS**	**9**
Gear profile and geometry – Nomenclature of spur and helical gears – Gear trains: Simple, Compound gear trains and epicylic gear trains - Determination of speed and torque - Cams – Types of cams and followers.		
UNIT IV	**FORCE ANALYSIS AND BALANCING**	**10**
Introduction to force analysis - Static and dynamic – Inertia force and inertia torque – D'Alembert's principle -Static and dynamic balancing – Single and several masses in different planes –Balancing of reciprocating masses- primary balancing and concepts of secondary balancing – Single and multicylinder engines (Inline) – Balancing of radial V engine – direct and reverse crank method.		
UNIT V	**VIBRATION**	**9**
Free, forced and damped vibrations of single degree of freedom systems – Force transmitted to supports – Vibration isolation – Vibration absorption – Torsional vibration of shaft – Single and multi rotor systems – Geared shafts – Critical speed of shaft.		

Text Books:

1. Rattan.S.S., Theory of Machines, Tata McGraw–Hill Publishing Co, New Delhi, 2004.
2. Balaguru. S., Dynamics of Machinery, SciTech publication (2nd edition), 2009.

Reference Books:

1. Rao, J.S and Dukkipati, R.V, "Mechanism and Machine Theory", Second Edition, Wiley Eastern Ltd., 1992.
2. Malhotra, D.R and Gupta, H.C., "The Theory of Machines", SatyaPrakasam, Tech. India Publications, 1989.
3. Gosh, A. and Mallick, A.K., "Theory of Machines and Mechanisms", Affiliated East West Press,1989.
4. Shigley, J.E. and Uicker, J.J., "Theory of Machines and Mechanisms", McGraw-Hill, 1980.
5. Burton Paul, "Kinematics and Dynamic of Planer Machinery", Prentice Hall, 1979.
6. *ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=5593596*
7. *www.simple**machines**.org/*

BCE3L1	FLUID MECHANICS AND MACHINERIES LAB	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Engineering Mechanics				
	Course Designed by – Department of Civil Engineering				

OBJECTIVES

1. To help the student to understand about pipe flow losses and flow through notches and weirs.
2. To accustom the student about buoyancy test and Bernoulli's principle
3. To introduce to the student about the various flow meters
4. To acquaint the student about the performance characteristics of various pumps
5. To introduce to the student about the performance characteristics of various turbines

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Observe** the flow characteristics in a fluid flow system. **(Imitation)**
CO 2	**Acquire** the pressure data with manometers/sensors for finding the efficiency of given system. **(Manipulation)**
CO 3	**Perform**the basic calculations and plot graphs to infer fluid behaviour at various flow conditions. **(Precision)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H			H	
CO 2	H								H	H			H	
CO 3	H								H	H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Determination of pipe flow losses.
2	Calibration of orifice meter and venture meter.
3	Flow through notches and weir.
4	Flow through open orifice.
5	Verification of Bernoulli's Equation.
6	Performance characteristics of centrifugal pump.

7	Performance characteristics of submergible pump.
8	Performance characteristics of jet pump.
9	Characteristics of impulse turbine – Pelton wheel turbine.
10	Characteristics of reaction turbine – Francis turbine.

References:

1. Fluid Mechanics and Machinery Lab Manual, Department of Civil Engineering, 2015

BCE3L2	STRENGTH OF MATERIALS LAB	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Engineering Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To enable the student to understand about the tensile test and stress – strain curves and also about the compression tests
2. To accustom the student about shear test, torsion test and hardness tests.
3. To introduce to the student about the impact test.
4. To acquaint the student about the open and closed coil spring tests.
5. To introduce to the student about fatigue test.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Carry out** elementary mechanical coupon testing of materials as per the given procedure**. (Imitation)**
CO 2	**Acquire** data using the available measuring devices. **(Manipulation)**
CO 3	**Perform** basic mathematical calculation using the appropriate formulae and represent the results in form of graph and table**.(Precision)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H			H	
CO 2	H								H	H			H	
CO 3	H								H	H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Tension test of a mild steel rod.
2	Shear test on mild steel and aluminum rod.
3	Torsion test on mild steel rod.
4	Hardness test (a) Brinell& (b) Rockwell.
5	Impact tests (a) Izod (b) Charpy.

6	Deflection test on helical spring.
7	Deflection of beams with various end conditions.
8	Flexural Test by 3-point Bending method.
9	Block compression test.
10	Determination of fracture strength and fracture pattern of ductile and brittle material.

References:

1. Strength of Materials Lab Manual, Department of Aeronautical Engineering, 2015

BME3L1	MACHINE DRAWING	L	T	P	C
	Total Contact Hours – 30	0	0	**4**	2
	Prerequisite – Engineering Graphics				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

1. To give the students an idea of fundamental issues common to almost all areas of machine drawing.
2. To train the student to draw an assembled diagram of a machine part based on the details of individual parts.
3. To help the student to understand the machine drawing, nomenclature and various notations.
4. To train the students to prepare a working drawing of machines.
5. To enable the student to communicate his ideas through drawings.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Observe** basic representation of symbols used in Engineering drawings. **(Imitation)**
CO 2	**Acquire** attributes of Production Drawing and Limits, fits, tolerances. **(Manipulation)**
CO 3	**Complete** the assembly of a given set of machine components. **(Manipulation)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H	H							H	H			H	
CO 2	H	H							H	H			H	
CO 3	H	H							H	H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

Indian standard code (BIS) of practice for engineering drawing – general principle of presentation, conventional representation of threaded parts, springs, Gears and common features, Abbreviations and symbols used in technical drawings.

Tolerance – Types – Symbols used and representation on the drawing – fit types, selection for different application – Allowance, Interchangeability. Surface finish Relation to the manufacturing processes – Types of representation on the drawing welding symbols.

Preparation of working drawing for given machine components: Bolts, Screws, Studs, Nuts, Keys and Key-ways.

Preparation of simple assembly drawings: Different types of cotter and knuckle joints.

Preparation of simple assembly drawing for following machine with part drawings given: Screw jack, Plummer block, connecting rod, machine vice, tail stock of lath, fuel injection pump for single cylinder engine, stop valve.

List of Experiments:

1. Draw the various Types of representation on welding symbols.
2. Preparation of working drawing for given machine components Bolts and Nuts.
3. Preparation of working drawing for given machine components Screw.
4. Preparation of working drawing for given machine components Key and Key-ways.
5. Draw the sectional assembled view of Sleeve and cotter joint
6. Draw the sectional assembled view of Knuckle joint.
7. Draw the sectional assembled view of Screw Jack.
8. Draw the sectional assembled view of Plummer Block.
9. Draw the sectional assembled view of Connecting Rod.
10. Draw the sectional assembled view of Tail stock.

Text Books:

1. Narayanan. K. L. Machine Drawing, New age publisher, 2006.

References:

1. Bhatt, N. D.., Machine Drawing, Charotar publishing house, 2000.
2. Gopala Krishnan, Machine Drawing, Subash publishers, 2001.
3. *https://www.smartdraw.com/**software**/mechanical-**drawing-software**.htm*
4. *https://www.**machine**designonline.com/*

BMA402	NUMERICAL METHODS	L	T	P	C
	Total Contact Hours – 60	3	**1**	0	4
	Prerequisite – Mathematics III, Engineering Physics, Engineering Mechanics				
	Course Designed by – Department of Mathematics				

OBJECTIVES

1. To introduce the solution of equations and Eigen value problems.
2. To acquaint the student with interpolation techniques used in wide variety of situations.
3. To introduce the effective mathematical tools for the solutions of numerical differentiation and integration.
4. To develop the initial value problems for ordinary differential equations.
5. To develop the boundary value problems for ODE and PDE.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Apply** numerical techniques to solve equations and linear system of equations. **(Apply)**
CO 2	**Interpolate** the value of a dependent variable in the given data by Newton's forward and backward difference formulae and also unequal intervals. **(Understand)**
CO 3	**Understand** and apply the concept of numerical methods to differentiation and integration. **(Understand)**
CO 4	**Evaluate**initial value problems of ODE by applying single step and multistep methods. **(Evaluate)**
CO 5	**Analyse** the two dimensional and one-dimensional ordinary differential equation with numerical techniques. **(Analyse)**
CO 6	**Solve** the boundary value problems in engineering with the help of finite difference methods. (**Create)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	H	H	H		H							H		
CO 2	H	H	H		H							H		
CO 3	H	H	H									H		
CO 4	H	H	H		H							H		
CO 5	H	H	H		H							H		
CO 6	H	H	H		H							H		

Category	Basic Sciences (BS)	
Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	INTERPOLATION (FINITE DIFFERENCES)	12
Iterative method, Newtown-Raphson method for single variable-solutions of linear system by Gaussian, Gauss-Jordan, Jacobian and Gauss-Siedel methods, Inverse of matrix by Gauss-Jordan method , Eigen value of a matrix power and Jacobian methods.		
UNIT II	INTERPOLATION (FINITE DIFFERENCES)	12
Newton's Divided difference formula, Lagrange's interpolation-forward and backward difference formula-Stirling's and Bessel's central difference formula.		
UNIT III	NUMERICAL DIFFERENTIATION AND INTEGRATION	12
Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal Simpson's 1/3" and 3/8" rule, Double integrals using Trapezoidal and Simpson's rule.		
UNIT IV	INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS	12
Single step methods, Taylor series, Euler and modified Euler, Runge kutta method of first and second order differential equations, multiple step methods, Milne and Adam's – Bash forth predictor and corrector method.		
UNIT V	BOUNDARY VALUE PROBLEMS FOR ODE AND PDE	12
Finite difference for the second order ordinary differential equations, finite difference solutions for one dimensional heat equations (both implicit and explicit), one dimensional wave equation, Two dimensional, Laplace and Poisson equation.		
Text Books: 1. Jain. M. K. Iyengar, S. R. K. And Jain, R K., Numerical Methods for Scientific and Engineering Computation, 3rd edition, New age international publication, company, 1993 2. Grewal, B.S., Higher Engineering Mathematics, Khanna Publications, 2007.		
References: 1. M. K. Venkatraman., Numerical Methods, NPC, Chennai. 2. Richard W. Hamming., Numerical Methods for Scientists and Engineers, Dover Publications (2nd edition), 1987. 3. *https://www.wolfram.com/**mathematica**/*		

BAN401	AIRCRAFT STRUCTURES I	L	T	P	C
	Total Contact Hours – 60	3	**1**	0	4
	Prerequisite – Engineering Mechanics, Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint students with the fundamentals of aircraft structures.
2. To acquaint students with statically determinate and indeterminate structures.
3. To introduce students to energy methods applied to simple aerospace structural elements.
4. To introduce various structural analysis of various column type aerospace structural elements.
5. To introduce various failure theory of structural analysis.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Determine**the forces acting in the members of statically determinate truss and frames. (**Apply**)
CO 2	**Calculate** the slope and deflection of statically indeterminate beams. (**Apply**)
CO 3	**Calculate** the deflection and strain energy ofstatically determinate and indeterminate structures. (**Apply**)
CO 4	**Compute** the buckling load and crippling stress of columns with different end conditions.(**Apply**)
CO 5	**Determine** the safe stress of the structural component using failure theories. (**Apply**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									M			H	
CO 2	H											M	H	
CO 3	H											M	H	
CO 4	H												H	
CO 5	H									M			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**TRUSSES AND FRAMES**	**12**

Statically determinate frames - Analysis of plane Truss - Method of joints - 3 D Truss- Plane frames - Composite beam.

UNIT II	**STATICALLY DETERMINATE AND INDETERMINATE STRUCTURES**	**12**

Propped Cantilever - Fixed-Fixed beams - Clapeyron's Three Moment Equation – slope deflection and energy distribution method.

UNIT III	ENERGY METHODS	12

Strain energy evaluation in structural members – energy theorems – dummy load & unit load methods – Maxwell's reciprocal theorem – energy methods applied to statically determinate and indeterminate beams, frames, rings & trusses

UNIT IV	COLUMNS	12

Euler's column curve – inelastic buckling – effect of initial curvature – the Southwell plot – columns with eccentricity – use of energy methods – theory of beam columns – beam columns with different end conditions – stresses in beam columns.

UNIT V	FAILURE THEORY	12

Fail safe and safe life structures, factor of safety, Brief introduction of yield material, brittle vs. ductile behavior, Creep and creep rupture, viscoelastic materials - environmental stress, stress potentials, effect of time and temperature - Fatigue and Fracture - Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory – Application to aircraft Structural problems.

Text Books:

1. Donaldson, B.K., Analysis of Aircraft Structures – An Introduction, McGraw-Hill,1993.
2. Megson T M G, Aircraft Structures for Engineering Students, Edward Arnold Publishers
3. C.T.Sun, Mechanics of aircraft structures, John wiley & sons, inc.

References:

1. Timoshenko, S., Strength of Materials, Vol. I and II, Princeton D. Von Nostrand Co, 1990.
2. Peer, D. J., and Azar J. J., Aircraft Structures, McGraw – Hill (2nd edition), 1999.
3. Bruhn.E.F., Analysis and design of flight vehicle structures, Tri set of offset company, 1973.
4. Michael C.Y.Niu ,Airframe structural design (ISBN No.962-7128-04-X), 1998
5. Rivello,Theory and Analysis of Flight Structures, McGraw-Hill, 1969.
6. Perry, Aircraft Structures, McGraw-Hill, 1950.

BAN402	AERODYNAMICS I	L	T	P	C
	Total Contact Hours – 60	3	**1**	0	4
	Prerequisite – Fundamentals of Fluid Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce student about basic concepts of mathematical formulation of air flow.
2. To impart theoretical knowledge about the elementary flow and their combination to analysis flow over real object.
3. To Study the distribution of pressure around airfoil for incompressible inviscid flow. To study transformation of flow over circle cylinder into flow over the airfoil
4. To study flow around wing and measure lift generated.
5. To introduce the students about viscous flow theory for flow over flat plate and solution for incompressible boundary layer

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Identify** the concepts of various types of flow based on mathematical equations. (**Understand**)
CO 2	**Apply** the concept of inviscid flow theory to solve flow over basic aerodynamic shapes. (**Apply**)
CO 3	**Practice** the construction of airfoils numerically with the help of mathematical transformations. (**Apply**)
CO 4	**Describe** the concept of lift generation and will be able to analyze the factors for efficient wing design. (**Understand**)
CO 5	**Determine** the skin friction drag over surfaces. (**Apply**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									M			H	
CO 2	H												H	
CO 3	H				L							H	H	
CO 4	H											H	H	
CO 5	H									M			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT		
UNIT I	**BASIC AERODYNAMIC PRINCIPLES**	**10**
Models of fluid - System and Control volume approach, substantial, local and convective derivative, Continuity, momentum and energy equations, Inviscid flow, Euler equation, incompressible Bernoulli‟s Equation. Circulation and Vorticity		
UNIT II	**FUNDAMENTALS OF INVISCID FLOWS**	**13**
Elementary Flows and their combinations – Ideal Flow over a circular cylinder, D‟Alembert‟s Paradox, Magnus effect, KuttaJoukowski Theorem, Starting Vortex, Kutta condition, Real flow over smooth and rough cylinder		
UNIT III	**AIRFOIL THEORY**	**15**
Complex Potential, Methodology of Conformal Transformation, Kutta-Joukowski transformation and its applications, Karman Trefftz Profiles, Thin Airfoil theory and its applications.		
UNIT IV	**FINITE WING THEORY**	**11**
Vortex Filament, Biot and Savart Law, Bound Vortex and trailing Vortex, Horse Shoe Vortex, Lifting Line Theory and its limitations, induced drag coefficient, elliptic and general lift distribution, Oswald's wing efficiency factor, effect of plan form and aspect ratio.		
UNIT V	**VISCOUS FLOW THEORY**	**11**
Laminar Boundary layer and its thickness, displacement thickness, momentum thickness, Energy thickness, Shape parameter, Boundary layer equations for a steady two-dimensional incompressible flow, Boundary Layer growth over a Flat plate, Critical Reynolds Number, Blasius solution, Basics of Turbulent flow		
Text Books: 1. Anderson, J.D., Fundamentals of Aerodynamics, McGraw Hill Book Co., 1999, Indian Edition		
References: 1. Rathakrishnan, E., Theoretical Aerodynamics, John Wiley & Sons, Inc., 2013 2. Milne Thomson, L.H., Theoretical Aerodynamics, Macmillan, 1985. 3. John J Bertin., Aerodynamics for Engineers, Pearson Education Inc, 5th Edition. 4. Clancy L J., Aerodynamics, John Wiley & sons, 1991.		

BAN403	AIRCRAFT PROPULSION	L	T	P	C
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Engineering Mechanics, Fundamentals of Aero – Thermodynamics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To provide students with an overview of various aerospace propulsion systems.
2. To provide students with a sound foundation in the fundamentals of thermodynamics of aircraft engines
3. To teach students the elementary principles of inlets and nozzle
4. To teach students basic principles of compressors and turbines used in aircraft propulsion
5. To teach students about the various type of combustion chamber and combustion process

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Compare** the performance characteristics of turbojet, turbofan, turboprop and propeller engines. **(Understand)**
CO 2	**Identify** the engine starting problems associated with inlets. **(Understand)**
CO 3	**Discuss** the types of nozzles and the losses in nozzles. (**Understand**)
CO 4	**Explain** the working principle of axial and centrifugal flow compressors. **(Understand)**
CO 5	**Discuss** important factors affecting combustion chamber design and the problems associated with flame stabilization. (**Understand**)
CO 6	**Analyze** the working principle of axial and radial flow turbines and their overall performance. **(Analyze)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	H												H	
CO 2	H												H	
CO 3	H											H	H	
CO 4	H									M		H	H	
CO 5	H											H	H	
CO 6	H									M			H	
Category	**Professional Core (PC)**													

Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	**FUNDAMENTALS OF ENGINES**	**10**
History and classifications of Aero engines, working of gas turbine engine – Thrust equation – Factors affecting thrust – Engine performance parameters – Efficiency, Specific fuel consumption, Methods of thrust augmentation – Characteristics of propeller, turboprop, turbofan and turbojet engines.		
UNIT II	**INLETS AND NOZZLES**	**14**
Subsonic inlets– External and internal flow pattern – inlet performance criterion –Boundary layer separation – Supersonic inlets – the starting problem – shock boundary layer problem – external deceleration – flow stability problem – Exhaust nozzles –Theory of flow in isentropic nozzles – Losses in nozzles –Nozzle efficiency—nozzle choking –Over expanded and under expanded nozzles – Ejector and variable area nozzles – Interaction of nozzle flow with adjacent surfaces – Thrust reversal		
UNIT III	**COMPRESSORS**	**14**
Principle of operation of centrifugal compressor – Work done and pressure rise – Velocity diagrams – Diffuser vane design considerations – Concept of pre whirl – Rotation stall – Elementary theory of axial flow compressor – Velocity triangles – degree of reaction – Three dimensional – Air angle distributions for free vortex and constant reaction designs – Compressor blade design – Centrifugal and Axial compressor performance characteristics.		
UNIT IV	**COMBUSTION CHAMBERS**	**12**
Classification of combustion chambers – Important factors affecting combustion chamber design – Combustion process – Combustion chamber performance – Effect of operating variables on performance – Flame tube cooling – Flame stabilization – flame holders.		
UNIT V	**TURBINES**	**10**
Elementary theory of axial flow turbine – Vortex theory – Stator and rotor blades – losses in the blade – choice of blade profile, chord and pitch – stage and overall performance – blade cooling – radial flow turbine.		
Text Books: 1. Hill, P.G. & Peterson, C.R, Mechanics & Thermodynamics of Propulsion, Addison – Wesley Longman INC, 1999. 2. Cohen, H. Rogers, G.F.C. and Saravana Muttoo, H.I.H., Gas Turbine Theory, Longman, 1989.		
References: 1. Ahmed F. El-Sayed, Aircraft Propulsion and Gas turbine engines, CRS Press, 2008 2. Saeed Farokhi, Aircraft Propulsion, John Wiley & Sons, Inc., 2009 3. Rolls Royce Jet Engine – 5thEdition – 1996. 4. Oates, G.C., Aero thermodynamics of Aircraft Engine Components, AIAA Education Series.		

BAN404	AIRCRAFT SYSTEMS AND INSTRUMENTATION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Aeronautics and Astronautics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with the various aircraft systems
2. To introduce to the student about the different control systems in aircrafts
3. To familiarize the student to the different systems associated with aircraft engines
4. To acquaint the student to the several auxiliary systems in aircrafts
5. To enable the student to understand about the working of basic aircraft instruments

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Identify** the components of Hydraulic, Pneumatic, Landing gear and brake system. (**Understand**)
CO 2	**Compare** the advantages and disadvantages of conventional and modern flight control systems. (**Understand**)
CO 3	**Explain** the operating principle of various systems associated with the aircraft engines. (**Understand**)
CO 4	**Describe** the working principle of air-conditioning, oxygen, fire protection and ice protection systems. (**Understand**)
CO 5	**Describe** the operating principle of flight and navigation instruments. (**Understand**)
CO 6	**Summarize** the working principle of engine instruments such as tachometers, temperature gauges and Pressure gauges. (**Understand**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									H			H	H
CO 2	H												H	H
CO 3	H												H	H
CO 4	H									H			H	H
CO 5	H												H	H
CO 6	H												H	H

Category	Professional Core (PC)	
Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	AIRCRAFT SYSTEMS	12
Hydraulic systems - Study of typical workable system - components –Hydraulic systems controllers – Pneumatic systems - Advantages - Working principles - Typical Air pressure system – Brake system- Typical Pneumatic power system - Components, Landing Gear systems – Classification.		
UNIT II	AIRPLANE CONTROL SYSTEMS	10
Conventional Systems - fully powered flight controls - Power actuated systems – Modern control systems - Digital fly by wire systems - Auto pilot system active control Technology.		
UNIT III	ENGINE SYSTEMS	8
Fuel systems for Piston and jet engines, - Components of multi engines. Lubricating systems for piston and jet engines - Starting and Ignition systems - Typical examples for piston and jet engines.		
UNIT IV	AUXILIARY SYSTEMS	8
Basic Air cycle systems - Vapour Cycle systems, Evaporative vapour cycle systems -Evaporative air cycle systems –Oxygen systems - Fire protection systems, Deicing and anti icing systems.		
UNIT V	AIRCRAFT INSTRUMENTS	7
Flight Instruments and Navigation Instruments – Gyroscope - Accelerometers, Air speed Indicators – TAS, EAS- Mach Meters - Altimeters - Principles and operation - Study of various types of engine instruments - Tachometers - Temperature gauges – Pressure gauges - Operation and Principles.		
Text Books: 1. McKinley, J.L., and Bent, R.D., Aircraft Maintenance & Repair, McGraw-Hill,1993. 2. General Hand Books of Airframe and Powerplant Mechanics, U.S. Dept. of Transportation, Federal Aviation Administration, The English Book Store, NewDelhi1995.		
References: 1. Mekinley, J.L. and Bent, R.D., Aircraft Power Plants, McGraw-Hill, 1993. 2. Pallet, E.H.J., Aircraft Instruments & Principles, Pitman & Co., 1993. 3. Treager, S., Gas Turbine Technology, McGraw-Hill, 1997.		

BCE407	ENVIRONMENTAL STUDIES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Chemistry, Biology for Engineers				
	Course Designed by – Department of Humanities and Sciences				

OBJECTIVES

1. To acquaint the student about the various natural resources and their associated problems
2. To accustom the student about ecosystem and the different types of ecosystems and their importance
3. To introduce to the student about the values of bio diversity and the importance of its conservation and also on environmental pollution
4. To familiarize the student on the social issues that have a direct effect on the environment
5. To help the student understand about the effects of human population on the environment and remedial measures

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Summarize** the types of natural resources and identify the role of an individual in conservation of nature. (**Understand**)
CO 2	**Describe** different eco systems and energy flow in a defined ecosystem. (**Understand**)
CO 3	**Define** ecosystem bio-diversity and the threats to biodiversity. (**Remember**)
CO 4	**Define** types of pollution, effects and control measures of pollution. (**Remember**)
CO 5	**Explain** the need for sustainable development and water conservation. (**Understand**)
CO 6	**Express** the need for population control and the impact of population growth in economy. (**Understand**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H					H	H							
CO 2	H					H	H			M				
CO 3	H					H	H			M				
CO 4	H					H	H							
CO 5	H					H	H		L					
CO	H			L		H	H							

6														

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**NATURAL RESOURCES AND ASSOCIATED PROBLEMS**	**6**

The multidisciplinary nature of environmental studies definition, scope and importance – need for public awareness – Natural Resources – Forest Resources – Water Resources - Mineral Resources –Energy resources – Land Resources – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT II	**ECOSYSTEMS**	**9**

Concept of an ecosystem structure and function of an ecosystem, produces consumers and decomposes, energy flow in the ecosystem, Ecological succession food chains, food webs and ecological pyramids, introduction, types, characteristics features, structure and function of different ecosystem

UNIT III	**BIODIVERSITY AND ENVIRONMENTAL POLLUTION**	**12**

BIODIVERSITY

Introduction – definition ;.genetic, species and ecosystem diversity, biogeographically classification of India, value of biodiversity; consumptive use productive use social, ethical aesthetic and option values, biodiversity at global, national and local levels India as a mega-diversity nation, hot spots of biodiversity, threats to biodiversity habitual loss poaching of wild life man, wildlife conflicts, endangered and endemic species of India, conservation of biodiversity in-situ and ex-situ conservation of biodiversity.

ENVIRONMENTAL POLLUTION

Definition,causes, effects and control measure of air pollution, water pollution, soil pollution, marine pollution, noise pollution, thermal pollution, nuclear hazards, solid waste management – causes, effects and its control measure – role of an individual in presentation of pollution and case studies.

UNIT IV	**SOCIAL ISSUES AND THE ENVIRONMENT**	**9**

From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people its problems and concerns , case studies environmental ethics, issues and possible solution climate change global warming add rain, ozone layer depletion nuclear accident and holocaust case studies waste land reclamation, various environment protection act , issues involved enforcement of environmental legislation public awareness.

UNIT V	**HUMAN POPULATION AND THE ENVIRONMENT**	**9**

Population growth variation among nations, population explosion family welfare program environment and human health, human right, value education, HIV/AIDS, women and child welfare role of information technology in environment and human health case studies.

FIELDWORK

Visit to a local area to document assets river forest/ grass land/ hill mountain, visit to local polluted site rural/industrial / agricultural, study of common plants, insects, birds, study of simple ecosystems = ponds,

river hill slopes etc(field work equal to 5 lecture hours)

Text Books:

1. Sharma.B.K. andKaur, Environmental Chemistry, Goel Publishing House, Meerut, 1994.
2. De.A.K., Environmental Chemistry, New Age International (p) lt., New Delhi, 1996.
3. Kurian Joseph and Nagendran.R, Essential of Environmental Studies, Pearson Education, 2004.

References:

1. Dara S.S., A Text Book of Environmental Chemistry and Pollution Control, S.Chand and company Ltd., New Delhi, 2004.
2. Jeyalakshmi.R, Principles of Environmental Science, First Edition, Devi Publications, Chennai, 2006.
3. Kamaraj.P and Arthanareeswari.M, Environmental Science - Challenges and Changes, first Edition, Sudhandhir Publications, 2007.

BAN4L1	AIRCRAFT STRUCTURES LABORATORY	L	T	P	C
	Total Contact Hours – 30	0	0	**4**	2
	Prerequisite – Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student to the various experimental processes to carry out structural analysis.
2. To familiarize to the student about the analysis of beams.
3. To enable the student to understand about the analysis of columns.
4. To help the student to understand about the effect of complex loading on aircraft structures.
5. To introduce to the student about the shear flow estimation in aircraft structures.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Demonstrate** structural mechanics principles/phenomenon using simple experiments. **(Manipulation)**
CO 2	**Observe** deformation of structural members or/and failure of materials under given loads. **(Imitation)**
CO 3	**Perform** comparative study between the obtained experimental results and theoretical values.**(Precision)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H			H	
CO 2	H								H	H			H	
CO 3	H								H	H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Verification of Maxwell's theorem and principle of superposition.
2	Column – Testing.
3	Testing of riveted joints.
4	Unsymmetrical Bending of a Beam.
5	Determination of Shear Centre in open Section.
6	Determination of Shear Centre in closed Section.
7	Combined bending and Torsion of a Hollow Circular Tube.
8	Constant Strength Beams.

9	Wagner beam – Tension field beam.
10	Material properties test of composite laminate.

References:

1. Aircraft Structures Lab Manual, Department of Aeronautical Engineering, 2015

BME4L1	MANUFACTURING ENGINEERING LABORATORY	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Manufacturing Engineering				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce student to various machine cutting operation
2. To train the student for using the lathe
3. To train the student for performing various operation using lathe
4. To train the student for performing drilling operations and boring operation
5.To train the student for using the surface grinding machine and milling machine

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Carry out** different machining operations on center lathe **(Imitation)**
CO 2	**Perform** drilling, reaming and boring processes. **(Precision)**
CO 3	**Observe** the working of Planner shaper miller and grinder. **(Imitation)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H			H		
CO 2	H								H	M		H		
CO 3	H								H			H		

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Study of centre, capstan and automatic lathes and their accessories.
2	Exercise on setting the work piece and the tool in the lathe.
3	Plane turning and step turning.
4	Taper turning and knurling.
5	Eccentric Turning.
6	Thread cutting and grooving.
7	Exercise on Drilling and reaming.
8	Drilling and boring.

9	Surface grinding
10	Study of milling and grinding machines.

References:

1. Machine Shop Lab Manual, Department of Mechanical Engineering, 2015

BAN4L2	COMPUTER AIDED DESIGNING AND DRAFTING	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Engineering Graphics, Machine Drawing				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with various computer software for engineering design
2. To familiarize the student with to the various options and types of designs that can be carried out using CATIA software
3. To train the student on the designing of basic mechanical parts
4. To train the student on the assembly of different mechanical parts
5. To train the student on the drafting of the part / model / assembly designed.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Master** the geometrical profile and modification tools. **(Precision)**
CO 2	**Create** 3-Dimensional models from 2-Dimensional geometries. **(Naturalization)**
CO 3	**Design** basic Aerospace components using CADD. **(Articulation)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H				H					H			H	
CO 2	H				H				H	H		M	H	
CO 3	H	M	M		H				H	H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Study of various software for engineering design and drafting.
2	Study of CATIA and its tools.
3	Exercise on 2D drawing.
4	Exercise on pad and groove.
5	Exercise on shaft, mirror and array.

6	Exercise on threading, bores and tapings.
7	Exercise on part assembly.
8	Exercise on drafting.
9	Exercise on surface modeling.
10	Exercise on kinematics.

References:

1. CADD Lab Manual, Department of Aeronautical Engineering, 2015

BAN501	AIRCRAFT STRUCTURES - II	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Fundamentals of Structural Mechanics, Aircraft Structures I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To Understand the basics concept of unsymmetrical bending.
2. To Understand the basic concept of shear flow in open and closed sections.
3. To Understand the buckling of plates and to solve the sheet panel problems.
4. To carry-out stress analysis in wing and fuselage.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Compute** the bending stress distribution in beams of symmetric and unsymmetrical sections. (**Apply**)
CO 2	**Calculate** the shear flow distribution in symmetrical and unsymmetrical thin-walled open section and its shear center. (**Apply**)
CO 3	**Calculate** the shear flow distribution in thin walled single and multi-cell structures subjected to combined loading. (**Apply**)
CO 4	**Compute** the crippling strength of thin plates and effective width of sheet stiffener panels. (**Apply**)
CO 5	**Analyze** the stress developed in aircraft wings and fuselage. (**Analyze**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO 9	PO10	PO11	PO1 2	PSO1	PSO2
CO 1	H									H			H	
CO 2	H									H			H	
CO 3	H									H			H	
CO 4	H												H	
CO 5	H												H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**UNSYMMETRICAL BENDING**	**12**

Bending of symmetric beams subject to skew loads - bending stresses in beams of unsymmetrical sections – generalized 'k' method, neutral axis method, principal axis method- advantages and disadvantages.		
UNIT II	**SHEAR FLOW IN OPEN SECTIONS**	**12**
Thin walled beams – concept of shear flow – the shear centre and its determination – shear flow distribution in symmetrical and unsymmetrical thin-walled sections – structural idealization – shear flow variation in idealized sections.		
UNIT III	**SHEAR FLOW IN CLOSED SECTIONS**	**12**
Bredt - Batho theory – single-cell and multi-cell tubes subject to torsion – shear flow distribution in thin-walled single & multi-cell structures subject to combined bending torsion – with walls effective and ineffective in bending – shear center of closed sections.		
UNIT IV	**BUCKLING OF PLATES**	**12**
Bending of thin plates – rectangular sheets under compression - local buckling stress of thin walled sections – crippling strength by Needham's and Gerard's methods – thin-walled column strength – load carrying capacity of sheet stiffener panels – effective width – inter-rivet and sheet wrinkling failures - short panel failing strength.		
UNIT V	**STRESS ANALYSIS OF WING AND FUSELAGE**	**12**
Wing structural arrangements – factors influencing - wing stress analysis methods – determination of shear force and bending moment distribution over fuselage – Numerical problems – Tension field beam – general Wagner equation - Semi-tension field beams.		

TEXTBOOKS:

1. Megson T M G, 'Aircraft Structures for Engineering Students', Fifth Edition, Elsevier Aerospace Engineering Series,2007. (Units 1, 2, 3 & 5)
2. Peery, D.J., and Azar, J.J., Aircraft Structures, 2nd edition, McGraw – Hill, N.Y., 1999 (Unit 4)

REFERENCES:

1. Rivello, R.M., Theory and Analysis of Flight Structures, McGraw Hill, 1993.
2. Howard D Curtis, 'Fundamentals of Aircraft Structural Analysis', WCB-McGraw Hill, 1997
3. Bruhn. E.H., 'Analysis and Design of Flight Vehicles Structures', Tri-state off-set company, USA, 1985

WEBLINKS:

http://nptel.ac.in/courses/105106049/63
https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-21-techniques-for-structural-analysis-and-design-spring-2005/

BAN502	AERODYNAMICS II	L	T	P	C
	Total Contact Hours – 60	3	**1**	0	4
	Prerequisite – Fundamentals of Fluid Mechanics, Aerodynamics I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To make the student understand concepts and 1-d equations used for compressible flows.
2. To acquaint the student with the estimation of flow properties across normal shock, oblique shock and expansion waves.
3. To familiarize the student to the governing equations in compressible flows.
4. To educate the student on problems faced by high speed flow airfoils, wings and airplane configuration and to understand design modifications required to overcome problems.
5. To create awareness among the students about various experimental methods and measurement techniques.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Apply** the concepts of isentropic flow for problems related to variable area ducts. (**Apply**)
CO 2	**Calculate** the properties of flow through shock and expansion waves. (**Apply**)
CO 3	**Determine** the aerodynamic coefficients of compressible flows based on linearized flow theory. (**Apply**)
CO 4	**Categorize** various aircrafts intended for subsonic and supersonic regimes based on wing and fuselage design. (**Analyze**)
CO 5	**Describe** flow measurement and visualization techniques for high-speed flows. **(Understand)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	H											H	H	
CO 2	H											H	H	
CO 3	H		L									H	H	
CO 4	H				M					L		H	H	
CO 5	H				M							H	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT		
UNIT I	**FUNDAMENTAL ASPECTS OF COMPRESSIBLE FLOW**	**12**
Compressibility, Continuity, Momentum and Energy equation for steady one-dimensional flow, Compressible Bernoulli's equation, Area – Mach number – Velocity relation, Mach cone, Mach angle, One dimensional Isentropic flow through variable area duct, Isentropic relations - Critical conditions, Characteristic Mach number, Maximum discharge velocity.		
UNIT II	**SHOCKS AND EXPANSION WAVES**	**14**
Normal shock relations, Prandtl's relation, Hugonoit equation, Raleigh Supersonic Pitot tube equation, Moving normal shock waves, Oblique shocks, θβM relation, Shock Polar, Reflection of oblique shocks, Left running and Right running waves, Interaction of oblique shock waves, slip line, Rayleigh flow, Fanno flow, Expansion waves, Prandtl-Meyer expansion, Maximum turning angle, Simple and non-simple regions, Operating characteristics of convergent and convergent-divergent nozzles.		
UNIT III	**TWO-DIMENSIONAL COMPRESSIBLE FLOW**	**14**
Potential equation for 2-dimensional compressible flow, Linearization of potential equation,Small perturbation theory, Linearised Pressure Coefficient, Linearised subsonic flow, Prandtl-Glauert rule, Linearised supersonic flow, Method of characteristics, Wave drag coefficient.		
UNIT IV	**HIGH SPEED FLOW OVER AIRFOILS, WINGS AND AIRPLANE CONFIGURATION**	**10**
Critical Mach number, Drag divergence Mach number, Shock Stall, Shock- Boundary layer interaction, Supercritical Airfoil Sections, Transonic area rule, Swept wing, Airfoils for supersonic flows, Lift, drag, Pitching moment and Centre of pressure for supersonic profiles, Shock-expansion theory, wave drag, supersonic wings, Design considerations for supersonic aircrafts, Introduction to Hypersonic Flows, Numerical Analysis of one Dimensional flow.		
UNIT V	**EXPERIMENTAL METHODS**	**10**
Wind tunnels for Subsonic, transonic, Supersonic and hypersonic flows, Various Measurement techniques, Power requirement, Force and moment measurement, Wind tunnel balance, Wind tunnel corrections, Flow visualization techniques, Hot wire technique, Optical methods, Shock tube, Gun tunnels		

Text Books:

1. Anderson, J. D, Modern Compressible Flow, Third Edition, Tata McGraw-Hill & Co., 2012.
2. Rathakrishnan., E, Gas Dynamics, Prentice Hall of India, 2004.
3. Yahya S.M., Fundamentals of Compressible Flows, Third Edition, New Age International Publishers, 2003.

References:

1. Shapiro, A. H., Dynamics and Thermodynamics of Compressible Fluid Flow, Ronald Press, 1982.
2. Zucrow, M. J. and Anderson, J. D., Elements of Gas Dynamics, McGraw- Hill & Co., 1989.
3. Oosthuizen,P.H., &Carscallen,W.E., Compressible Fluid Flow, McGraw- Hill & Co., 19976. Perry, Aircraft Structures, McGraw-Hill, 1950.

BAS501	Rocket Propulsion	L	T	P	C
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Engineering Mechanics, Fundamentals of Aero – Thermodynamics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student about the basic theory of rocket propulsion.
2. To introduce to the student about the significance and applications of solid propellant rockets.
3. To introduce to the student about the significance and applications of liquid propellant rockets.
4. To help the student understand about the modern propulsion techniques.
5. To help the student understand about the types and performance of rocket nozzle.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	Analyze the propulsion system with performance parameters
CO 2	Describe performance parameters used in solid rocket motor engines
CO 3	Explain the fundamental concept of a liquid rocket engine performance
CO 4	Comprehend and illustrate the basics of hybrid, nuclear rockets in terms of their designing approach
CO 5	Relate the significance of nozzle design.

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	H													H
CO 2	H													H
CO 3	H									H				H
CO 4	H									H				H
CO 5	H													H

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**THEORY OF ROCKET PROPULSION**	**10**

Brief History – Classification – Rocket Principle and Rocket Equation – Mass Ratio – Specific Impulse – Desirable Parameters of Rockets – Propulsive Efficiency – Performance Parameters – Staging and Clustering of Rockets – Statics Testing of Rockets		
UNIT II	**SOLID PROPELLANT ROCKETS**	**14**
Operating principle – Specific impulse of a rocket – Igniters – Internal ballistics – Selection criteria of solid propellants – propellant grain design considerations – Progressive, Regressive and neutral burning in solid rockets.		
UNIT III	**LIQUID PROPELLANT ROCKETS**	**14**
Liquid propellant rockets – selection of liquid propellants – performance and choice of various feed systems for liquid propellant rockets – hydrazine monopropellant rockets–basics of cryogenic techniques – Cooling in liquid rockets and the associated heat transfer problems – advantages of liquid rockets over solid rockets – draining of propellant tanks under microgravity conditions		
UNIT IV	**MODERN PROPULSION TECHNIQUES**	**12**
Hybrid Rockets, Burning Mechanism, Advantages of Hybrid Rockets over Solid and Liquid Propellant Rockets – Nuclear Rockets – Pulse Detonation Rockets – Beamed Rockets and Sail Propulsion – Basics of Electrothermal, Electrostatic and Electromagnetic Thrusters		
UNIT V	**ROCKET NOZZLE AND PERFORMANCE**	**10**
Nozzle types – Effect of Shape and Area Ratio – Performance Losses, Flow Separation in Nozzles – Mass Flow Rate and Characteristic Velocity – Thrust Coefficient – Bell Nozzle – Unconventional Nozzles, SERN nozzle – Aerospike nozzle, annular nozzles.		

TEXTBOOKS:

1. Ramamurthi, K., "Rocket Propulsion", Trinity Press, First Edition, 2010

REFERENCES:

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 8th Edition, 2010.
2. J D Mattingly, "Elements of Propulsion - Gas Turbines and Rockets ", AIAA Education Series, 2006.
3. Thomas A Ward, "Aerospace Propulsion Systems", John Wiley & Sons Inc., New York,2010.
4. DanM.Goebel, Ira Katz, „Fundamentals of Electric Propulsion", John Wiley & Sons Inc, New York, 2003.

BAN504	**FLIGHT MECHANICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	**1**	0	4

	Prerequisite – Fundamentals of Aeronautics and Astronautics, Aerodynamics I
	Course Designed by – Department of Aeronautical Engineering

OBJECTIVES

1. To understand aircraft performance relating to steady level
2. To understand aircraft performance relating to Range, Endurance, climb & Glide
3. To acquire knowledge about Takeoff, Landing and Turning performance
4. To understand the principles of stability and control relating to longitudinal stability
5. To understand the principles of stability and control relating to directional and lateral stability

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Calculate** thrust and power required for propeller driven and jet powered aircraft at steady level flight. (**Apply**)
CO 2	**Evaluate** the Range, Endurance, glide and climb performances. **(Evaluate**)
CO 3	**Estimate** the take-off, landing, turning performance using V-n diagram. (**Evaluate**)
CO 4	**Describe** the characteristics of longitudinal stability. **(Understand)**
CO 5	**Evaluate** the lateral and directional stability characteristics. (**Evaluate**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	H												H	
CO 2	H												H	
CO 3	H												H	
CO 4	H									H			H	
CO 5	H									H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**STEADY LEVEL FLIGHT**	**12**

International Standard Atmosphere, TAS, IAS and EAS, Streamlined and Bluff body – Skin friction Drag, Pressure Drag and Induced Drag – Drag Polar – Various drags of an airplane – Methods of Drag Reduction -

Effect on Drag Polar. Steady level flight, Thrust required and Power required, Thrust available and Power available for propeller driven and jet powered aircraft, Effect of altitude, conditions for minimum drag and minimum power required

UNIT II	RANGE, ENDURANCE, CLIMB AND GLIDE PERFORMANCE	12

Range and Endurance of Propeller and Jet aircrafts, Shallow and steep angles of climb, Rate of climb, Climb hodograph, Maximum Climb angle and Maximum Rate of climb- Effect of design parameters for propeller and jet aircrafts, Absolute and service ceiling, Cruise climb, Gliding flight, Glide hodograph

UNIT III	TAKE OFF, LANDING AND TURNING PERFORMANCE	10

Take-off and landing performance, Turning performance, bank angle and load factor, Constraints on load factor, Pull up and pull down maneuvers, maximum turn rate, V-n diagram.

UNIT IV	LONGITUDINAL STABILITY	14

General concepts, Static and dynamic stability, Stability and Controllability, Requirements of control surfaces, criteria for longitudinal static stability, contribution to stability by wing, tail, fuselage, wing fuselage combination, Total longitudinal stability, Neutral point-Stick fixed and Stick free aspects, Free elevator factor, static margin, Hinge moment, Power effects on stability-propeller and jet aircrafts, longitudinal control, Movement of centre of gravity, elevator control power, elevator angle to trim, elevator angle per g, maneuver point, Stick force gradient and stick force per g, Aerodynamic balancing
Aircraft Equations of motion, small disturbance theory, Estimation of longitudinal stability derivatives
Routh's discriminant, solving the stability quartic, Phugoid motion, Factors affecting the period and damping.

UNIT V	LATERAL AND DIRECTIONAL STABILITY	12

Directional stability-yaw and sideslip, contribution to static directional stability by wing, fuselage, vertical tail, Power effects on directional stability-propeller and jet aircrafts, Rudder lock and Dorsal fin, Directional control, rudder control power, rudder requirements, adverse yaw, asymmetric power condition, spin recovery, Lateral stability-Dihedral effect, contribution of various components, lateral control, aileron control power, strip theory, roll control by spoilers, aileron reversal, aileron reversal speed

Text Books:

1. Anderson, Jr., J.D. Aircraft Performance and Design, McGraw-Hill International Edition, 2012.
2. Houghton,E.L. and Carruthers, N.B. Aerodynamics for engineering students, Edward Amold Publishers, 2000

References:

1. Nelson, R.C." Flight Stability & Automatic Control", McGraw Hill, 2005.
2.Pamadi, B.N. Performance, Stability, Dynamics, and Control of Airplanes, AIAA Education Series, 2004
3. McCormick, B.W. "Aerodynamics, Aeronautics & Flight Mechanics", John Wiley, 1995.
4. Babister, A.W. "Aircraft Stability and response", Pergamon Press, 1996.
5. Etkin, B., "Dynamics of Flight Stability and Control", John Wiley, New York, 1982.
6. Perkins C.D. &Hage R.E. "Airplane performance, stability and control", John Wiley & Sons 1976.

BME505	MANUFACTURING ENGINEERING	L	T	P	C
	Total Contact Hours – 45	3	0	0	3

	Prerequisite – Nil
	Course Designed by – Department of Aeronautical Engineering

OBJECTIVES

1. To introduce student about various metal working process
2. To impart theoretical knowledge about the metal cutting and machining process.
3. Introduce students about various special purpose machine and milling machine.
4. Introducing students about various drilling, boring and surface finish operations.
5. Introduce students about various non-conventional process and high energy rate forming process.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** various metal forming process and different types of welding.(**Understand**)
CO 2	**Calculate** the forces involved in metal cutting process and **Estimate** the tool life,machining time and economics. (**Apply**)
CO 3	**Describe** types of lathe and their construction. (**Understand**)
CO 4	**Explain** the process of shaping, planing and milling operations. (**Understand**)
CO 5	**Discuss** the process involved in drilling, boring, broaching, surface finishing. (**Understand**)
CO 6	**Describe** the working principle of various Non-traditional machining techniques. (**Understand**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1	H													
CO 2	H										L			
CO 3	H													
CO 4	H									M				
CO 5	H													
CO 6	H									M		L		

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	METAL WORKING PROCESS	8
Mechanical working of metals –hot and cold working –rolling, extrusion, spinning, wire-drawing, press working. Welding – different types of gas and arc welding process, soldering and brazing. Casting – different types, furnaces, casting defects and inspection		
UNIT II	**THEORY OF METAL CUTTING AND MACHINING PROCESSES**	**12**
Introduction, mechanics of metal cutting-chip formation, Merchant's circle theory cutting force calculations, tool materials. Influence of tool angles, tool life, cutting fluids, machining time calculations, Metal cutting economics, problem in merchant circle, tool life, machining time and economics. Lathe – introduction, types, construction, mechanisms and attachments for various operations, nomenclature of single point cutting tool. Capstan and turret lathes various mechanisms, tool and loading arrangement. Automatic lathes - single spindle and multi spindle mechanisms, CNC lathes.		
UNIT III	**SHAPER, PLANER AND MILLING PROCESS**	**8**
Shaper, planer and slotter: types, specifications, mechanisms, holding devices, difference between shaper and planer. Milling machine – types and specification, mechanisms, holding devices, milling operations. Milling tool nomenclature, indexing types-simple, compound and differential		
UNIT IV	**DRILLING, BORING, BROACHING, SURFACE FINISHING PROCESS**	**8**
Drilling, Boring- Specification, Nomenclature of drilling and reaming tool and its specification. Broaching: Specification, types, mechanisms, nomenclature of broaching tool. Grinding process, Types of grinding machines, Grinding Wheels, Honing, Super finishing, Polishing, Metal spraying, Galvanizing, Electroplating.		
UNIT V	**NON-TRADITIONAL MACHINING PROCESSES AND HIGH ENERGY RATE FORMING PROCESSES**	**9**
Non-traditional machining techniques, classification, Abrasive jet machining, Electrical Discharge Machining, E. D wire cutting, Electro chemical machining, Electron Beam Machining, Laser Beam Machining, Ultrasonic Machining. Explosive forming, Electro hydraulic, Electromagnetic forming, Dynapack machine.		

Text Books:

1. P.C. Sharma., A text book of Production Technology, S.Chand& Company ltd, 2007.
2. P.N.Rao. Manufacturing Technology-Foundry Forging and Welding, TMH publishing co, 2009.

References:

1. W.A.J. Chapman., Workshop Technology. Vol I, II& III, 1975, ELBS.
2. Roy A Lindberg, Process and Material Manufacture, PHI, 1995.
3. Kalpakjan, Manufacturing Engineering and Technology, Addison Wesley, 2005.
4. Hajra Chowdary S.K, The fundamentals of work shop technology Vol. I & II, Media publishers, 1997.

BAN5V1	VALUE ADDED PROGRAM I	L	T	P	C
	Total Contact Hours – 30	0	0	2	1

	Prerequisite – Nil
	Course Designed by – Department of Aeronautical Engineering

OBJECTIVES

1. To acquaint the student about personal value, responsibility in the society and about self-confidence and self esteem
2. To introduce about goal setting, time management and planning
3. To boost the creativity, lateral thinking of the students
4. To familiarize the student on teamwork, interpersonal skills, leadership skills and ability to manage stressed situations
5. To help the student understand about decision making and self-assessment

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Demonstrate**Team work and leadership quality. (**Manipulation**)
CO 2	**Demonstrate**communication and interpersonal skills. (**Manipulation**)
CO 3	**Express**the need of social responsibilities. (**Articulation**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1						H		H	H					
CO 2						H		H	H					
CO 3						H	L	H	H					

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	An activity to make a goal setting..
2	An activity to describe the importance of team work.
3	An activity to make a time management chart.
4	An activity for personal grooming.
5	An activity to enhance self-confidence and self-esteem.
6	An activity to make SWOT analysis.
7	An activity to describe the planning process.
8	An activity to create environmental awareness.
9	An activity to describe the responsibilities of students in society.

10	An activity to showcase the impact of engineers on society.

References:

1. Value Added Program Booklet, Department of Aeronautical Engineering, 2015

BAN5L1	AERODYNAMICS LABORATORY	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Fundamentals of Fluid Mechanics, Aerodynamics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student to the various experimental processes to carry out structural analysis.
2. To familiarize to the student about the analysis of beams.
3. To enable the student to understand about the analysis of columns.
4. To help the student to understand about the effect of complex loading on aircraft structures.
5. To introduce to the student about the shear flow estimation in aircraft structures.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Carryout** flow analysis over various aerodynamic models. (**Imitation**)
CO 2	**Demonstrate** the usage of mechanical and electronic instruments in data acquisition. (**Manipulation**)
CO 3	**Conduct** experiments at various orientation of models to characterize the flow. (**Articulation**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H			H	
CO 2	H								H	H			H	
CO 3	H								H	H		M	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Calibration of subsonic wind tunnel.
2	Pressure distribution over smooth cylinder
3	Pressure distribution over rough cylinder.
4	Pressure distribution over symmetric airfoil.
5	Pressure distribution over cambered airfoil.
6	Pressure distribution over a wing.
7	Force measurement on Airfoil using wind tunnel balance.
8	Pressure distribution over a building model.

9	Aerodynamic studies of automotive models.
10	Flow visualization at subsonic velocity using (a) Smoke (b) Oil

References:

1. Aerodynamics Lab Manual, Department of Aeronautical Engineering, 2015

BAN5L2	AERO DESIGN AND MODELING LABORATORY	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Fundamentals of Aeronautics and Astronautics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To design and fabricate gliders, catapult and power gliders.
2. To design and fabricate single, double and pivoted double crank flapping wing mechanism.
3. To design and fabricate wing, vertical and horizontal stabilizer using balsa wood.
4. To design and fabricate fuselage and control surfaces using polystyrene and glass fibers.
5. To estimate discharge rate of Li-Po battery, propeller thrust and assembling Remote Control Aircraft.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Design** and fabricate the Aircraft Structural components with appropriate materials. (**Naturalization**)
CO 2	**Conduct** flight testing of powered glider and RC plane. (**Precision**)
CO 3	**Observe** Performance characteristics of Glider and RC plane. (**Imitation**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H		H						H	H			H	
CO 2	H		H						H	H			H	
CO 3	H						M		H	H		M	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Design and fabrication of gliders using balsa wood.
2	Design and fabrication of power gliders.
3	Design and fabrication of single crank flapping wing mechanism.
4	Design and fabrication of double crank flapping wing mechanism.
5	Design and fabrication of pivoted double crank flapping wing mechanism.
6	Design and fabrication of wing using balsa wood.
7	Design and fabrication of horizontal and vertical stabilizer using balsa wood.
8	Estimation the discharge rate of Li-Po battery for different thrust setting.

9	Estimating the propeller thrust for different voltage setting.
10	Assembling of Remote-Control Aircraft.

References:

1. Aero Design and Modeling Lab Manual, Department of Mechanical Engineering, 2015

BAN5L3	COMPUTER AIDED ANALYSIS	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Aircraft Structures, Aerodynamics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with various computer software for engineering analysis
2. To familiarize the student with to the various options and types of analysis that can be carried out using ANSYS software
3. To train the student on basic structural analysis
4. To train the student on basic thermal analysis
5. To train the student on basic fluid flow analysis

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Design** the structural components under static and dynamic loading. **(Precision)**
CO2	**Observe** temperature distribution for structure under thermal loading. **(Imitation)**
CO 3	**Carry out** the flow analysis over aerodynamic shapes. **(Imitation)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H				H				H	H		H	H	
CO 2	H				H				H	H		H	H	
CO 3	H	M			H				H	H		H	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Study of ANSYS and its tools
2	Stress analysis of beams with different loading conditions.
3	Stress analysis of a plate with circular hole.
4	Stress analysis of an axisymmetric component.
5	Vibration analysis of cantilever beam.
6	Simple conduction example.
7	Thermal mixed boundary example.

8	Flow field analysis of jets.
9	Flow field simulation over an airfoil.
10	Fluid – Structure interaction.

References:

1. CAA Lab Manual, Department of Aeronautical Engineering, 2015

BSS601	VALUE EDUCATION AND PROFESSIONAL	L	T	P	C

	ETHICS				
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Designed by – Department of Humanities and Social Sciences				

OBJECTIVES

1. To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
2. To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the meaning and philosophy of life and the qualities an individual must possess. (**Understand**)
CO 2	**Explain** the individual responsibility towards family and society. (**Understand**)
CO 3	**Discuss** the methods to maintain proper physical and mental health. (**Understand**)
CO 4	**Summarize** the importance of safety during social experimentation. (**Understand**)
CO 5	**Express** the rights and responsibilities of engineer on global issues. (**Understand**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
CO 1								H						
CO 2								H	H		L	M		
CO 3								H				M		
CO 4							M	H	H					
CO 5							M	H	H	L				

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES**	**9**

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II	SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE)	9
Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man: - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftiness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.		
UNIT III	**MIND CULTURE & TENDING PERSONAL HEALTH**	**9**
Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelizing the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases		
UNIT IV	**ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS'S RESPONSIBILITIES FOR SAFETY**	**9**
Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Challenger, case study. Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies.		
UNIT V	**ENGINEER'S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES**	**9**
Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination. Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership		

Text Books:

1.Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications (Unit 1 – III).

2.Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata Mcgraw Hill, Newyork 2005 (Units IV & V)

References:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook on Professional Ethics and Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004(for Units IV-V)

BAN601	AEROSPACE STRUCTURAL MATERIALS AND COMPOSITES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aircraft Structures – I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with various types of aerospace composite materials.
2. To develop the understanding of composite mechanics.
3. To learn different theory of laminate design.
4. To learn different theory of failure analysis.
5. To have a clear understanding of composite fabrication process.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** various materials used in aerospace applications. (**Understand**)
CO 2	**Compute** the properties of isotropic, anisotropic and orthotropic materials. (**Apply**)
CO 3	**Calculate** the properties of laminated composites along natural and arbitrary axis. (**Apply**)
CO 4	**Determine** the stiffness matrix, stress and strain of laminated composite plate with different orientations. (**Apply**)
CO 5	**Interpret** the properties and failure modes in composite plates and sandwich panels. (**Apply**)
CO 6	**Describe** the manufacturing process of fibers and fabrication methods of composites. (**Understand**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H												H	
CO 2	H											M	H	
CO 3	H									M		M	H	
CO 4	H												H	
CO 5	H												H	
CO 6	H									M			H	
Category	**Professional Core (PC)**													

Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
UNIT I	**INTRODUCTION TO AEROSPACE MATERIALS**	**9**
Introduction – Monocoque and semi monocoque structure – Wrought Aluminum Alloys – Cast Aluminum Alloy – Plastics and Rubber – Introduction to FRP, Glass and Carbon Composites– Fibers and Resins – Thermoplastics and Thermoset– Super Alloys. Emerging Trends in Aerospace Materials.		
UNIT II	**MICROMECHANICS**	**9**
Micro mechanics – Mechanics of materials approach, elasticity approach to determine material properties – Fiber Volume ratio – Mass fraction – Density of composites-Generalized Hooke's Law - Elastic constants for anisotropic, orthotropic and isotropic materials. Numerical problems.		
UNIT III	**MACROMECHANICS**	**9**
Macro Mechanics – Stress-strain relations with respect to natural axis, arbitrary axis – Determination of material properties - Experimental characterization of lamina. Numerical problems.		
UNIT IV	**LAMINATION THEORY AND FAILURE ANALYSIS**	**9**
Governing differential equation for a unidirectional lamina and general laminate, angle ply and cross ply laminate, Failure criteria for composites-Failure modes of sandwich panels – Numerical problems.		
UNIT V	**FABRICATION METHODS**	**9**
Various open and closed mould processes, Manufacture of fibers, Types of resins, properties and applications, Netting analysis-Basic design concepts of sandwich construction - Materials used for sandwich construction.		

Text Books:

1. Jones, R.M., "Mechanics of Composite Materials", Taylor & Francis, II Edition, 2000.
2. Madhuji Mukhapadhyay, "Mechanics of Composite Materials and Structures", University Press, 2004

References:

1. Agarwal, B.D., and Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 1995.
2. Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co., New York, 1989.
3. Autar K Kaw, "Mechanics of Composite Materials", CRC Press, 1997.
4. Calcote, L R. "The Analysis of laminated Composite Structures", Von – Nostrand Reinhold Co., New York 1998.
5. Allen Baker, "Composite Materials for Aircraft Structures", AIAA Series, Second Edition, 1999.

BAN602	FINITE ELEMENT METHODS	L	T	P	C
	Total Contact Hours – 60	3	1	0	4
	Prerequisite – Fundamentals of Fluid Mechanics, Structural Mechanics, Aerothermodynamics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with basic numerical methods for analyzing structural components.
2. To develop the understanding of finite element modeling and analysis of one-dimensional system.
3. To develop the understanding of finite element modeling and analysis of two-dimensional system.
4. To develop the understanding of finite element modeling and analysis of three-dimensional system
5. To acquaint with the application of finite element method to aerospace structures.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Compare** various functional approximation methods for structural problems. (**Analyze**)
CO 2	**Calculate** the nodal field variables for one dimensional structure. (**Apply**)
CO 3	**Determine** the stiffness matrix and stress developed in two dimensional structures. (**Apply**)
CO 4	**Calculate** the nodal displacements and stress for axi-symmetric structures. (**Apply**)
CO 5	**Analyze t**he static and dynamic behavior of structures. (**Analyze**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									M			H	
CO 2	H											M	H	
CO 3	H											M	H	
CO 4	H									M			H	
CO 5	H				L								H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION**	**12**

Introduction to FEA - historical background - Review of various approximate methods – Rayleigh Ritz method, Weighted residual methods - Convergence criteria - Fundamentals of Finite Element Modeling – Element Division - Numbering Scheme - Examples of Finite Element Modeling

UNIT II	ONE DIMENSIONAL SYSTEMS	12

Direct stiffness method – spring element- Derivation of the stiffness matrix- Example of a spring assemblage- Assembly of global stiffness matrix-Types of boundary conditions- The Potential energy approach –Examples - bar element – Coordinate systems and Shape Functions- The Potential Energy Approach- Assembly of Global Stiffness Matrix and Load Vector - Boundary Conditions- Temperature Effects – Heat transfer problems in 1D bar and wall

UNIT III	TWO DIMENSIONAL SYSTEMS	12

Beam element – element stiffness – load vector – global stiffness matrix – boundary conditions – solution, Plane truss structure - Coordinate Transformation – Local & Global Coordinate- The Element Stiffness Matrix- Stress Calculations- Temperature Effects –Examples. Plane stress & strain – Constant Strain Triangle (CST)- Potential Energy Approach - Element Stiffness; Force Terms, Stress Calculations- Temperature Effects- Examples

UNIT IV	THREE DIMENSIONAL SYSTEMS	12

Axisymmetric formulation – Element stiffness matrix and force vector – Body forces and temperature effects – Stress calculations – Boundary conditions and Nodal Solution; Mapping and Numerical Integration— Applications to cylinders under internal or external pressures – Rotating discs - Isoparametric Representation- Four noded quadrilateral for axisymmetric problems

UNIT V	APPLICATIONS OF FEM TO AEROSPACE STRUCTURES	12

Linear static analysis - nonlinear static analysis – dynamic analysis-simple harmonic motion-damping consideration-forced vibration - Case studies and problems using software packages and programming.

TEXTBOOKS:

1. Tirupathi. R. Chandrapatha and Ashok D. Belegundu", Introduction to Finite Elements in Engineering", Prentice Hall India, Fourth Edition, 2011.

REFERENCES:

1. Reddy J.N.,"An Introduction to Finite Element Method ",McGraw Hill , 3rd edition, 2005.
2. Krishnamurthy, C.S., "Finite Element Analysis", Tata McGraw Hill, 2nd 2001.
3. Bathe, K.J. and Wilson, E.L., "Numerical Methods in Finite Elements Analysis", Prentice Hall of India, 1985.
4. Rao. S.S., "Finite Element Methods in Engineering", Butterworth and Heinemann, Fourth Edition, 2005.
5. Daryl L. Logan, "A First Course in the Finite Element Method", 5th Edition, PWS Publishing Company, Boston, 2010.

WEBLINKS:

https://nptel.ac.in/courses/112104116/

BAN603	CONTROL ENGINEERING	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Basic Electrical and Electronics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To provide students an understanding on various physical systems, development of flight control system and their important. Also Introduce students the concept of electrical analogies to mechanical system
2. Introduce students the concept of feedback control system, Block diagram reduction technique and signal flow graph
3. To impart knowledge on various signals, system response on respective signals and time response of first order and second order system. Also, to provide knowledge on steady state errors
4. To provide knowledge on concept of stability, Routh Hurwitz criteria for stability. Make student to develop Stability analysis using Bode plot, Root locus technique
5. To provide students brief knowledge on digital control system, Digital controllers. To introduce z- plane and z- transform techniques.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Analyze** mathematical model for mechanical and Electrical systems. **(Analyze)**
CO 2	**Analyze** time response of the system with various test inputs and steady state errors. (**Analyze**)
CO 3	**Analyze** the frequency response of the system and Correlate frequency - time domain specifications. (**Analyze**)
CO 4	**Predict** the stability of the system using Root Locus and Routh Hurwitz stability criterion. (**Evaluate**)
CO 5	**Discuss** the basic components of Digital Control System. **(Understand)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H												H	
CO 2	H									M			H	
CO 3	H												H	
CO 4	H									M			H	

CO 5	H												H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**SYSTEM AND REPRESENTATION**	**9**

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical systems – Transfer function – Block diagram reduction techniques.

UNIT II	**TIME RESPONSE**	**9**

Time response – Time domain specifications – Types of test input- I and II order system response – Error coefficients – Generalized error series – Steady state error- P, PI, PID modes of feedback control – Time response analysis.

UNIT III	**FREQUENCY RESPONSE**	**9**

Frequency response – Bode plot- polar plot – Determination of closed loop response from open loop response – Correlation between frequency domain and time domain specifications.

UNIT IV	**CONCEPT OF STABILITY**	**9**

Characteristics equation – Root Locus construction - Routh Hurwitz stability criterion

UNIT V	**SAMPLED DATA SYSTEMS**	**9**

Sampled data control systems- functional elements – sampling process- z-transforms-properties inverse z transforms – ZOH and First Order Hold process- pulse transfer functions – step response – Introduction to digital control system, Digital Controllers and Digital PID controller

Text Books:

1. OGATO, Modern Control Engineering, Fifth Edition, Prentice-Hall of India Pvt.Ltd., New Delhi, 2010.
2. Azzo, J.J.D. and C.H. Houpis, Feedback control system analysis and synthesis, McGraw-Hill international 3rs Edition, 1998.

References:

1. Kuo, B.C. Automatic control systems, Prentice-Hall of India Pvt.Ltd., New Delhi, 2009.
2. Houpis, C.H. and Lamont, G.B. Digital control Systems, McGraw Hill Book co., New York, U.S.A. 1995.
3. Naresh K Sinha, Control Systems, New Age International Publishers, New Delhi, 1998.

BAN6V1	VALUE ADDED PROGRAM II	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To boost up the technical writing skills of the student
2. To enhance the presentation skills of the student
3. To familiarize the student on attractive resume writing
4. To familiarize the student on Interviews and Group Discussions
5. To advance the problem-solving ability of the student

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Acquire** written communication & its importance in current scenario. (**Understand**)
CO 2	**Develop** Individual or in-group class presentations skills pertaining to the applications of concepts, theories or issues in human development. (**Apply**)
CO 3	**Develop** analytical problem-solving skills. (**Apply**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1								H	H	H				
CO 2								H	H	H				
CO 3								H	H	H				

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	A business letter to a company asking for Quotation.
2	A cover letter, resume, CV for applying a Job.
3	A sample Email communication for the given situation.
4	A model Technical report writing.
5	Group discussion on technical topics.
6	Group discussion on social awareness.

7	Group discussion on current affairs.
8	An activity to develop reasoning skills..
9	An activity to develop analytical skills.
10	An activity to develop critical thinking.

References:

1. Value Added Program II Preparatory Material, Department of Aeronautical Engineering, 2015

BAN6L1	AIRCRAFT SYSTEM LABORATORY	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Aircraft Systems and Instrumentation.				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. Appreciate the need of various aircraft systems, components, accessories and its functions.
2. Understand the importance of aircraft system maintenance and checks.
3. Understand the jacking procedure, levelling and symmetric checks done in the aircraft.
4. Understand the rigging procedure of the aircraft, Understand the operation of Brake torque load test and fuel clogging test
5. Develop the skills of trouble shooting and rectification of snags.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Observe** Aircraft ground operations. (**Imitation**)
CO 2	**Conduct** Checks to ensure the airworthiness of aircraft. (**Precision**)
CO 3	**Refine** the performance of aircraft systems. (**Articulation**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H				H
CO 2	H								H	H				H
CO 3	H								H	H				H

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Aircraft systems observations during Ground run.
2	Aircraft “Mooring” procedure.
3	Aircraft “Symmetry Check” procedure.
4	Procedure to find the centre of gravity of Aircraft.
5	“Study of aircraft fuel system components.

6	“Brake Torque Load Test” on wheel brake units.
7	Maintenance and rectification of snags in hydraulic systems.
8	Rectification of snags in aircraft fuel systems.
9	Tyre pressure checking and Oleo leg pressure procedure.

References:

1. Aircraft Systems Lab Manual, Department of Aeronautical Engineering, 2015

BAN6L2	PROPULSION LABORATORY	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Aerodynamics I & II, Aircraft Propulsion				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. Understand the need of various incompressible circular and non-circular jets.
2. Understand the importance of velocity in supersonic circular and noncircular jets.
3. Understand the determination of wall jet velocity profile in the aircraft.
4. Understand the need of operation of a ramjet engine.
5. Develop the studies of liquid fuel atomizer and pre-mixed flame.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Demonstrate** the various procedures and techniques for the experiments. (**Manipulation**)
CO 2	**Observe** the data using the different measuring devices and techniques. (**Imitation**)
CO 3	**Follow** the mathematical concepts/equations to obtain quantitative results. (**Imitation**)

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H		H	H	
CO 2	H								H	H		H	H	
CO 3	H								H	H			H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Estimation of spread rate in incompressible circular jets.
2	Estimation of spread rate in incompressible non- circular jets.
3	Estimation of centre line velocity decay in supersonic circular jets.
4	Estimation of centre line velocity decay in supersonic non-circular jets.
5	Determination of Wall jet velocity profile.
6	Supersonic Jet Pattern Analysis using Schlieren Technique.
7	Study of free convective heat transfer over a flat plate.
8	Study of forced convective heat transfer over a flat plate.

9	Operation of a subsonic Ramjet engine.
10	Determine the calorific value of Fuel using Bomb Calorimeter.

References:

1. Propulsion Lab Manual, Department of Aeronautical Engineering, 2015

BAN6L3	AIRCRAFT DESIGN PROJECT I	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Fundamentals of Aeronautics and Astronautics, Flight Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To familiarize the student to the different configurations of airplanes and on the comparison of the parameters of different airplanes to arrive at a proper selection of main parameters to design a new aircraft
2. To enable the student to be able to estimate the weight of the aircraft according to the main parameters selected
3. To enable the student to select an appropriate powerplant and estimate the wing geometry according to the results of weight estimation
4. To enable the student to calculate tail dimensions and to estimate the total drag of the airplane and also to perform a stability analysis of the airplane
5. To make the student able to draft a three-view diagram of the designed airplane.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Acquire** the design parameters of various aircrafts necessary for the suitable preliminary design. **(Manipulation)**
CO 2	**Acquire** aerodynamic and geometric parameters for detailed aircraft design. **(Manipulation)**
CO 3	**Integrate** performance and stability parameters for different phases of flight. **(Precision)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H								H	H		H	H	
CO 2	H								H	H		H	H	
CO 3	H								H	H		H	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Comparative configuration study of different types of airplanes.
2	Comparative study on specification and performance details of aircraft.
3	Preparation of comparative data sheets.
4	Work sheet layout procedures.
5	Comparative graphs preparation.

6	Selection of main parameters for the design.
7	Preliminary weight estimations.
8	Selection of main parameters.
9	Power plant selection.
10	Aerofoil selection.
11	Wing and stabilizers selection.
12	Control surfaces designing.
13	Drag estimation.
14	Detailed performance calculations and stability estimates.
15	Preparation of layouts of balance diagram and three view drawings.

References:

1. Aircraft Performance and Design, “John D Anderson”, Tata McGraw Hill Publications
2. Analysis and Design of Flight Vehicle Structures, E F Bruhn
3. CADD and CAA Lab Manuals, Department of Aeronautical Engineering, 2015

BAN701	COMPUTATIONAL FLUID DYNAMICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Numerical methods, Fundamentals of Fluid Dynamics, Aerodynamics I & II				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To make the student be familiar with the various fluid flow analysis technique.
2. To give insight of various computational technique for fluid flow analysis.
3. To acquaint the student with various challenges involved in computational techniques.
4. To get exposure regarding its applications and recent developments.
5. To learn advanced computing techniques like parallel computing, vector computing etc.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Solve** the well posed and ill posed problems. (**Apply**)
CO 2	**Apply** appropriate Finite Difference schemes for solving PDE. (**Apply**)
CO 3	**Analyze** various explicit and implicit methods for a converging solution. (**Analyze**)
CO 4	**Solve** the steady state diffusion and convection problems using finite volume method. (**Apply**)
CO 5	**Identify** suitable turbulence model for fluid flow problems. (**Understand**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									H			H	
CO 2	H											H	H	
CO 3	H												H	
CO 4	H									H		H	H	
CO 5	H											H	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	FUNDAMENTAL CONCEPTS	10
Basics of computational fluid dynamics – Governing equations of fluid dynamics – Substantial Derivative-Non conservative and conservative form of Continuity, Momentum and Energy equations -Well posed and ill posed problems.		
UNIT II	**INTRODUCTION TO FINITE DIFFERENCE METHOD EQUATIONS**	**9**
Classification of PDEs-Reduction of system of second order PDEs-Boundary Conditions-Mathematical behavior of PDEs on CFD-Elliptic, Parabolic, Hyperbolic Equations. Derivation of Finite Difference Equations- Use of Finite Difference method.		
UNIT III	**FINITE DIFFERENCE METHOD FOR DIFFUSION**	**8**
Explicit Methods-The FTCS method, Richardson method, DuFort& Frankel method-Implicit methods-Laasonen method, Crank Nicolson method, Beta formulation. Terminologies in Finite difference equations-Types of error-Error analysis-Consistency analysis-Von-Neuman stability analysis.		
UNIT IV	**FINITE VOLUME METHOD FOR DIFFUSION AND CONVECTION**	**10**
Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems -Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness.		
UNIT V	**TURBULENCE MODELLING**	**8**
Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models. Large eddy simulation- Direct numerical simulation.		

Text Books:

1. Jiyuan Tu, Guan,HengYeoh, Chaoqun Liu, “Computational Fluid Dynamics A Practical Approach” Springer Verlag,2012.
2. J. D.Anderson, “Computational Fluid Dynamics”, McGraw Hill International, 2012.

References:

1. H.K. Versteeg and W. Malalsekera “An Introduction to Computational Fluid Dynamics, The Finite Volume Method”, Longman Scientific & Technical, 2007.
2. T. J. Chung, “Computational Fluid Dynamics”, Cambridge University Press, 2002.
3. C. Hirch, “Numerical Computation of Internal and External Flows” Volume-2, John Wiley and Sons, 1994.

BAS701	SATELLITE TECHNOLOGY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Basic Electricals and Electronics, Mechanics of Machines				
	Course Designed by – Department of Aeronautical Engineering.				

OBJECTIVES

1. To introduce to the student about different types of satellites and their functions
2. To accustom the student to the governing equations of motion and orbital mechanics
3. To acquaint the student to the structure of the satellites and the components used and their thermal protection
4. To familiarize the student about the control system for spacecraft
5. To enable the student to understand about the power system in a satellite and the various bus electronics used

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** the basics of satellites and its system's functions. **(Understand)**
CO 2	**Describe** the fundamentals of orbital mechanics and the coordinate systems. **(Understand)**
CO 3	**Analyze** the satellite structures and thermal protection systems. **(Analyze)**
CO 4	**Express** the attitude controls and its stabilization schemes. **(Understand)**
CO 5	**Summarize** various types of power systems and bus electronics. **(Understand)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H												H	
CO 2	H									H			H	
CO 3	H												H	
CO 4	H									H			H	
CO 5	H												H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION TO SATELLITE SYSTEMS**	**9**

Common satellite applications and missions – Typical spacecraft orbits – Definitions of spin the three axis stabilization- Space environment – Launch vehicles – Satellite system and their functions (structure, thermal, mechanisms, power, propulsion, guidance and control, bus electronics).		
UNIT II	**SATELLITE DYNAMICS**	**9**
Fundamental of satellite dynamics – Time and coordinate systems – Orbit determination and prediction – Orbital maneuvers – GPS systems and application for satellite/orbit determination – Ground station network requirements.		
UNIT III	**SATELLITE STRUCTURES & THERMAL CONTROL**	**9**
Satellite mechanical and structural configuration: Satellite configuration choices, launch loads, separation induced loads, deployment requirements – Design and analysis of satellite structures – Structural materials and fabrication – The need of thermal control: externally induced thermal environment – Internally induced thermal environment - Heat transfer mechanism: internal to the spacecraft and external heat load variations – Thermal control systems: active and passive methods.		
UNIT IV	**SPACECRAFT CONTROL**	**9**
Control requirements: attitude control and station keeping functions, type of control maneuvers – Stabilization schemes: spin stabilization, gravity gradient methods, 3 axis stabilization – Commonly used control systems: mass expulsion systems, momentum exchange systems, gyro and magnetic torque - Sensors star and sun sensors, earth sensor, magnetometers and inertial sensors		
UNIT V	**POWER SYSTEM AND BUS ELECTRONICS**	**9**
Solar panels: Silicon and Ga-As cells, power generation capacity, efficiency – Space battery systems – battery types, characteristics and efficiency parameters – Power electronics. Telemetry and telecommand systems: Tm & TC functions, generally employed communication bands (UHF/VHF, S, L, Ku, Kaetc), their characteristics and applications- Coding Systems – Onboard computer- Ground checkout Systems.		

Text Books:

1. Spacecraft Thermal Control, Hand Book, Aerospace Press, 2002.
2. Introduction Space Flight, Francis J. Hale Prentice Hall, 1994.

References:

1. Analysis and Design of Flight Vehicle Structures, Tri-State off set company, USA, 1980.
2. Space Systems Engineering Rilay, FF, McGraw Hill, 1982.
3. Principles of Astronautics Vertregt. M., Elsevier Publishing Company, 1985

BAN703	HEAT TRANSFER	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Aero – Thermodynamics, Fluid Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student about the fundamentals of heat transfer.
2. To introduce to the student about the heat transfer analysis of conduction problems.
3. To introduce to the student about the heat transfer analysis of convection problems.
4. To introduce to the student about the heat transfer analysis of radiation problems.
5. To help the student understand about the various heat transfer problems in the aerospace applications.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Solve** one dimensional steady state heat conduction problems. (**Apply**)
CO 2	**Estimate** heat transfer rate ofsemi-infinite and infinite solids. (**Evaluate**)
CO 3	**Estimate** heat transfer coefficient for flow over a flat plate and circular pipe. (**Evaluate**)
CO 4	**Calculate** radiative heat transfer of black and gray surfaces. (**Apply**)
CO 5	**Compare** different types of heat exchangers and Evaluate their performance. (**Analyze**)
CO 6	**Solve** heat transfer problems related to aerospace applications. (**Apply**)

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H									M			H	
CO 2	H												H	
CO 3	H									M			H	
CO 4	H												H	
CO 5	H												H	
CO 6	H				L								H	
Category	**Professional Elective (PE)**													

Approval	37th Academic Council Meeting held in May 2015.	
COURSE CONTENT		
(Use of Heat and Mass Transfer Data Book is permitted)		
UNIT I	**FUNDAMENTALS OF HEAT TRANSFER**	**9**
Modes of heat transfer: Conduction – Convection – Radiation – One dimensional steady state heat conduction: Composite Medium – Critical thickness – Effect of variation of thermal Conductivity – Extended Surfaces.		
UNIT II	**CONDUCTION HEAT TRANSFER**	**9**
Unsteady state. Heat Conduction: Lumped System Analysis – Heat Transfer in Semi-infinite and infinite solids – Use of Transient – Temperature charts – Application of numerical techniques.		
UNIT III	**CONVECTIVE HEAT TRANSFER**	**9**
Introduction – Free convection in atmosphere - free convection on a vertical flat plate – Empirical relation in free convection – Forced convection – Laminar and turbulent - convective heat transfer analysis in flows between parallel plates, over a flat plate and in a circular pipe. Empirical relations, application of numerical techniques in problem solving.		
UNIT IV	**RADIATIVE HEAT TRANSFER AND HEAT EXCHANGERS**	**9**
RADIATIVE HEAT TRANSFER: Concept of black body-Intensity of radiation-Laws of Black body Radiation-Radiation from nonblack surfaces- real surfaces – Radiation between surfaces-Radiation shape factors-Radiation shields. HEAT EXCHANGERS: Types-overall heat transfer coefficient- LMTD- NTU method of heat exchanger Analysis.		
UNIT V	**HEAT TRANSFER PROBLEMS IN AEROSPACE ENGINEERING**	**9**
Heat transfer problems in gas turbine, rocket thrust chambers and Re-entry vehicles –numerical problems using MATLAB.		

Text Books:

1. Sachdeva, S.C. “Fundamentals of Engineering, Heat and Mass Transfer, Wiley Eastern Ltd. Fourth Edition, New Delhi, 2012.
2. Holman, J.P., "Heat Transfer ", McGraw Hill Book Co., Inc., New York, TenthEdition.,2009.

References:

1. Sutton, G.P., "Rocket Propulsion Elements ", John Wiley and Sons, 8th Edition.2010.
2. Lienhard J. H., “A Heat Transfer Text Book”, Phlogiston Press, U.S.A., 2008.
3. Ozisik M.N.,”Heat Transfer A Basic Approach”, The McGraw-Hill Company, reprint 1995.

BAN7L1	AIRFRAME AND AERO ENGINE REPAIR LAB	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To know the basic concepts of the maintenance and repair of both piston and jet aero engines and the procedures followed for overhaul of aero engines.
2. To practice the procedures of dismantling of piston engine and jet engine, study of components, accessories of both engines and handling safety precautions.
3.To demonstrate the various inspection methods such as visual inspection dimensional checks and testing methods especially NDT have studied clearly and
4. Ability to inspect surface defects, internal defects, by using dye penetrant method and identification of defects on jet engine components.
5. To know about the reassembly procedure of piston engines, jet engines and starting procedure of piston engines.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Demonstrate** the various procedures and techniques for the Airframe repair (**Manipulation**)
CO 2	**Demonstrate** the procedures and techniques followed in Aero Engine inspection . (**Manipulation**)
CO 3	**Perform** engine dismantling and Assembling **(Precision)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H						H		H	H				H
CO 2	H						H		H	H				H
CO 3	H						H		H	H				H

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Dismantling and reassembling a piston engine.
2	Piston Engine - cleaning, visual inspection, NDT checks.
3	Piston Engine Components - dimensional checks.
4	Study of carburetor, fuel pump, spark plug and ignition system.

5	Jet Engine – identification of components & defects.
6	Engine starting procedures.
7	Aircraft wood gluing by single scarf and double scarf joint point.
8	Fabric and Riveted patch repairs.
9	Tube bending and flaring.
10	Sheet metal forming.

References:

1. Airframe and Aero Engine Repair Lab Manual, Department of Aeronautical Engineering, 2015

BAS7L2	SATELLITE DESIGN LABORATORY	L	T	P	C
	Total Contact Hours – 15	0	0	2	1
	Prerequisite – Basic Electricals and Electronics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES : To help the student to understand the process of satellite design.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	Perform investigation on accessories in nano satellites
CO 2	Design of satellite subsystems
CO 3	Demonstrate the systems in nano satellite

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H				H				H	H		H	H	
CO 2	H				H				H	H		H	H	
CO 3	H				H				H	H		H	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	Introduction – Payload Specifications and Requirements
2	Study of Various Types of Sensors and Accessories in Nano Satellites
3	Cost Estimation and Feasibility Studies
4	Design and Fabrication of a Structural Framework for a Nano Satellites
5	Demonstration of Onboard GPS for recovery
6	Design of Communication System for Data Transfer
7	Design of Thermal Protection System
8	Design of Electro Magnetic Shield
9	Exercise on Selection of Appropriate Power Source and Distribution System
10	Assembling and Packing of Nano Satellite

References:

1. Analysis and Design of Flight Vehicle Structures, Tri-State off set company, USA, 1980.
2. Space Systems Engineering Riley, FF, McGraw Hill, 1982.

BAN7L3	AIRCRAFT DESIGN PROJECT II	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Flight Mechanics, Aircraft Structures I & II, Aerodynamics I & II, Aircraft Design Project I, Computer Aided Design and Analysis				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about the various kinds of loads acting on an airplane and about the detailed structural design of an aircraft
2. To enable the student to be able to estimate the loads on aircraft's wing and fuselage
3. To enable the student to able to perform a detailed design of the aircraft's wing and fuselage components
4. To enable the student to make a detailed design report and a layout of aircraft drawings
5. To enable the student to model the designed aircraft and perform a flow analysis and structural analysis

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Observe** safety flying critical flying load limits. **(Imitation)**
CO 2	**Design** of fuselage and wing structural members. **(Articulation)**
CO 3	**Integrate** all the design parameters to assemble an aircraft. **(Articulation)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H	H	H						H	H		H	H	
CO 2	H	H	H		H				H	H		H	H	
CO 3	H	H	H		H				H	H		H	H	

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

LIST OF EXPERIMENTS

1	V-n diagram for the design study.
2	Gust and maneuverability envelopes.
3	Critical loading performance and final V-n graph calculation.
4	Structural design study – Theory approach.
5	Load estimation of wings.
6	Load estimation of fuselage.
7	Balancing and Maneuvering loads on tail plane, Aileron and Rudder loads.

8	Detailed structural layouts.
9	Design of various components of wings, fuselage.
10	Preparation of a detailed design report with drawings.
11	Preparation of model using computer aided design packages.
12	Preparation of structural analysis report for wing.
13	Preparation of structural analysis report for Fuselage.
14	Preparation of flow analysis report for wing.
15	Preparation of flow analysis report for fuselage.

References:

1. Aircraft Performance and Design, “John D Anderson”, Tata McGraw Hill Publications
2. Analysis and Design of Flight Vehicle Structures, E F Bruhn
3. CADD and CAA Lab Manuals, Department of Aeronautical Engineering, 2015

BAN7P1	Project Phase 1	L	T	P	C
	Total Contact Hours – 30	0	0	4	2
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with theoretical and experimental studies related to aeronautical science.
2. To enable the student to get involved in key area of research in the branch of study.
3. To perform the literature studies and survey that will help in formulating the problem statement.
4. To enable the student to understand the concept of the acquired statement to get the idea about the work.
5. To work according to the acquired idea and to develop report in the form as specified in the guidelines.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Observe** the current market scenario to develop new or modify the existing product. **(Imitation)**
CO 2	**Complete** the concept design of the project. **(Manipulation)**
CO 3	**Point out** the methodology for implementation of design. **(Manipulation)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H							H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H		H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H		H	H	H	H	H	H	H

Category	**Professional Core (PC)**
Approval	**37th Academic Council Meeting held in May 2015.**

The objective of the Project Phase 1 is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Each student shall finally produce a comprehensive report covering background information, literature survey and problem statement. This final report shall be in typewritten form as specified in the guidelines.

BAN8P1	PROJECT WORK	L	T	P	C
	Total Contact Hours – 60	0	0	18	9
	Prerequisite – Basic Subjects, Aerodynamics, Aircraft Structures, Aircraft Propulsion, Flight Mechanics, Engineering Mathematics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVE :

The objective of the project work is to enable the students in convenient groups of not more than 4 members on a project involving theoretical and experimental studies related to the branch of study. Every project work shall have a guide who is the member of the faculty of the institution. Six periods per week shall be allotted in the time table and this time shall be utilized by the students to receive the directions from the guide, on library reading, laboratory work, computer analysis or field work as assigned by the guide and also to present in periodical seminars on the progress made in the project. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion. This final report shall be in typewritten form as specified in the guidelines.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Tell** the value of achieving perfection in projects implementation & completion. **(Imitation)**
CO 2	**Build** the skills, competencies and point of view of designed concepts. **(Naturalization)**
CO 3	**Replicate** professional skills in Presentation, Technical report writing, critical thinking and decision making. **(Manipulation)**

CO / PO MAPPING

L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H							H	H	H	H	H	H	H
CO 2	H	H	H	H	H	H		H	H	H	H	H	H	H
CO 3	H	H	H	H	H	H		H	H	H	H	H	H	H

BAN8C1	COMPREHENSION	L	T	P	C
	Total Contact Hours – Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses up to eighth semester				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To provide a complete review of Aeronautical/Aerospace Engineering topics covered up to eighth semesters, so that a comprehensive understanding is achieved.
2. It will also help students to face job interviews, competitive examination and also to enhance the employment potential.
3. To provide overview of all topics covered and to assess the overall knowledge level up to eighth semester.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Recollect** the core engineering concepts. **(Remember)**
CO 2	**Acquire** Presentation Skills to face job interviews. **(Apply)**
CO 3	**Write** competitive examinations for successful career. **(Apply)**

CO / PO MAPPING
L –LOW, M – MEDIUM, H – HIGH

COs / POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	H													
CO 2	H								H	M				
CO 3	H								H					

BASE01	THEORY OF ELASTICITY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

To make the student understand the elastic behavior of different structural components under various loadings and boundary conditions.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	The student will know about the basic equations of elasticity
CO 2	The student will be able to solve plane stress and plane strain problems using modules
CO 3	The student will know the procedure of coordinates system.
CO 4	The student will understand the procedure of conduct torsion problems
CO 5	The student will get an idea of theory of plates and shells

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	BASIC EQUATIONS OF ELASTICITY	9

Definition of Stress and Strain: Stress - Strain relationships - Equations of Equilibrium, Compatibility equations, Boundary Conditions, Saint Venant's principle - Principal Stresses, Stress Ellipsoid - Stress invariants

UNIT II	PLANE STRESS AND PLANE STRAIN PROBLEMS	9

Airy's stress function, Bi-harmonic equations, Polynomial solutions, Simple two dimensional problems in Cartesian coordinates like bending of cantilever and simply supported beams.

UNIT III	POLAR COORDINATES	9

Equations of equilibrium, Strain - displacement relations, Stress – strain relations, Airy's stress function, Axi – symmetric problems, Introduction to Dunder's table, Curved beam analysis, Lame's, Kirsch, Michell's and Boussinesque problems – Rotating discs

UNIT IV	TORSION	9

Navier's theory, St. Venant's theory, Prandtl's theory on torsion, semi- inverse method and applications to shafts of circular, elliptical, equilateral triangular and rectangular sections. Membrane Analogy.

UNIT V	INTRODUCTION TO THEORY OF PLATES AND SHELLS	9

Classical plate theory – Assumptions – Governing equations – Boundary conditions – Navier's method of solution for simply supported rectangular plates – Levy's method of solution for rectangular plates under different boundary conditions.

Text Books:

1. 1. Timoshenko, S., and Goodier, T.N., "Theory of Elasticity", McGraw–Hill Ltd., Tokyo, 1990.

References:

1. Enrico Volterra & J.H. Caines, "Advanced Strength of Materials", Prentice Hall, New Jersey, 1991.
2. Wng, C.T., "Applied Elasticity", McGraw–Hill Co., New York, 1993.
3. Sokolnikoff, I.S., "Mathematical Theory of Elasticity", McGraw–Hill New York,1978.

BANE02	ROCKETS AND MISSILES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aerodynamics, Aircraft Stability and Control, Avionics, Aircraft Structural Materials and Composites				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVE: To learn about the aerodynamics and stability of Rockets and Missiles.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** combustion mechanisms in solid and liquid propellant rockets**. (Understand)**
CO 2	**Compute** the forces and moments acting on rockets and missile while passing through atmosphere. **(Apply)**
CO 3	**Analyze** the trajectory of rockets and missiles in free space and gravitational field. **(Analyze)**
CO 4	**Summarize** different thrust vector control techniques and stage separation inrockets. **(Understand)**
CO 5	**Apply** suitable materials used for their construction. **(Apply)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**ROCKET SYSTEMS**	**9**

Ignition system in rockets – types of igniters and igniter design considerations – injection system and propellant feed systems of liquid rockets and their design considerations – design considerations of liquid rocket thrust chambers – combustion mechanisms of liquid and solid propellants.

UNIT II	**AERODYNAMICS OF ROCKETS AND MISSILES**	**9**

Airframe components of rockets and missiles – forces acting on a missile while passing through atmosphere – classification of missiles – slender body aerodynamics – method of describing forces and moments – lift force and lateral moment –lateral aerodynamic damping moment – longitudinal moment – drag estimation – body upwash and body downwash in missiles – rocket dispersion.

UNIT III	**ROCKET MOTION IN FREE SPACE AND GRAVITATIONAL FIELD**	**9**

One dimensional and two-dimensional rocket motions in free space and homogeneous gravitational fields – description of vertical, inclined and gravity turn trajectories – determination of range and altitude – simple approximations to burn out velocity and altitude – estimation of culmination time and altitude.

UNIT IV	**STAGING AND CONTROL OF ROCKETS AND MISSILES**	**9**

Design philosophy behind multistaging of launch vehicles and ballistic missiles – multistage vehicle optimization – stage separation techniques in atmosphere and in space – stage separation dynamics and lateral separation characteristics – various types of thrust vector control methods including secondary

injection thrust vector control – numerical problems on stage separation and multistaging.		
UNIT V	**MATERIALS FOR ROCKETS AND MISSILES**	**9**
Selection criteria of materials for rockets and missiles – materials for various airframe components and engine parts – materials for thrust control devices – various adverse conditions faced by aerospace vehicles and the requirement of materials to perform under these conditions.		
Total Periods: 45		
Text Books: 1.Martin J L Turner, Rocket and Spacecraft Propulsion, Springer-Praxis Publishing, 2001 2.Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 7th Edition, 2001		

BASE02	ELECTRIC PROPULSION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Rocket Propulsion				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce basic physics of electric propulsion systems.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	LIST different types of techniques used in electric PROPULSION(Remember)
CO 2	Discuss the properties of ionized gases (Understand)
CO 3	Classify electro thermal propulsive engines (understand)
CO 4	Identify the engines working based on electromagnetic propulsion(Understand)
CO 5	Explain the field electric propulsive systems

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	INTRODUCTION TO THE BASIC PHYSICS OF ELECTRIC PROPULSION SYSTEMS	9

Historical outline - Definition of Electric Propulsion - High impulse Space Missions - Exhaust velocity and specific impulse - Power supply penalty – Electric charges and Electrostatic fields - Currents and Magnetic interactions - Time dependent fields and Electromagnetic wave propagation - Application to ionized gas flows

UNIT II	PHYSICS OF IONIZED GASES	9

Atomic structure of gases - Ionization processes - Particle collisions in an ionized gas - Electrical conductivity of an ionized gas - Kinetic Theory

UNIT III	ELECTRO-THERMAL PROPULSION	9

One dimensional model - Enthalpy of high temperature gases - Frozen flow efficiency - Resistojets - Electrical discharges - Arcjets - Operation and Analysis - Materials - Advantages and Disadvantages

UNIT IV	ELECTROMAGNETIC PROPULSION	9

The Lorentz force - Magnetogasdynamics channel flow - Ideal steady flow acceleration - Thermal and viscous losses - Geometry considerations - Self induced fields - Sources of the conducting gas - The magneto plasmadynamic arc - Magneto- plasmadynamic (MPD) thrusters - Pulsed plasma acceleration - Pulsed plasma thrusters (PPT) - Quasi steady acceleration - Pulsed inductive acceleration - Traveling wave acceleration

UNIT V	**ELECTROSTATIC PROPULSION**	**9**

One dimensional space-charge flows - Basic relationships - The acceleration- deceleration concept - Ion engines - Design and Performance - Hall effect – Hall thrusters - Field emission electric propulsion (FEEP) - Colloid thrusters

TEXTBOOKS:

1. 1. Robert G. Jahn, “Physics of Electric Propulsion”, McGraw-Hill Series, New York, 1968.

REFERENCES:

1. George W. Sutton, “Engineering Magneto hydrodynamics”, Dover Publications Inc., New York, 2005 2. George P. Sutton & Oscar Biblarz, “Rocket Propulsion Elements, John Wiley & Sons Inc., New York, 8th Edition, 2010.

WEBLINKS:

https://engineering.purdue.edu/ProEd/courses/electric-propulsion

https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-522-space-propulsion-spring-2015/

BASE03	LAUNCH VEHICLE AERODYNAMICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Applied Dynamics and Vibrations, Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

To acquaint the students with the fundamentals of the aerodynamics of launch vehicles

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** calibration procedures using various instruments and **Determine**aerodynamic coefficients.(**Apply**)
CO 2	**Explain**various types of high-speed wind tunnels and discuss their design parameters.**(Understand)**
CO 3	**Describe**measurement techniques for flow properties.**(Understand)**
CO 4	**Explain** different flow visualizations technique in subsonic and supersonic regimes.**(Understand)**
CO 5	**Discuss**data acquisition and error analysis.**(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	BASICS OF HIGH SPEED AERODYNAMICS	9

Compressible flows-Isentropic relations-mathematical relations of flow properties across shock and expansion waves-fundamentals of Hypersonic Aerodynamics

UNIT II	BOUNDARY LAYER THEORY	9

Basics of boundary layer theory-compressible boundary layer-shock shear layer interaction -Aerodynamic heating-heat transfer effects

UNIT III	LAUNCH VEHICLE CONFIGURATIONS AND DRAG ESTIMATION	9

Types of Rockets and missiles-various configurations-components-forces on the vehicle during atmospheric flight-nosecone design and drag estimation.

UNIT IV	AERODYNAMICS OF SLENDER AND BLUNTBODIES	9

Aerodynamics of slender and blunt bodies, wing-body interference effects-Asymmetric flow separation and vortex shedding-unsteady flow characteristics of launch vehicles-determination of aero elastic effects.

UNIT V	AERODYNAMIC ASPECTS OF LAUNCHING PHASE	9

Booster separation-crosswind effects-specific consideration sin missile launching-missile integration and separation-methods of evaluation and determination-Stability and Control Characteristics of Launch Vehicle Configuration-Wind tunnel tests –Comparison with CFD Analysis.

Text Books:

1. Anderson, J.D., "Fundamentals of Aerodynamics", McGraw-Hill BookCo. NewYork, 2010. (Units 1 & 2)
2. Chin SS, Missile Configuration Design, McGrawHill, New York, 1961. (Unit 3)
3. Anderson, J.D., "Hypersonic and High Temperature Gas Dynamics", AIAA Education Series.(Units 4 &

References:

1. Nielson, Jack N, Stever, Gutford, "Missile Aerodynamics", McGraw Hill, New York, 1960.
2. Anderson Jr.,D.,–"Modern compressible flows", McGraw-Hill BookCo.,NewYork1999.
3. Charles D.Brown, "Spacecraft Mission Design", AIAA Education Series, Published by AIAA, 1998
4. Elements of Space Technology for Aerospace Engineers", Meyer Rudolph X, Academic Press,1999

BANE06	SPACE MECHANICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about the basic concepts in space mechanics and about the laws that govern motion in space
2. To enable the student to decide on the locations for satellite injections in to the orbit and the various perturbations on satellites in space
3. To acquaint the student about the interplanetary trajectories and to select/design appropriate trajectory according to mission requirements
4. To introduce to the student about the trajectories for ballistic missiles
5. To familiarize the student about the different types of materials used in spacecrafts

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** the basic concepts and laws applicable to attracting bodies in the universe. **(Understand)**
CO 2	**Determine** orbital parameters of Satellite injection and **Discuss** methods of satellite perturbations. (**Apply**)
CO 3	**Explain** two- and three-dimensional interplanetary trajectories and launch of interplanetary spacecrafts. **(Understand)**
CO 4	**Estimate** the ballistic missile trajectory. (**Evaluate**)
CO 5	**Discuss** the materials required for the construction of spacecraft and the impact of space environment on spacecraft materials. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

(Use of Heat and Mass Transfer Data Book is permitted)

UNIT I	BASIC CONCEPTS AND THE GENERAL N- BODY PROBLEM	6

The solar system – reference frames and coordinate systems – terminology related to the celestial sphere and its associated concepts – Kepler's laws of planetary motion and proof of the laws – Newton's universal law of gravitation - the many body problem- Lagrange-Jacobi identity – the circular restricted three body problem – libration points – the general N-body problem two body problems – relations between position and time.

UNIT II	SATELLITE INJECTION AND SATELLITE PERTURBATIONS	12

General aspects of satellite injection – satellite orbit transfer – various cases – orbit deviations due to injection errors – special and general perturbations – Cowell's method and Encke's method – method of variations of orbital elements – general perturbations approach.

UNIT III	INTERPLANETARY TRAJECTORIES	12

Two-dimensional interplanetary trajectories – fast interplanetary trajectories – three dimensional interplanetary trajectories – launch of interplanetary spacecraft – trajectory estimation about the target planet – concept of sphere of influence – Lambert's theorem

UNIT IV	BALLISTIC MISSILE TRAJECTORIES	9

Introduction to ballistic missile trajectories – boost phase – the ballistic phase – trajectory geometry – optimal flights – time of flight – re-entry phase – the position of impact point – influence coefficients.

UNIT V	MATERIALS FOR SPACECRAFT	6

Space environment – peculiarities of space environment – effect of space environment on materials of spacecraft structure – materials required for the construction of space craft – TPS for re-entry space vehicles.

Text Books:

1.Cornelisse, J.W., "Rocket Propulsion and Space Dynamics", J.W. Freeman &Co., Ltd, London, 1982
2. Parker, E.R., "Materials for Missiles and Spacecraft", Mc Graw Hill Book Co. Inc., 1982.

References:

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 7th Edition, 2001.

BASE04	SPACE MECHANICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about the basic concepts in space mechanics and about the laws that govern motion in space
2. To enable the student to decide on the locations for satellite injections in to the orbit and the various perturbations on satellites in space
3. To acquaint the student about the interplanetary trajectories and to select/design appropriate trajectory according to mission requirements
4. To introduce to the student about the trajectories for ballistic missiles
5. To familiarize the student about the different types of materials used in spacecrafts

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss**the basic concepts and laws applicable to attracting bodies in the universe.**(Understand)**
CO 2	**Determine**orbital parameters of Satellite injection and**Discuss** methods of satellite perturbations. (**Apply**)
CO 3	**Explain**two- and three-dimensional interplanetary trajectories and launch of interplanetary spacecrafts. **(Understand)**
CO 4	**Estimate** the ballistic missile trajectory. (**Evaluate**)
CO 5	**Discuss** the materials required for the construction of spacecraft and the impact of space environment on spacecraft materials.**(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

(Use of Heat and Mass Transfer Data Book is permitted)

UNIT I	BASIC CONCEPTS AND THE GENERAL N- BODY PROBLEM	6

The solar system – reference frames and coordinate systems – terminology related to the celestial sphere and its associated concepts – Kepler's laws of planetary motion and proof of the laws – Newton's universal law of gravitation - the many body problem- Lagrange-Jacobi identity – the circular restricted three body problem – libration points – the general N-body problem two body problems – relations

between position and time.

UNIT II	SATELLITE INJECTION AND SATELLITE PERTURBATIONS	12

General aspects of satellite injection – satellite orbit transfer – various cases – orbit deviations due to injection errors – special and general perturbations – Cowell's method and Encke's method – method of variations of orbital elements – general perturbations approach.

UNIT III	INTERPLANETARY TRAJECTORIES	12

Two-dimensional interplanetary trajectories – fast interplanetary trajectories – three dimensional interplanetary trajectories – launch of interplanetary spacecraft – trajectory estimation about the target planet – concept of sphere of influence – Lambert's theorem

UNIT IV	BALLISTIC MISSILE TRAJECTORIES	9

Introduction to ballistic missile trajectories – boost phase – the ballistic phase – trajectory geometry – optimal flights – time of flight – re-entry phase – the position of impact point – influence coefficients.

UNIT V	MATERIALS FOR SPACECRAFT	6

Space environment – peculiarities of space environment – effect of space environment on materials of spacecraft structure – materials required for the construction of space craft – TPS for re-entry space vehicles.

Text Books:

1.Cornelisse, J.W., "Rocket Propulsion and Space Dynamics", J.W. Freeman &Co., Ltd, London, 1982
2. Parker, E.R., "Materials for Missiles and Spacecraft", Mc Graw Hill Book Co. Inc., 1982.

References:

1. Sutton, G.P., "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 7th Edition, 2001.

BANE07	THEORY OF VIBRATIONS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Mechanics, Flight Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To know about the role of Vibrations, vibration analysis and ideas about Aero elasticity in engineering and industry.
2. To make thorough understanding of single degree of freedom, Two degrees of freedom and multi degrees of freedom systems and deriving equations to solve for natural frequency.
3. To understand the Newton second Law, Energy method and know how to use it to solve single degree of freedom systems.
4. To understand the approximate methods to solve vibration engineering problems in Two degree and multi degree of freedom systems.
5. To understand the collars triangle and various aero elastic phenomena in the aircraft structural components.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Compute** the natural frequency of SDOF systems under free and forced vibrations. **(Apply)**
CO 2	**Determine** the frequency of vibrating body using instruments. **(Apply)**
CO 3	**Calculate** principle mode of vibration for MDOF systems. **(Apply)**
CO 4	**Calculate** the natural frequency of continuous systems. **(Apply)**
CO 5	**Calculate** natural frequency of MDOF systems using approximate methods. **(Apply)**
CO 6	**Discuss** the problems in aeroelastic instability and its prevention. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**SINGLE DEGREE OF FREEDOM SYSTEMS**	**9**

Vibration Terminologies, Simple harmonic motion, Newton's law, D'Alembert's principle, Energy methods, Free vibrations, Damped vibrations, Forced Vibrations with and without damping, support excitation,Transmissibility, Vibration measuring instruments.

UNIT II	**MULTI DEGREES OF FREEDOM SYSTEMS**	**9**

Two degrees of freedom systems, static and dynamic couplings, Vibration absorbers, Principal co-ordinates, principal modes and orthogonal condition, Eigen value problems, Lagrangean equations and applications.

UNIT III	CONTINUOUS SYSTEMS	9
Vibration of elastic bodies, vibration of strings, Longitudinal –lateral and Torsional vibrations.		
UNIT IV	**APPROXIMATE METHODS**	**9**
Approximate methods-Rayleigh‟s method, Dunkerleys method, Holzer method, Matrix iteration method		
UNIT V	**ELEMENTS OF AEROELASCTICITY**	**9**
Vibrations due to coupling of bending and torsion, collars triangle, aero elastic instabilities and their prevention, Wing divergence,reversal of aileron control, Flutter and its prevention.		

Text Books:

1. Y.C. Fung, “An Introduction to the Theory of Aeroelasticity”, John Wiley & Sons Inc., New York, 2008.
2. Thomson W T, ‘Theory of Vibration with Application’ - CBS Publishers, 1990.

References:

1. Timoshenko S., Vibration Problems in Engineering – John Wiley and Sons, New York, 1993.
2. Bisplinghoff R.L., Ashely H and Hogman R.L., Aeroelasticity – Addision Wesley Publication, New Tork, 1983.
3. R.H. Scanlan and R.Rosenbaum, “Introduction to the study of Aircraft Vibration and Flutter”, Macmillan Co., New York, 1981.
4. R.D.Blevins, “Flow Induced Vibrations”, Krieger Pub Co., 2001

BANE08	HELICOPTER AERODYNAMICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Aeronautics and Astronautics, Aerodynamics I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint with the basics of rotating wing concept.
2. To understand the concept of hovering flight dynamics.
3. To understand the concept of forward flight dynamics.
4. To analyze the climb and descent performance.
5. To acquaint with ground effect machines.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** various helicopter configurations and their working principles. **(Understand)**
CO 2	**Estimate** the rotor performance parameters for hover flight. **(Evaluate)**
CO 3	**Discuss** the forward flight dynamic performance parameters. **(Understand)**
CO 4	**Discuss** the power required for climb and descent. **(Understand)**
CO 5	**Discuss** the working principle and applications of hovercraft. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION TO ROTATING WING CONCEPT**	**9**

Evolution of helicopter-Helicopter configurations - Configurations based on Torque reaction – Jet rotors and compound helicopters –Methods of Control, rotor blade pitch control, –Collective pitch and and Cyclic pitch – Lead – Lag and flapping hinges.

UNIT II	**HOVERING FLIGHT DYNAMICS**	**9**

Actuator disc theory-Blade Element Theory-ideal twist Induced & profile power-Figure of merit-Thrust and power coefficients-calculation of drag, torque, power-Ground effect in hover- Estimation of hover ceiling.

UNIT III	**FORWARD FLIGHT DYNAMICS**	**9**

Forward flight performance-Parasite drag and Power-Stall limitations-flapping-cyclic Pitch - Autorotation in hover and in forward flight-Dead man’s curve.

UNIT IV	CLIMB AND DESCENT PERFORMANCE	9
Vertical flight-flow patterns surrounding the rotor-Power required in climb and descent- Descent speed calculations-Take-off techniques.		
UNIT V	**GROUND EFFECT MACHINES**	**9**
Types – Hover height, lift augmentation and power calculations for plenum chamber and peripheral jet machines – Drag of hovercraft on land and water –Applications of hovercraft.		

Text Books:

1. Gupta. L "Helicopter Engineering", Himalayan Books, 1996
2. Seddon. J "Basic Helicopter Aerodynamics" AIAA education series, 1990.

References:

1. Gessow A & Myers G.C "Aerodynamics of Helicopter" Mac Millan& Co, 1987
2. Saunders "Dynamics of Helicopter flight", John Wiley, 1975
3. Newman. S "Foundation of Helicopter Flight" Halsted Press, 1994

BANE09	AIRCRAFT ENGINE REPAIR AND MAINTENANCE	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aircraft Propulsion, Basic aircraft maintenance and repair				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To know about the hydraulic, pneumatic, brake and landing gear systems principle, function of components, types and operation of typical system.
2. To study and differentiate conventional and modern aircraft control systems and engine control systems
3. To study about layout, components, functions of fuel, lubrication, starting, ignition systems of piston and jet engines.
4. To understand air-conditioning, air cycle, vapor cycle, oxygen, deicing, anti icing and fire protection systems of aero plane.
5. To study construction and operation of flight, navigation instruments and engine instruments installed in the aero plane.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the inspection and troubleshooting procedure for piston engine components. **(Understand)**
CO 2	**Explain** the inspection and troubleshooting methods of aircraft propeller. **(Understand)**
CO 3	**Discuss** the overhauling and testing procedure for aircraft reciprocating engine. **(Understand)**
CO 4	**Describe** the checks and maintenance procedures followed in gas turbine engines and **select** appropriate trouble shooting technique. **(Understand)**
CO 5	**Discuss** the overhauling procedure of aircraft gas turbine engine. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INSPECTIONS AND TROUBLE SHOOTING OF PISTON ENGINES**	**9**

Need for Inspection, maintenance and trouble shooting in Piston engine – Inspection of all components – Daily and routine checks – Overhaul procedures – Compression testing of cylinders – Special inspection schedules – Engine fuel, control and exhaust systems – Engine mount and super charger – Details of carburetion and injection systems for small and large engines – Ignition system components – Spark plug – Maintenance and inspection check to be carried out.

UNIT II	**INSPECTION AND TROUBLE SHOOTING OF PROPELLER**	**9**

Propeller theory - operation, construction assembly and installation -Pitch change mechanism-Propeller axially system- Damage and repair criteria - General Inspection procedures - Checks on constant speed

propellers - Pitch setting, Propeller Balancing, Blade cuffs, Governor/Propeller operating conditions.

UNIT III	OVERHAULING OF PISTON ENGINES	9

Symptoms of failure - Fault diagnostics - Case studies of different piston engine systems - Rectification during testing equipments for overhaul: Tools and equipments requirements for various checks and alignment during overhauling - Tools for inspection - Tools for safety and for visual inspection - Methods and instruments for non destructive testing techniques - Equipment for replacement of parts and their repair. Engine testing: Engine testing procedures and schedule preparation - Online maintenance

UNIT IV	INSPECTION AND TROUBLE SHOOTING OF GAS TURBINE ENGINE	9

Gas turbine engine inspection & checks – Use of instruments for online maintenance – Maintenance procedures of gas turbine engines – Trouble shooting and rectification procedures – Component maintenance procedures – Systems maintenance procedures. Special inspection procedures: Foreign Object Damage – Blade damage – etc. Gas turbine testing procedures – test schedule preparation – Storage of Engines – Preservation and de-preservation procedures.

UNIT V	OVERHAULING OF GAS TURBINE ENGINES	9

Gas turbine Engine Overhaul procedures – Inspections and cleaning of components – Repairs schedules for overhaul – Balancing of Gas turbine components. Trouble Shooting - Procedures for rectification – Condition monitoring of the engine on ground and at altitude – engine health monitoring and corrective methods.

Text Books:

1. KROES & WILD, “Aircraft Power plants”, 7th Edition – McGraw Hill, New York, 1994.

References:

1. TURBOMECA, “Gas Turbine Engines”, The English Book Store, New Delhi, 1995.
2. UNITED TECHNOLOGIES PRATT & WHITNEY, “The Aircraft Gas turbine Engine and its Operation”, The English Book Store, New Delhi.

BANE10	CRYOGENIC ROCKET PROPULSION	L	T	P	C

	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Thermodynamics, Advanced aerospace propulsion				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student the basics of cryogenic systems and associated processes.
2. To acquaint the student with the propellants used in cryogenic technology.
3. To introduce the various equipment and accessories used in cryogenic rocket propulsion.
4. To familiarize the student to the different flow circuits and parts in a cryogenic engine.
5. To enable the student to understand about various challenges in implementing cryogenic rocket technology.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** the basic components of cryogenic systems. **(Understand)**
CO 2	**Explain** the types of cryogenic propellant used and their storage and handling. **(Understand)**
CO 3	**Discuss** cryo equipment and accessories of cryogenic engine system. **(Understand)**
CO 4	**Discuss** various subsystem involved in the operation of cryogenic engine and their design aspects. **(Understand)**
CO 5	**Discuss** the challenges in cryogenic rocket technology. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION TO CRYOGENIC SYSTEMS**	**9**

Cryogenic systems and basic components, Properties of Cryogenic fluids, Liquefaction systems, ideal, Cascade, Linde Hampson and Claude cycles and their derivatives; Refrigerators: Stirling, Gifford-McMahon cycles and their derivatives. Cryogenic Insulations: Foam, Fibre, powder and Multilayer.

UNIT II	**CRYO FUEL SYSTEMS**	**9**

Cryogenic and semi – cryogenic propellants - Hydrogen - properties, and pretreatment - Liquefaction of hydrogen - Linde, Claude and helium - hydrogen condensing cycles, Ortho-para conversion. Storage and handling of liquefied hydrogen

UNIT III	**CRYO EQUIPMENT AND ACCESSORIES**	**9**

Mechanical and Thermal Properties of engineering materials at low temperatures; Compressors: types, construction and characteristics; Expansion machines:characteristics of reciprocating and turbine expanders, design of J-T expander; Heat exchangers: types, design approaches and selection criteria, Design of cryogenic storage vessels, transfer devices, insulation system, valves; Characteristics of cryogenic pumps, Instrumentation in cryogenic systems

UNIT IV	**CRYOGENIC ENGINES**	**9**

Fluid circuits of various cryogenic engines and semi-cryogenic engines; Design of regeneratively cooled combustion chamber, film cooling, dump cooling, transpiration cooling and radiation cooling. Design of expansion nozzle- characteristics, Design of injector–hydraulic characteristics; Engine thrust and mixture ratio control, Igniters, Propellant tanks.		
UNIT V	**CHALLENGES IN CRYOGENIC ROCKET TECHNOLOGY**	**9**
Problems in storage and handling of cryogenic propellants: safety aspects, Thermal protectionsystems for stage tanks, Thermal stratification- destratification, Geysering effect – geysering elemination, Zero "g" problems – restart mechanism.		
TEXTBOOKS: 1. "A text book of Cryogenics", "Valery V. Kostionk", Discovery Publishing House, 2010. (Units 1 to 3) 2. "Operation of a Cryogenic Rocket Engine", "Kitsche, Wolfgang", Springer Publications, 2011. (Units 4 & 5)		
REFERENCES: 1. "Rocket Propulsion Elements", "Sutton G. P., Bibliarz" **WEBLINKS:** https://nptel.ac.in/courses/112101004/		

BASE08	**SPACE MISSION DESIGN AND ANALYSIS**	**L**	**T**	**P**	**C**

	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite – Introduction to Aerospace Engineering				
	Course Designed by – Department of Aeronautical Engineering				
OBJECTIVE: To make the students learn basics of Space Mission design process					

UNIT I SPACE MISSION DESIGN PROCESS 9

Classification of space missions – Low earth, Medium altitude, Geo-stationary, deep space, space mission life cycle, Mission objectives, identification of mission needs, requirements and constraints, mission characterization, mission evaluation, orbit and constellation design - Space Environment – peculiarities, survivability, selection of spacecraft material - Selection of launch systeM

UNIT II SPACECRAFT SYSTEM ENGINEERING 9

Spacecraft design and sizing, spacecraft payload design, spacecraft subsystems, functional requirement - Propulsion, attitude determination and control, power systems, thermal control, navigation and guidance, telemetry, tracking and command systems, ground system design

UNIT III GENERAL N-BODY PROBLEM 9

Relative Motion in the N-body Problem, Two body problem, orbit determination techniques, Kepler's equation, Lamberts problem - Restricted Three Body Problem – Lagrange points - Jacobi Integral, orbital perturbation

UNIT IV SATELLITE INJECTION AND REENTRY FLIGHT DYNAMICS 9

Launching of a satellite - General aspects of satellite Injections, launch vehicle ascent trajectories, injection parameters and orbital elements, launch vehicle performance, orbit deviations due to injection errors - Reentry flight dynamics – fundamentals of entry flight mechanics, fundamentals of entry heating, entry vehicle design, landing and recovery techniques

UNIT V INTERPLANETARY TRAJECTORIES 9

Patched Conic Approximation - Patched Conic Procedure - Sphere of Influence - Locating the Planets - Design of the Transfer Ellipse - Design of the Departure Trajectory - Design of the Arrival Trajectory - Gravity-Assist maneuver - Establishing Planetary Orbit – Motion of the Earth-Moon System - Time of Flight and Injection Velocity - Lunar Patched Conic

TEXTBOOKS:

1. Cornelisse, J.W, Schoyer H F R, and Wakker K F, "Rocket Propulsion and Space Dynamic", Pitman Publishing Co., 1979

REFERENCES:

1. Peter Fortescue, John Stark, Graham Swinerd, "Spacecraft systems engineering" Wiley 2004
2. Vincent N Pisacane, "Fundamentals of space system design" Oxford University Press, 2005
3. W J Larson and J R Wertz, "Space Mission Analysis and Design", Kluwer Academic Publishers, 1999.
4. Michael Griffin, "Space Vehicle Design", AIAA education series, 2004
5. Ashish Tewari, "Atmospheric and Space Flight Dynamics", Birkhauser, Boston, 2007

WEBLINKS:
https://www.aticourses.com/space_mission_analysys.html

COURSE OUTCOMES	
CO 1	Describe the basic process of space mission design (understand)
CO 2	Classify the various spacecraft systems and their design (understand)
CO 3	Summarize orbit determination techniques and n body problems (understand)
CO 4	Identify the concepts of launching and reentry of vehicles (understand)
CO 5	Develop the trajectory and orbits for space vehicles (apply)

BANE12	**HYPERSONIC AERODYNAMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aerodynamics I & II				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To study the environment around hypersonic vehicles created by strong shock waves.
2. To introduce students to real gas effects caused by high temperature conditions.
3. To study pressure and heat transfer phenomena at the stagnation point of a hypersonic vehicle.
4. To study the distribution of pressure around a general vehicle shape.

5. To study the distribution of heat transfer and skin friction around a general vehicle shape.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Recall** the concepts of compressible flows and differentiate between supersonic and hypersonic flows. **(Remember)**
CO 2	**Discuss** simple solution methods of hypersonic inviscid flows. **(Understand)**
CO 3	**Discuss** the basics of viscous hypersonic flows. **(Understand)**
CO 4	**Describe** the shock shear layer interaction in hypersonic flows. **(Understand)**
CO 5	**Discuss** basics of high temperature flows. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**FUNDAMENTALS OF HYPERSONIC AERODYNAMICS**	**9**

Introduction to hypersonic aerodynamics-differences between hypersonic aerodynamics and supersonic aerodynamics-concept of thin shock layers-hypersonic flight paths – hypersonic similarity parameters-shock wave and expansion wave relations of inviscid hypersonic flows.

UNIT II	**SIMPLE SOLUTION METHODS FOR HYPERSONIC IN VISCID FLOWS**	**9**

Local surface inclination methods-Newtonian theory-modified Newtonian law-tangent wedge and tangent cone and shock expansion methods-approximate theory-thin shock layer theory.

UNIT III	**VISCOUS HYPERSONIC FLOW THEORY**	**9**

Boundary layer equation for hypersonic flow-hypersonic boundary layers-self similar and non self similar boundary layers-solution methods for non self similar boundary layers aerodynamic heating.

UNIT IV	**VISCOUS INTERACTIONS IN HYPERSONIC FLOWS**	**9**

Introduction to the concept of viscous interaction in hypersonic flows-strong and weak viscous interactions-hypersonic viscous interaction similarity parameter-introduction to shock wave boundary layer interactions.

UNIT V	**INTRODUCTION TO HIGH TEMPERATURE EFFECTS**	**9**

Nature of high temperature flows-chemical effects in air-real and perfect gases-Gibb's free energy and entropy-chemically reacting mixtures-recombination and dissociation.

TEXTBOOKS:

1. Ethirajan Rathakrishnan., "High Enthalpy Gas Dynamics", John Wiley and Sons, 2015

REFERENCES:

1. John. D. Anderson. Jr., "Hypersonic and High Temperature Gas Dynamics", AIAA Series, New York, 2006.

2. John. D. Anderson. Jr., "Modern compressible flow with historical perspective", McGraw Hill Publishing Company, New York, 1996.

3. John. T Bertin, “Hypersonic Aerothermodynamics”, published by AIAA Inc.,Washington. D.C., 1994.

WEBLINKS:

https://nptel.ac.in/courses/101103003/

BANE13	**AN INTRODUCTION TO COMBUSTION**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Aerothermodynamics, Aircraft Propulsion				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint with the basics of combustion.
2. To understand the combustion process in aircraft piston engines.
3. To understand the combustion process in gas turbine engines.
4. To understand the combustion process in scramjet engines.

5. To understand the combustion process in rocket engines.	
COURSE OUTCOMES **At the end of Course, Students will be able to,**	
CO 1	**Explain** thermo chemical reaction associated with combustion process and the various parameters affecting burning velocity. **(Understand)**
CO 2	**Select** apt fuel for optimum combustion in piston engines. **(Analyze)**
CO 3	**Compare** the ramjet and gas turbine combustion chamber design. **(Understand)**
CO 4	**Analyze** the challenges associated with supersonic combustion. **(Analyze)**
CO 5	**Discuss** combustion process in solid, liquid propellant rockets and hybrid rockets. **(Understand)**
Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION TO COMBUSTION**	**9**
Thermochemical equations – heat of reaction- first, second and third order reactions – premixed flames – diffusion flames – measurement of burning velocity – various methods – effect of various parameters on burning velocity – flame stability – deflagration – detonation – Rankine-Hugoniot curves – radiation by flames		
UNIT II	**COMBUSTION IN AIRCRAFT PISTON ENGINES**	**9**
Introduction to combustion in aircraft piston engines – various factors affecting the combustion efficiency - fuels used for combustion in aircraft piston engines and their selection – detonation in piston engine combustion and the methods to prevent the detonation		
UNIT III	**COMBUSTION IN GAS TURBINE ENGINES**	**9**
Combustion in gas turbine combustion chambers - recirculation – combustion efficiency, factors affecting combustion efficiency, fuels used for gas turbine combustion chambers – combustion stability – ramjet combustion – differences between the design of ramjet combustion chambers and gas turbine combustion chambers- flame holders types – numerical problems.		
UNIT IV	**COMBUSTION IN SCRAMJET ENGINES**	**9**
Introduction to supersonic combustion – need for supersonic combustion for hypersonic air-breathing propulsion- supersonic combustion controlled by diffusion, mixing and heat convection – analysis of reactions and mixing processes - supersonic burning with detonation shocks - various types of supersonic combustors.		
UNIT V	**COMBUSTION IN ROCKET ENGINES**	**9**
Solid propellant combustion - double and composite propellant combustion – various combustion models – combustion in liquid rocket engines – single fuel droplet combustion model – combustion hybrid rockets		

Text Books:

1.Stephen R turns, ”An Introduction to Combustion”, Tata Mc. Graw Hill Publishing Co., Ltd., New Delhi, Reprint 2013.

2. Lefebvre AG and Dilip R ballal, “Gas Turbine Combustion”, CRC press ,Third Edition, 2010.

References:

1.Warnatz J, Maas U and Dibble RW,”Combustion”,Springer, Fourth Edition,2006.

2. Beer, J.M., and Chiger, N.A. “Combustion Aerodynamics”, Applied Science Publishers Ltd., London, 1981.

3. Sharma, S.P., and Chandra Mohan, “Fuels and Combustion”, Tata Mc. Graw Hill Publishing Co., Ltd., New Delhi, 1987

U18PEAS034	**SOLAR THERMAL ENERGY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite – Nil				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVE: To learn the basics of solar thermal energy

COURSE OUTCOMES	
CO 1	Describe the different techniques to extract energy form the sun (Understand)
CO 2	Discuss the modeling and analysis of solar collectors (Understand)
CO 3	Explain the principle , working methodology for solar concentrators and receivers (understand)
CO 4	Classify solar power generation systems based on efficiencies (understand)
CO 5	Identify the models for thermal storage and cooling systems (Understand)

UNIT I	**INTRODUCTION** **9**

Introductory aspects of non-renewable and renewable energy sources – fundamentals of thermal radiation – resource assessment – solar radiation concepts – solar-earth geometry – models to predict global and daily and hourly irradiation.
UNIT II SOLAR COLLECTION THEORY AND TECHNOLOGIES 8
Heat transfer in solar collectors – basic modeling aspects – steady and dynamic analysis – performance parameters.
UNIT III SOLAR CONCENTRATION SYSTEMS AND RECEIVERS 10
Overview and introduction to concentration optics – concentration ratio and thermodynamic maximum – linear concentration: trough and linear Fresnel – point concentration: dish and tower (central receiver system).
UNIT IV SOLAR POWER GENERATION SYSTEMS 9
Overview and types of systems – components and sub systems – aspects of design and performance prediction.
UNIT V THERMAL STORAGE AND SOLAR COOLING 9
Need for thermal storage – methods – simple models for thermal storage - solar liquid absorption and solar solid sorption technologies
TEXTBOOKS:
1. Boyle, G., Renewable Energy: Power for a Sustainable Future, 3rd ed., Oxford Univ. Press (2012).
REFERENCES:
1. Duffie, J. A. and Beckman, W. A., Solar Engineering of Thermal Processes, John Wiley (1991).
2. Sukhatme, S. P. and Nayak, J. K., Solar Energy: Principles of Thermal Collection and Storage, 3rd ed., McGraw-Hill (2009).
WEBLINKS:
https://solarenergytraining.org/
https://www.edx.org/course/solar-energy

BANE15	NANO SCIENCE TECHNOLOGY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Physics, Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Memorize** the fundamentals of nanoscale materials and the scope of nanoscience and technology. **(Remember)**
CO 2	**Describe** the types of nanostructures and quantum size effects in nanostructures. **(Understand)**
CO 3	**Discuss** the synthesis of nanomaterials and methods of nanomaterials preparation. **(Understand)**
CO 4	**Define** the Mechanical, optical, electronic, magnetic, thermal and chemical properties of nanomaterials. **(Understand)**
CO 5	**List** the physical properties of nanostructured materials. **(Apply)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**
Introduction to nanoscale materials - atomic & molecular size. Scientific revolutions-nanotechnology application area. Scope of nanoscience and technology		
UNIT II	**NANOSTRUCTURES AND DIMENSIONS**	**9**
Classification of nanostructures-zero, one, two and three dimensional nanostructures. Size Dependency inNanostructures-quantum size effects in nanostructures.		
UNIT III	**NANOMATERIAL SYNTHESIS**	**9**
Synthesis of nanomaterials-top down and bottom up approach. Method of nanomaterials preparation – wet chemical synthesis-mechanical grinding-gas phase synthesis.		
UNIT IV	**NANOMATERIAL PROPERTIES**	**9**

Surface to volume ratio. Surface properties of nanoparticles. Mechanical, optical, electronic, magnetic, thermal and chemical properties of nanomaterials. Size dependent properties-size dependent absorption spectra.Shape impact.

UNIT V	PHYSICAL PROPERTIES OF NANOSTRUCTURED MATERIALS	9

Quantum dots-optical properties and applications. Carbon nanotubes-physical properties and applications. Magnetic behavior of nanomaterials. Electronic transport in quantum wires.

TEXTBOOKS:

1. T. Pradeep, "Nano the Essential Nanoscience and Nanotechnology", Tata McGraw hill, 2007.

REFERENCES:

1. Charles P. Poole, Frank J. Owens, "Introduction to Nanotechnology", Wiley Interscience, 2003.
2. Mark A. Ratner, Daniel Ratner, "Nanotechnology: A gentle introduction to the next Big Idea", Prentice Hall
P7R:1st Edition, 2002.
3. J. Dutta, H. Hoffmann, "Nanomaterials", Topnano-21, 2003.
4. Mick Wilson, Kamali Kannargare., Geoff Smith, "Nano technology: Basic Science and Emerging technologies", Overseas Press, 2005.

WEBLINKS:

https://www.edx.org/learn/nanotechnology

BANE16	UNMANNED AERIAL VEHICLE	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Aeronautics and Astronautics, Flight Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** theunmanned aircraft systems and their selection criteria. **(Understand)**
CO 2	**Explain** the aerodynamics and airframe configurations of UAV. **(Understand)**
CO 3	**List** the different types of UAVs and their performance parameters. **(Apply)**
CO 4	**Discuss** the various communication and navigation systems used in UAVs. **(Understand)**
CO 5	**Describe** the concept behind the operation of Horizontal Takeoff and landing of aircrafts. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION TO UNMANNED AIRCRAFT SYSTEMS**	**9**
The Systemic Basis of UAS-System Composition- Conceptual Phase-Preliminary Design-Selection of the System- Some Applications of UAS		
UNIT II	**AERODYNAMICS AND AIRFRAME CONFIGURATIONS**	**9**
Lift-induced Drag - Parasitic Drag - Rotary-wing Aerodynamics - Response to Air Turbulence - Airframe Configurations Scale Effects - Packaging Density – Aerodynamics - Structures and Mechanisms - Selection of power-plants - Modular Construction - Ancillary Equipment		
UNIT III	**CHARACTERISTICS OF AIRCRAFT TYPES**	**9**

Long-endurance, Long-range Role Aircraft – Medium-range, Tactical Aircraft - Close-range/Battlefield Aircraft - MUAV Types - MAV and NAV Types - UCAV - Novel Hybrid Aircraft Configurations - Research UAV		
UNIT IV	**COMMUNICATIONS NAVIGATION**	**9**
Communication Media - Radio Communication - Mid-air Collision (MAC) Avoidance - Communications Data Rate and Bandwidth Usage - Antenna Types NAVSTAR Global Positioning System (GPS) - TACAN - LORAN C - Inertial Navigation - Radio Tracking - Way-point Navigation		
UNIT V	**CONTROL AND STABILITY**	**9**
HTOL Aircraft - Helicopters - OTE/OTE/SPH - Convertible Rotor Aircraft - Payload Control - Sensors –culmon filter- Autonomy		

Text Books:

1. Reg Austin., Unmanned Aircraft Systems, John Wiley and Sons., 2010

References:

1. Milman & Halkias, “Integrated Electronics”, McGraw Hill, 1999.
2. Malvino & Leach, “Digital Principles & Applications”, McGraw Hill, 1986
3. Collinson R.P.G, “Introduction to Avionics”, Chapman and Hall, India, 1996
4.BernadEtikin,“Dynamic of flight stability and control“, John Wiley, 1972

BANE17	BOUNDARY LAYER THEORY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Maths				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint with the fundamentals of viscous flow.
2. To learn the different regime of viscous flow and its solution.
3. To understand the concept of laminar boundary layer.
4. To understand the concept of turbulent boundary layer.
5. To acquaint the concept of compressible boundary layer.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Recall** the fundamental equations of viscous flow and basics of boundary layer theory. **(Understand)**
CO 2	**Discuss** the solutions of simplified viscous flow equations. **(Understand)**
CO 3	**Discuss** theequations and methods used for solving the flow field of laminar boundary layer over a flat plate. **(Understand)**
CO 4	**Describe** the basics of Turbulent boundary layer. **(Understand)**
CO 5	**Describe** the basics of Compressible boundary layer. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	FUNDAMENTAL EQUATIONS OF VICOUS FLOW	9

Fundamental equations of viscous flow, Conservation of mass, Conservation of Momentum-Navier-Stokes equations, Energy equation, Mathematical character of basic equations, Dimensional parameters in viscous flow, Non dimensionalising the basic equations and boundary conditions, vorticity

considerations, creeping flow, boundary layer flow

UNIT II	SOLUTIONS OF VICOUS FLOW EQUATIONS	9

Solutions of viscous flow equations, Couette flows, Hagen-Poisuelle flow, Flow between rotating concentric cylinders, Combined Couette-Poiseuille Flow between parallel plates, Creeping motion, Stokes solution for an immersed sphere, Development of boundary layer, Displacement thickness, momentum and energy thickness.

UNIT III	LAMINAR BOUNDARY LAYER EQUATIONS	9

Laminar boundary layer equations, Flat plate Integral analysis of Karman – Integral analysis of energy equation – Laminar boundary layer equations – boundary layer over a curved body-Flow separation-similarity solutions, Blasius solution for flat-plate flow, Falkner–Skan wedge flows, Boundary layer temperature profiles for constant plate temperature –Reynold's analogy, Integral equation of Boundary layer – Pohlhausen method – Thermal boundary layer calculations

UNIT IV	TURBULENT BOUNDARY LAYEREQUATIONS	9

Turbulence-physical and mathematical description, Two-dimensional turbulent boundary layer equations — Velocity profiles – The law of the wall – The law of the wake – Turbulent flow in pipes and channels – Turbulent boundary layer on a flat plate – Boundary layers with pressure gradient, Eddy Viscosity, mixing length , Turbulence modeling

UNIT V	COMPRESSIBLE BOUNDARY LAYERSEQUATIONS	9

Compressible boundary layer equations, Recovery factor, similarity solutions, laminar supersonic Cone rule, shock-boundary layer interaction

Text Books:

1. White, F. M., Viscous Fluid Flow, McGraw-Hill & Co., Inc., New York, 2005.

References:

1. Schlicting, H., Boundary Layer Theory, McGraw-Hill, New York, 2000.
2. Reynolds, A, J., Turbulent Flows Engineering, John Wiley and Sons, 1980.

BANE18	FATIGUE AND FRACTURE MECHANICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To familiarize the student about the basic terminologies of fatigue and fracture mechanics.
2. To enable the student to grasp the various statistical tools used in fatigue analysis.
3. To acquaint the student about the physical processes taking place during fatigue.
4. To introduce to the student about the mechanism taking place during fracture.
5. To make the student realize about the importance of fatigue and fracture mechanics in aerospace industry.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Calculate** the stress concentration in structures subjected to fatigue loads. (**Analyze**)
CO 2	**Describe** statistical methods to determine the strain in structures under fatigue loading. (**Understand**)
CO 3	**Describe** various stages of failures due to fatigue load. (**Understand**)
CO 4	**Determine** stress in cracked structures. (**Apply**)
CO 5	**Design** composite material-based structures subjected to fatigue load which are fail-safe. **(Create)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	FATIGUE OF STRUCTURES	9

S.N. curves - Endurance limits - Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors - Plastic stress concentration factors - Notched S.N. curves.

UNIT II	STATISTICAL ASPECTS OF FATIGUE BEHAVIOUR	9

Low cycle and high cycle fatigue - Coffin - Manson's relation - Transition life - cyclic strain hardening and

softening - Analysis of load histories - Cycle counting techniques -Cumulative damage - Miner's theory - Other theories.

UNIT III	PHYSICAL ASPECTS OF FATIGUE	9

Phase in fatigue life - Crack initiation - Crack growth - Final Fracture - Dislocations - fatigue fracture surfaces.

UNIT IV	FRACTURE MECHANICS	9

Strength of cracked bodies - Potential energy and surface energy - Griffith's theory - Irwin - Irwin extension of Griffith's theory to ductile materials - stress analysis of "cracked bodies - Effect of thickness on fracture toughness - stress intensity factors for typical geometries.

UNIT V	FATIGUE DESIGN AND TESTING	9

Safe life and Fail-safe design philosophies - Importance of Fracture Mechanics in aerospace structures - Application to composite materials and structures.

TEXTBOOKS:

1. Matej Billy, "Cyclic Deformation and Fatigue of Metals", Elsevier Science Ltd., 1993. (Units 1 to 3)
2. Prashant Kumar, Elements of Fracture Mechanics, Tata McGraw Hill, New Delhi, India, 2009. (Unit 4)
3. Barrois W, Ripely, E.L., "Fatigue of aircraft structure", Pergamon press. Oxford, 1983 (Unit 5)

REFERENCES:

1. K. R.Y. Simha, Fracture Mechanics for Modern Engineering Design, Universities Press (India) Limited, 2001
2. D. Broek, Elementary Engineering Fracture Mechanics, Kluwer Academic Publishers, Dordrecht, 1986.
3. T.L. Anderson, Fracture Mechanics - Fundamentals and Applications, 3rd Edition, Taylor and Francis Group, 2005

WEBLINKS:

https://ocw.mit.edu/courses/materials-science-and-engineering/3-35-fracture-and-fatigue-fall-2003/

BANE19	HIGH TEMPERATURE MATERIALS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To acquaint the student with the fundamentals of creep.
2. To make the student understand about design with creep resistance.
3. To familiarize the student about fracture, cracks and their mechanics.
4. To introduce to the student about oxidation and corrosion in hot environments.
5. To acquaint the student with various super alloys and other materials.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** the effect of creep on the functional life of components. **(Understand)**
CO 2	**Explain** the creep resistance of ductile and brittle materials. **(Understand)**
CO 3	**Describe** the effect of different alloys and oxidesmaterials behaviour from low temperature to high temperature **. (Understand)**
CO 4	**Discuss** the fracture mechanism maps for different alloys and oxides**. (Understand)**
CO 5	**Describe** the process of oxidation and different oxidations prevention techniques. **(Understand)**
CO 6	**Discuss** the various types of super alloys and its strengthening mechanisms. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**CREEP**	**9**

Factors influencing functional life of components at elevated temperatures, definition of creep curve, various stages of creep, metallurgical factors influencing various stages, effect of stress, temperature and strain rate.

UNIT II	DESIGN FOR CREEP RESISTANCE	9
Design of transient creep time, hardening, strain hardening, expressions of rupture life of creep, ductile and brittle materials, Monkman-Grant relationship.		
UNIT III	**FRACTURE**	**9**
Various types of fracture, brittle to ductile from low temperature to high temperature, cleavage fracture, and ductile fracture due to micro void coalescence-diffusion controlled void growth; fracture maps for different alloys and oxides.		
UNIT IV	**OXIDATION AND HOT CORROSION**	**9**
Oxidation, Pilling, Bedworth ratio, kinetic laws of oxidation- defect structure and control of oxidation by alloy additions, hot gas corrosion deposit, modified hot gas corrosion, fluxing mechanisms, effect of alloying elements on hot corrosion, interaction of hot corrosion and creep, methods of combat hot corrosion.		
UNIT V	**SUPER ALLOYS AND OTHER MATERIALS**	**9**
Iron base, Nickel base and Cobalt base super alloys, composition control, solid solution strengthening, precipitation hardening by gamma prime, grain boundary strengthening, TCP phase, embrittlement, solidification of single crystals, Intermetallics, high temperature ceramics.		

Text Books:

1. Raj. R., "Flow and Fracture at Elevated Temperatures", American Society for Metals, USA, 1985.
2. Hertzberg R. W., "Deformation and Fracture Mechanics of Engineering materials", 4th Edition, John Wiley, USA, 1996.
3. Courtney T.H, "Mechanical Behavior of Materials", McGraw-Hill, USA, 1990.

References:

1. Boyle J.T, Spencer J, "Stress Analysis for Creep", Butterworths, UK, 1983.
2. Bressers. J., "Creep and Fatigue in High Temperature Alloys", Applied Science, 1981.
3. McLean D., "Directionally Solidified Materials for High Temperature Service", The Metals Society, USA, 1985.

BASE10	HIGH TEMPERATURE GAS DYNAMICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Compressible Flow				
	Cou10rse Designed by – Department of Aeronautical Engineering				

OBJECTIVE: To enable the student to understand about the basics of high temperature gas flows

COURSE OUTCOMES

CO 1	**Review** the types of compressible flow. (**Understand**)
CO 2	**Explain** the relevance of statistical thermodynamics to high temperature flows(**Understand**)
CO 3	**Determine the collision frequencies of molecules at high temeprature**. (**Apply**)
CO 4	**Describe** the governing equations of the inviscid and viscid high temperature flows. (**Understand**)
CO 5	**Discuss** the diffusion and radiative properties in high temperature flows. (**Understand**)

UNIT I INTRODUCTION 8

Nature of high temperature flows – Chemical effects in air – Real perfect gases – Gibb's free energy and entropy by chemical and non-equilibrium – Chemically reacting mixtures and boundary layers.

UNIT II STATISTICAL THERMODYNAMICS 8

Introduction to statistical thermodynamics – Relevance to hypersonic flow - Microscopic description of gases – Boltzmann distribution – Cartesian function

UNIT III KINETIC THEORY AND HYPERSONIC FLOWS 9

Chemical equilibrium calculation of equilibrium composition of high temperature air – equilibrium properties of high temperature air – collision frequency and mean free path – velocity and speed distribution functions.

UNIT IV INVISCID HIGH TEMPERATURE FLOWS 10

Equilibrium and non – equilibrium flows – governing equations for inviscid high temperature equilibrium flows – equilibrium normal and oblique shock wave flows – frozen and equilibrium flows – equilibrium conical and blunt body flows – governing equations for non-equilibrium inviscid flows.

UNIT V TRANSPORT PROPERTIES IN HIGH TEMPERATURE GAS 10

Transport coefficients – mechanisms of diffusion – total thermal conductivity – transport characteristics for high temperature air – radiative transparent gases – radiative transfer equation for transport, absorbing and emitting and absorbing gases

TEXTBOOKS:

1. "Ethirajan Rathakrishnan", "High Enthalpy Gas Dynamics", John Wiley and Sons, 2017

REFERENCES:

1. John D. Anderson, Jr., Hypersonic and High Temperature Gas Dynamics, McGraw-Hill Series, New York, 1996.
2. John D. Anderson, Jr., Modern Compressible Flow with Historical perspective McGraw Hill Series, New York, 1996.
3. William H. Heiser and David T. Pratt, Hypersonic Air breathing propulsion, AIAA Education Series.
4. John T. Bertin, Hypersonic Aerothermodynamics publishers - AIAA Inc., Washington, D.C., 1994.
5. .K.Bose, High Temperature Gas Dynamics
WEBLINKS:
https://engineering.purdue.edu/ProEd/courses/molecular-gas-dynamics
https://www.iitk.ac.in/new/ae690a

BANE21	SATELLITE TECHNOLOGY	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Basic Electrical and Electronics, Engineering Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about different types of satellites and their functions
2. To accustom the student to the governing equations of motion and orbital mechanics
3. To acquaint the student to the structure of the satellites and the components used and their thermal protection
4. To familiarize the student about the control system for spacecraft
5. To enable the student to understand about the power system in a satellite and the various bus electronics used

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** the basics of satellites and its system's functions. **(Understand)**
CO 2	**Describe** the fundamentals of orbital mechanics and the coordinate systems. **(Understand)**
CO 3	**Analyze** the satellite structures and thermal protection systems. **(Analyze)**
CO 4	**Express** the attitude controls and its stabilization schemes. **(Understand)**
CO 5	**Summarize** various types of power systems and bus electronics. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	INTRODUCTION TO SATELLITE SYSTEMS	9

Common satellite applications and missions – Typical spacecraft orbits – Definitions of spin the three axis stabilization-Space environment – Launch vehicles – Satellite system and their functions (structure, thermal, mechanisms, power, propulsion, guidance and control, bus electronics).

UNIT II	ORBITAL MECHANICS	9

Fundamental of flight dynamics – Time and coordinate systems – Orbit determination and prediction – Orbital maneuvers – GPS systems and application for satellite/orbit determination – Ground station network requirements.

UNIT III	SATELLITE STRUCTURES & THERMAL CONTROL	9

Satellite mechanical and structural configuration: Satellite configuration choices, launch loads, separation induced loads, deployment requirements – Design and analysis of satellite structures – Structural materials and fabrication – The need of thermal control: externally induced thermal environment – Internally induced thermal environment - Heat transfer mechanism: internal to the spacecraft and external heat load variations – Thermal control systems: active and passive methods.

UNIT IV	SPACECRAFT CONTROL	9

Control requirements: attitude control and station keeping functions, type of control maneuvers – Stabilization schemes: spin stabilization, gravity gradient methods, 3 axis stabilization – Commonly used control systems: mass expulsion systems, momentum exchange systems, gyro and magnetic torque - Sensors star and sun sensors, earth sensor, magnetometers and inertial sensors

UNIT V	POWER SYSTEM AND BUS ELECTRONICS	9

Solar panels: Silicon and Ga-As cells, power generation capacity, efficiency – Space battery systems – battery types, characteristics and efficiency parameters – Power electronics. Telemetry and telecommand systems: Tm & TC functions, generally employed communication bands (UHF/VHF, S, L, Ku, Ka etc), their characteristics and applications- Coding Systems – Onboard computer- Ground checkout Systems.

Text Books:

1. Spacecraft Thermal Control, Hand Book, Aerospace Press, 2002.
2. Introduction Space Flight, Francis J. Hale Prentice Hall, 1994.

References:

1. Analysis and Design of Flight Vehicle Structures, Tri-State off set company, USA, 1980.
2. Space Systems Engineering Rilay, FF, McGraw Hill, 1982.
3. Principles of Astronautics Vertregt. M., Elsevier Publishing Company, 1985
4.Space Communications Systems, Richard.F, Filipowsky Eugen I Muehllorf Prentice Hall, 1995
5. Space Vehicle Design, Michael D. Griffin and James R. French, AIAAEducation Series, 1991.

BBA001	PRINCIPALS OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management Studies				

OBJECTIVES

1. To acquaint the student about the management, various types of management function and structure.
2. To give insight of various methods of management of organization and managerial aspects.
3. To acquaint the student with various functions of organizational behavior.
4. To get exposure regarding its applications and recent developments of group dynamics and trade union
5. To help the student understand about the professional ethics and social responsibilities.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Describe** the structure of management andthe functions of each department. **(Remember)**
CO 2	**Understand** business, trading, partnership and methods to overcome pitfalls. **(Understand)**
CO 3	**Analyze** the causes of accidents and the minimization methods. **(Analyze)**
CO 4	**Explain** Organizational behavior and factors influencing personality. **(Understand)**
CO 5	**Define** group, Communication, Barriers and factors contributing effective leadership. **(Understand)**
CO 6	**Summarize** the various ethics to be followed in different workplace. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**MANAGEMENT FUNCTIONS & STRUCTURE**	**9**

Management – Definition – Basic Function – Contribution of Taylor &Fayol. Types of structure – Line, staff, Functional, Committee, and Project & Matrix – Structures. Departmentalization – Centralization – Decentralization – span of control. Management By Objectives –Management By Exception.

UNIT II	**MANAGEMENT OF ORGANISATION**	**9**

Forms of Business / Industrial Ownership – Sole Trader, Partnership, Company, Performance Appraisal – Basic Principles – Pitfalls – Methods to Overcome. Industrial Safety – Causes of Accidents – Cost of Accident – How to minimize Accidents. Plant Layout & Maintenance – Need, Types & Managerial Aspects.

UNIT III	**ORGANISATIONAL BEHAVIOUR**	**9**

OB – Definition – Nature & Scope – Contributing Disciplines – Importance of OB to Managers. Personality – Definition – Theories – Factors Influencing Personality. Motivation – Definition – Theories. Theory X & Y – Transactional Analysis. Morale & Job Satisfaction – Factors Influencing Job Satisfaction.

UNIT IV	GROUP DYNAMICS	9

Group – Definition – Types – Determinants of Group Cohesiveness – Communication – Process – Barriers – Effective Communication. Leadership Theories – Factors Contributing to Effective Leadership – Role of Trade Union in Organizations – Functions of Trade Union – Why Trade Union is required? – Types of Trade Union.

UNIT V	PROFESSIONAL ETHICS	9

Ethics in Workplace – Formulation of Ethics – Managerial Ethics – Managing Ethical Behaviour – Codes of Ethics – Encouraging Ethical Behaviour – Social Responsibility – Spirituality.

Text Books:

1. Gupta C.B., Management Theory and Practice, 14th Edition, Sultan Chand & Sons, 2009.
2. Dr. Prasad L.M., Principle & Practice of Management, 7th Edition, Sultan Chand & Sons, 2008.

References:

1. Aswathappa, Organizational Behaviour, 8th Edition, Himalaya Publishing House, 2010.
2. Dr. Prasad L.M., Organizational Behaviour, 4th Edition, Sultan Chand & Sons, 2008.
3. Harold Koontz, Principles of Management, 1st Edition, Tata McGraw Hill, 2004.

BANE23	AIRPORT MANAGEMENT	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about air transportation, various organizations involved and about the administrative structure in aviation.
2. To accustom the student about economic parameters in an aviation industry.
3. To introduce to the student about the processes involved in airline scheduling.
4. To acquaint the student about the various processes to ensure aircraft reliability.
5. To familiarize the student about the technologies used in aircraft maintenance.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**State** the Role of ICAO and IATA. **(Remember)**
CO 2	**Describe** aircraft forecasting and fleet planning and to do route analysis. **(Understand)**
CO 3	**Summarize** the flight operations and various methods of flight scheduling. **(Understand)**
CO 4	**Discuss** the condition monitoring maintenance and ageing aircraft maintenance production. **(Understand)**
CO 5	**List** the equipment and tools for aircraft maintenance. **(Apply)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	INTRODUCTION	9

Development of air transportation, comparison with other modes of transport – Role of IATA, ICAO – The general aviation industry airline – Factors affecting general aviation, use of aircraft, airport: airline management and organization – levels of management, functions of management, Principles of organization planning the organization – chart, staff departments & line departments.

UNIT II	AIRLINE ECONOMICS	9

Forecasting – Fleet size, Fleet planning, the aircraft selection process, operating cost, passenger capacity, load factor etc. – Passenger fare and tariffs – Influence of geographical, economic & political factors on routes and route selection.

Fleet Planning: The aircraft selection process – Fleet commonality, factors affecting choice of fleet, route selection and Capitol acquisition – Valuation & Depreciation – Budgeting, Cost planning – Aircrew evaluation – Route analysis – Aircraft evaluation.

UNIT III	PRINCIPLES OF AIRLINES SCHEDULING	9

Equipment maintenance, Flight operations and crew scheduling, Ground operations and facility limitations, equipments and types of schedule – hub & spoke scheduling, advantages / disadvantages & preparing flight plans – Aircraft scheduling in line with aircraft maintenance practices.

UNIT IV	AIRCRAFT RELIABILITY	9

Aircraft reliability – The maintenance schedule & its determinations – Condition monitoring maintenance – Extended range operations (EROPS) & ETOPS – Ageing aircraft maintenance production.

UNIT V	TECHNOLOGY IN AIRCRAFT MAINTENANCE	9

Airlines scheduling (with reference to engineering) – Product support and spares – Maintenance sharing – Equipments and tools for aircraft maintenance – Aircraft weight control – Budgetary control.

On board maintenance systems – Engine monitoring – Turbine engine oil maintenance – Turbine engine vibration monitoring in aircraft – Life usage monitoring – Current capabilities of NDT – Helicopter maintenance – Future of aircraft maintenance.

Text Books:

1. FEDRIC J.H., “Airport Management”, 2000.
2. C.H. FRIEND, “Aircraft Maintenance Management”, 2000.

References:

1. Gene Kropf, “Airline Procedures”.
2. Wilson & Bryon, “Air Transportation”.
3. Philip Locklin D, “Economics Of Transportation”.
4. “Indian Aircraft Manual” – Dgca Pub.
5. Alexander T Wells, “Air Transportation”, Wadsworth Publishing Company, California, 1993

BANE24	AEROSPACE BIO – MEDICAL AND LIFE SUPPORT ENGINEERING	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Basic Electrical and Electronics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To apply engineering methods to the study of astronaut adaptation to reduced gravity environments.
2. To use analytical techniques, such as structural idealizations, control theory, electrical circuit, and mechanical system analogs to model astronaut performance.
3. To enable quantitative assessment of the effectiveness of countermeasures.
4. To consider the socio-political implications for advanced technological R&D (e.g., space policy, health policy, international collaboration).
5. To teach, perform outreach, and demonstrate mastery of a chosen engineering concept.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Explain** physiological problems associated with human in space flight. **(Understand)**
CO 2	**Interpret** the equations of motion for human organ systems during space flight. **(Understand)**
CO 3	**Prepare** mechanical and electrical models of human systems for studying astronaut performance. **(Apply)**
CO 4	**Discuss** the life support systems onboard the space flight. **(Understand)**
CO 5	**Discover** life activities and specialties of space suit. **(Apply)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**
Physiological problems associated with human space flight – review of terminologies		
UNIT II	**BIO – MECHANICS IN SPACE FLIGHT**	**9**
Bone Mechanics, Muscle Mechanics, Musculoskeletal Dynamics, and the Cardiovascular System during space flight – their equations of motion		
UNIT III	**BIO – MECHANICAL MODELING**	**9**
Structural idealizations – mechanical and electrical modeling of muscle groups – musculoskeletal groups – joints, electrical analogies to model astronaut performance		
UNIT IV	**LIFE SUPPORT SYSTEMS**	**9**

Onboard environment control systems – waste product management and recycling system – bio – monitoring and control		
UNIT V	**EXTRA – VEHICULAR ACTIVITY**	**9**
Extra Vehicular activity – challenges – specialties of space suits – life support system for EVA		

Text Books:

1. "Space Physiology", Beckers, Frank, Bart Verheyden, Andre E Aubert, Wiley Encylopaedia of Bio – medical engineering, John Wiley and Sons, Inc., 2006
2. "Fundamentals of Space Life Sciences", Diamandis, Peter H. Edited by Susanne Churchill. Malabar, FL: Krieger Publishing Co., 1997.

References:

1. "Human Anatomy Manual: The Skeleton", Gatesville, TX, Medical Plastics Laboratory, Inc., 1997
2. Gomi, Hiroaki, and Mitsuo Kawato. "Equilibrium-Point Control Hypothesis Examined by Measured Arm Stiffness during Multijoint Movement." Science 272, no. 5258 (1996): 117-120.
3. Aubert, A.E., F. Beckers, and B. Verheyden. "Cardiovascular Function and Basics of Physiology in Microgravity." Acta Cardiol 60, no. 2 (2005): 129-151.
4. Flash, T. "The Control of Hand Equilibrium Trajectories in Multi-joint Arm Movements." Biological Cybernetics 57 (1987): 257-274.
5. Bizzi, E., W. Chapple, and N. Hogan. "Mechanical Properties of Muscles: Implications for Motor Control." Trends in Neurosciences 5, no. 11 (1982): 395-398.
6. Shenkman, Boris S., and Inessa B. Kozlovskaya. "Results of Studies of the Effects of Space Flight Factors of Human Physiological Systems and Psychological Status, and Suggestions of Future Collaborative Activities between the NSBRI and the IBMP." Section 3: Muscles. State Research Center of Russian Federation Institute for Biomedical Problems Report, Moscow, 2000.
7. Stuster, J., C. Bachelard, and P. Suedfeld. "The Relative Importance of Behavioral Issues during Long-duration ICE Missions." Aviat. Space Env. Med. (September 2000): A17-A25.
8. Brubakk, A. "Man in Extreme Environments." Aviat. Space Env. Med. (September 2000): A126-A130.

BBA008	TOTAL QUALITY MANAGEMENT	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Designed by – Department of Management Studies				

OBJECTIVES

1. To acquaint the student about the management, various types of management function and structure.
2. To give insight of various methods of management of organization and managerial aspects.
3. To acquaint the student with various functions of organizational behavior.
4. To get exposure regarding its applications and recent developments of group dynamics and trade union
5. To help the student understand about the professional ethics and social responsibilities.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Develop** action plans for customer centric business on the basis of various quality philosophies.**(Apply)**
CO 2	**Apply** total quality management techniques for design and manufacture of highly reliable products and services.**(Apply)**
CO 3	**Develop** statistical process control charts for monitoring the health of manufacturing systems. **(Apply)**
CO 4	**Solve** various industrial problems using Six Sigma and related techniques.**(Apply)**
CO 5	**Establish** quality management system and environmental management system for product and service industries.**(Apply)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	INTRODUCTION	9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II	TQM PRINCIPLES	9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership –Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III	STATISTICAL PROCESS CONTROL (SPC)	9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV	TQM TOOLS	9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA –Stages of FMEA.

UNIT V	QUALITY SYSTEMS	9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System –Elements, Implementation of Quality System, Documentation, Quality Auditing, TS16949, ISO 14000 – Concept, Requirements and Benefits.

Text Books:

1. Dale H. Besterfiled, et al., "Total Quality Management", Pearson Education, Inc.2003. (Indian reprint 2004). ISBN 81-297-0260-6.

References:

1. Evans. J. R. & Lindsay. W,M "The Management and Control of Quality", (5th Edition),South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991.
3. Oakland.J.S. "Total Quality Management", Butterworth Hcinemann Ltd., Oxford,1989.
4. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks",New Age International 1996.
5. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991.

BANE25	INDUSTRIAL AERODYNAMICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Aerodynamics I				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about the aerodynamics taking place in the atmosphere
2. To familiarize the student about the aerodynamics of flow over bluff bodies and its effect on those bodies
3. To acquaint the student about the various mechanisms and procedures by which energy can be extracted from the wind
4. To accustom the student about the aerodynamics of flow around buildings, towers and bridges and also about ventilation and architectural aerodynamics
5. To familiarize the student about the loads on a structure due to wind and the resulting vibrations and their calculations

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Discuss** weather terminology and terrain structure.**(Understand)**
CO 2	**Compare** the flow characteristics over automobile bodies for drag reductions**(Analyze)**
CO 3	**Discuss** the concepts of wind turbines and its applications**(Understand)**
CO 4	**Discuss** the codes of practice and analyze properties of externals and internal flows over buildings **(Understand)**
CO 5	**Discuss** the concepts of induced vibrations and their effect over launch vehicles and civil structures (**Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**ATMOSPHERIC BOUNDARY LAYER**	**9**

Atmospheric circulation-Local winds-Terrain types-Mean velocity profiles-Power law and logarithm law- wind speeds-Turbulence profiles-Roughness parameters-simulation techniques in wind tunnels

UNIT II	**BLUFF BODY AERODYNAMICS**	**9**

Boundary layers and separation-Two dimensional wake and vortex formation-Strouhal and Reynolds numbers-Separation and reattachments-Power requirements and drag coefficients of automobiles-Effects of cut back angle-aerodynamics of trains.

UNIT III	**WIND ENERGY COLLECTORS**	**9**

Horizontal and vertical axis machines-energy density of different rotors-Power coefficient-Betz coefficient by momentum theory.		
UNIT IV	**BUILDING AERODYNAMICS**	**9**
Pressure distribution on low rise buildings-wind forces on buildings-Environmental winds in city blocks-special problems of tall buildings-building codes-ventilation and architectural aerodynamics		
UNIT V	**FLOW INDUCED VIBRATIONS**	**9**
Vortex shedding, lock & effects of Reynolds number on wake formation in turbulent flows- across wind galloping-wake galloping-along wind galloping of circular cables-oscillation of tall structures and launch vehicles under wind loads-stall flutter.		

Text Books:

1. Blevins R.D "Flow Induced Vibrations", Van Nostrand, 1990
2.Sovran, M(ed) "Aerodynamic drag mechanism of bluff bodies and road vehicles",Plenum Press, N.Y, 1990

References:

1. Sachs P "Wind Forces in Engineering", Pergamon Press, 1988
2. Scorer R.S "Environmental Aerodynamics", Ellis Harwood Ltd, England, 1978
3. Calvert N.G "Wind Power Principles", Charles Griffin & Co London, 1979.

BANE26	MECHANICS OF HETEROGENEOUS	L	T	P	C

	MATERIALS				
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engineering Physics I, Fundamentals of Structural Mechanics				
	Course Designed by – Department of Aeronautical Engineering				

OBJECTIVES

1. To introduce to the student about the various heterogeneous materials.
2. To accustom the student to the mechanics of heterogeneous materials.
3. To acquaint the student to the structure of particulate, fibrous and cellular solids and their properties.
4. To familiarize the student about the hierarchical structure in heterogeneous materials.
5. To enable the student to understand various design considerations in application of heterogeneous materials.

COURSE OUTCOMES

At the end of Course, Students will be able to,

CO 1	**Summarize** various material structures and different crystal properties. **(Understand)**
CO 2	**Predict** the stiffness and strength of different directions. **(Understand)**
CO 3	**Memorize** the properties of Particulate, fibrous and cellular solids. **(Remember)**
CO 4	**Define** the various aspects of hierarchical structure of heterogeneous materials. **(Remember)**
CO 5	**Explain** the eutectic structure and gradient effects. **(Understand)**

Category	**Professional Elective (PE)**
Approval	**37th Academic Council Meeting held in May 2015.**

COURSE CONTENT

UNIT I	**INTRODUCTION**	**9**

Material heterogeneity. Survey of laminated, fibrous, particulate, cellular and porous, platelet structures. Single crystal properties and polycrystal properties. Heterogeneity of biological materials and designed heterogeneity. Strength of fibers. Constituent materials. Griffith's experiments, stress concentrations. Concept of equivalent homogeneity. Micro and nanotructures.

UNIT II	**STRUCTURE OF HETEROGENEOUS MATERIALS**	**9**

Unidirectional fibrous media. Bounds on physical properties: Voigt and Reuss bounds; Hashin-Shtrikman. Prediction of stiffness and strength for different directions. Symmetry and physical properties. Crystal symmetry classes. Generalized Hooke's law of elasticity. Modulus and compliance matrices. Anisotropy and dielectric and piezoelectric properties. Thermal expansion. Experimental methods.

UNIT III	**PARTICULATE, FIBROUS AND CELLULAR SOLIDS**	**12**

Structure. Particulate materials. Dental composites, metal matrix composites, asphalt. Toughened polymers via compliant inclusions. Stiffness vs. volume fraction. Self healing polymers. Attainment of the Hashin-Shtrikman bounds. Unidirectional fibrous materials; stiffness, strength, thermal expansion. Fibrous solids with short-fibers. Nano-tubes as fibers. Platelet reinforcement. Shear lag model. Laminates. Polycrystalline aggregates. Piezoelectric composites. Metal matrix composites. Structure property relations of cellular solids. Lightweight cellular solids. Foams, structural honeycombs, sandwich structures. Polymer lattice structures. Syntactic foams. Poisson's ratio of composites and foams. Applications.

UNIT IV	HIERARCHICAL STRUCTURE	6

Structure within structure. Bone, wood, tendon and other materials of biological origin. Fibrous aspects of bone structure. Tendon and ligament as fibrous biological materials. Biological cellular solids. Cellular architecture of bone, wood, bamboo.

UNIT V	DESIGN CONSIDERATIONS	9

Fracture mechanics, stress concentrations, free-edge effects. In situ composites; eutectic structure. Gradient effects. Role of microstructure size. Generalized continuum models; Cosserat elasticity. Toughness: empirical criteria; causal mechanisms. Spongy impact absorber, bone cement.

Text Books:

1. L. J. Gibson, and M. F. Ashby, Cellular Solids, Cambridge, (1999).
2. M. F. Ashby and D. R. H. Jones, Engineering Materials, 2nd ed. Butterworth, (1998).

References:

1. J. F. Nye, Physical Properties of Crystals, Oxford, (1976).
2. B. D. Agarwal and L. J. Broutman, Analysis and Performance of Fiber Composites, J. Wiley, 2nd ed. (1990).

REGULATIONS 2015 (CBCS)

B.TECH GENETIC ENGINEERING

CURRICULUM – SYLLABUS

SEMESTER I

SL. NO	SUB. CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY							
1.	BEN101	HS	English - I	3	0	0	3
2.	BMA101	BS	Mathematics - I	3	0	0	3
3.	BPH101	BS	Engineering Physics - I	3	0	0	3
4.	BCH101	BS	Engineering Chemistry - I	3	0	0	3
5.	BBT101	ES	Cell Biology	2	0	0	2
6.	BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
7.	BSS101	HS	Personality Development	1	1	0	2
8.	BCE101	ES	Basic Civil Engineering	2	0	0	2
9.	BME103	ES	Basic Mechanical Engineering	2	0	0	2
PRACTICAL							
10.	BCM1L1	ES	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	3	1
11.	BPC1L1	BS	Physics and Chemistry Laboratory#	0	0	3/3	0
	BSS1L4/BSS1L5/BSS1L6	HS	NCC/ NSS/ NSO (to be conducted during weekends)				1
For a given program, Total Instruction Periods per week=32; Total No. of Credits = 26							

Laboratory Classes on alternate weeks for Physics and Chemistry. The Lab examinations will be held only in the second semester (including the first semester experiments also)

SEMESTER II

SL. NO	SUB. CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY							
1.	BEN201	HS	English - II	3	1	0	3
2.	BMA201	BS	Mathematics - II	3	1	0	3
3.	BPH201	BS	Engineering Physics - II	3	0	0	3
4.	BCH201	BS	Engineering Chemistry – II	3	0	0	3
5.	BCS201	ES	Internet Programming	2	0	0	2
6.	BFR 201*	HS	Foreign / Indian Language	3	0	0	3
7.	BBT201	ES	Principles of Genetics	2	0	0	2
8.	BEE201	ES	Basic Electrical and Electronics Engineering	2	0	0	2
PRACTICAL							
9.	BCS2L1	ES	Internet Practices Lab	0	0	3	1
10.	BCS2L2	ES	Computer Practices Lab	0	0	3	1
11.	BEE2L1	ES	Basic Electrical and Electronics Engineering Practices Laboratory	0	0	3	1
12.	BPC2L1	BS	Physics and Chemistry Laboratory#	0	0	3/3	1
	BSS1L7	HS	Yoga (to be conducted during weekends)				1
For a given program, Total Instruction Periods per week=35; Total No. of Credits = 26							

*Any one of the following courses: BFR201 – French, BGM201-German, BJP201 – Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 – Tamil

SEMESTER – III

SUB.CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY						
BBR 301	PC	Enzyme Technology	4	0	0	4
BBR 302	PC	Principles of Genetic Engineering	4	0	0	4
BBR 303	PC	Immunology	3	0	0	3
BBR 304	PC	Microbiology	3	0	0	3
BBR 305	PC	Principles of Biochemistry	4	0	0	4
BMA 302	BS	Biostatistics	4	0	0	4
PRACTICAL						
BBR 3L1	PC	Microbiology Laboratory	0	0	3	2
BBR 3L2	PC	Biochemistry Laboratory	0	0	3	2
BBR 3S1	PR	Technical Seminar – I	0	0	2	1
Total No. of Contact Hours: 30					**Total No. of Credits: 27**	

SEMESTER – IV

SUB.CODE	CATEGORY	Course	L	T	P	C
THEORY						
BBR 401	PC	rDNA Technology	4	0	0	4
BBR 402	PC	Molecular Biology	3	0	0	3
BCE 406	HS	Environmental studies	3	0	0	3
BBR 404	PC	Genomics and Proteomics	4	0	0	4
BBR 405	PC	Bio-organic chemistry	4	0	0	4
BBR 406	PC	Basics of Bio-informatics	4	0	0	4
PRACTICAL						
BBR 4L1	PC	Molecular Biology Lab	0	0	3	2
BBR 4L2	PC	Cell Biology Lab	0	0	3	2
BBR 4S2	PR	Technical Seminar-II	0	0	2	1
Total No. of Contact Hours: 30					**Total No. of Credits: 27**	

SEMESTER – V

SUB.CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY						
BBR 501	PC	Industrial Biotechnology	4	0	0	4
BBR 502	HS	Research Methodology	4	0	0	4
BBR 503	PC	Cytogenetics	3	0	0	3
BBR 504	PC	Virology	4	0	0	4
BBR 505	PC	Plant tissue Culture	4	0	0	4
	PE	Core Elective – I	3	0	0	3
PRACTICAL						
BBR 5L1	PC	Immunology Laboratory	0	0	3	2
BBR 5L2	PC	Plant Genetic Engineering Laboratory	0	0	3	2
BBR 5P2	PR	Mini Project	0	0	3	1
BBR 5C1	PR	Comprehension-I	0	0	0	1

Total No. of Contact Hours: 30 **Total No. of Credits: 28**

SEMESTER – VI

SUB.CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY						
BBR 601	PC	Bio-Pharmaceutical Technology	3	0	0	3
BBR 602	PC	Genes and Diseases	4	0	0	4
BSS601	HS	Value Education and Professional Ethics	3	0	0	3
BBR 6E2	PE	Core Elective – II	3	0	0	3
BBR 6E3	NE	Non-Major Elective – I	3	0	0	3
BBR 6E4	OE	Open Elective – I	3	0	0	3
PRACTICAL						
BBR 6L1	PC	Gene Cloning Laboratory	0	0	3	2
BBR 6L2	PC	Bioinformatics Laboratory	0	0	3	2

Total No. of Contact Hours: 28 **Total No. of Credits: 25**

SEMESTER – VII

SUB.CODE	CATEGORY	COURSE TITLE	L	T	P	C
		THEORY				
BBR 701	PC	Biosafety, Bioethics, IPR & Patents	4	0	0	4
BBR 702	PC	Animal Cell Culture and Transgenic Technology	4	0	0	4
BBR 703	PC	Gene Therapy	3	0	0	3
BBR 704	PC	Stem Cell Biology	3	0	0	3
BBR 7E5	PE	Core Elective – III	3	0	0	3
BBR 7E6	NE	Non Major Elective – II	3	0	0	3
		PRACTICAL				
BBR 7L1	PC	Genome Analysis Laboratory	0	0	3	2
BBR 7L2	PC	Animal Cell Culture Laboratory	0	0	3	2
BBR 7P1	PR	Term Paper	0	0	4	2
BBR 7V1	PR	Implant Training	0	0	0	1

Total No. of Contact Hours: 30 **Total No. of Credits: 27**

SEMESTER – VIII

SUB CODE	CATEGORY	COURSE TITLE	L	T	P	C
		THEORY				
BBR 8E7	NE	Non Major Elective –III	3	0	0	3
BBR 8E8	OE	Open Elective –II	3	0	0	3
		PRACTICAL				
BBR 8C1	PR	Comprehension II	0	0	0	1
BBR8P1	PR	Project work	0	0	18	9

Total No. of Contact Hours: 24 **Total No. of Credits: 16**

Grand Total Credits: 198

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No.	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	7	8	-	3	7	-	3	-	28	12.62
2	Basic Sciences (BS)	9	10	4	-	-	-	-	-	23	13.13
3	Engineering Sciences (ES)	10	8	-	-	-	-	-	-	18	9.09
4	Professional Core (PC)	-	-	22	23	15	14	15	-	89	44.94
5	Core Electives (CE)	-	-	-	-	3	3	3	-	09	4.54
6	Non major Electives (NE)	-	-	-	-	-	3	3	3	09	4.54
7	Open Electives (OE)	-	-	-	-	-	3		3	06	3.03
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	1	1	2	-	3	9	16	8.08
	Total Credit	26	26	27	27	27	23	27	15	198	100%
	Total Contact Hour	32	35	30	30	30	25	32	24	238 hours	

LIST OF ELECTIVES

CORE ELECTIVE (CE) – I

ELECTIVE CODE	ELECTIVE SUBJECTS	L	T	P	C
BBR 001	Human Genetics	3	0	0	3
BBR 002	Animal Tissue engineering	3	0	0	3
BBR 003	Classical and molecular Plant breeding	3	0	0	3

CORE ELECTIVE (CE) – II

ELECTIVE CODE	ELECTIVE SUBJECTS	L	T	P	C
BBR 004	Cancer Biology	3	0	0	3
BBR 005	Agri, Veterinary and Medical informatics	3	0	0	3
BBR 006	Genetic Engineering of Plants	3	0	0	3

CORE ELECTIVE (CE) – III

ELECTIVE CODE	ELECTIVE SUBJECTS	L	T	P	C
BBR 007	Molecular Medicine	3	0	0	3
BBR 008	Microbial Genetics	3	0	0	3
BBR 009	Herbal drugs and genomics	3	0	0	3

NON-MAJOR ELECTIVE (NE) – I

ELECTIVE CODE	ELECTIVE SUBJECTS	L	T	P	C
BBR 010	Pharmacogenomics	3	0	0	3
BBR 011	Protein engineering	3	0	0	3
BBR 012	Bioconfinement of genetically modified organisms	3	0	0	3

NON MAJOR ELECTIVE (NE) - II

ELECTIVE CODE	ELECTIVE SUBJECTS	L	T	P	C
BBI 506	Molecular evolution and Phylogeny	3	0	0	3
BBR 013	Bioprocess Engineering	3	0	0	3
BBR 014	Food process technology	3	0	0	3

NON MAJOR ELECTIVE (NE) - III

ELECTIVE CODE	ELECTIVE SUBJECTS	L	T	P	C
BBR 015	Metabolism and Metabolomics	3	0	0	3
BBR 016	Industrial Microbiology	3	0	0	3
BBR 017	Plant Physiology	3	0	0	3

OPEN-ELECTIVE (OE) -I

ELECTIVE CODE	ELECTIVE SUBJECTS	L	T	P	C
BBA001	Principles of Management and Organizational Behaviors	3	0	0	3
BBI 608	Biophysics	3	0	0	3
BBM 001	Biomedical Engineering	3	0	0	3

OPEN-ELECTIVE (OE) – II

ELECTIVE CODE	ELECTIVE SUBJECTS	L	T	P	C
BBR 018	Bioreactor Design	3	0	0	3
BBR 019	Developmental Biology	3	0	0	3
BBI 404	Food and medical microbiology	3	0	0	3

BBR 301	ENZYME TECHNOLOGY	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Molecular Biology, Biopharmaceutical technology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

1. To understand the basics of enzymes and classification and enzyme kinetics
2. To study the production, purification and characterization of enzymes
3.To study the Instrumental Techniques In Enzymatic Analysis

COURSE OUTCOMES (COs)

CO1	Understand the basics of enzymes, nomenclature and classification
CO2	Apply the knowledge to derive the kinetics for enzymes
CO3	Learn and apply the different techniques for immobilization of enzymes and kinetics
CO4	To gain knowledge in various enzyme kinetics
CO5	Study and apply the knowledge on design of enzyme reactors
CO6	Discuss the applications of enzymes in Instrumental Techniques In Enzymatic Analysis

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			

4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016

UNIT I: INTRODUCTION 12

Structure and functions of Enzymes. Classification of enzymes. Specificity of enzyme action – monomeric and oligomeric enzymes,-Factors modifying enzyme activity, biotechnological applications of enzymes and applications of enzymes in various industries.

UNIT II: CHEMICAL NATURE OF ENZYME CATALYSTS 12

Structural Components of Enzymes – Structure, apoenzymes, prosthetic group, cofactors, Mechanisms of reactions catalysed by enzymes – Metal activated enzymes – metalloenzymes – involvement of coenzymes.

UNIT III: FREE AND IMMOBILISED ENZYME KINETICS 12

Classification of enzymes, Kinetics of single substrate reactions, turnover number, Enzyme Inhibition, pre steady state kinetics, Kinetics of multi-substrate reactions, Allosteric enzymes – The Monad – Changeux – Wymanmodel (MCW) and The Koshland – Nemethy – Filmer (KNF) model, Temperature and pH effects on enzyme activity. Methods of immobilization of enzymes, Kinetics of immobilized enzymes – Effects of external mass transfer and intra – particle diffusion.

UNIT IV: EXTRACTION AND PURIFICATION OF ENZYMES 12

Methods of production of enzymes, Extraction of Enzymes –soluble enzymes – membrane bound enzymes –Nature of extraction medium – purification of enzyme – criteria of purity **–** Determination of molecular weight of enzymes.

UNIT V: INSTRUMENTAL TECHNIQUES IN ENZYMATIC ANALYSIS 12

Principles – Manometry – Spectrophotometry – Spectrofluorimetry – Electrochemical methods – Enthalpimetry– Radio chemical methods – Automation in enzymatic analysis.

Total contact hours: 60

REFERENCE BOOKS

1. Principles of Fermentation technology – Stanbury, 2nd edition, 2003
2. Enzyme technology by Martin F. Chaplin, C. Bucke
3. Methods in Enzymology vol. 152 by S.L. Berger and A.R. Kimmel

TEXT BOOKS

1. Enzymes by Trevor palmer
2. Enzymes by Robert A. Copeland, 2nd edition.

http://www.biologydiscussion.com/enzymes/enzyme-technology/enzyme-technology-application-and-commercial-production-of-enzymes/10185

BBR 302	**PRINCIPLES OF GENETIC ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Recombinant DNA technology, Principles of Genetics				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

1. To learn various types of vector-host systems and steps in creating a recombinant DNA molecule
2. To gain knowledge on various recombinant DNA techniques and their applications.

COURSE OUTCOMES (COs)

CO1	Understand the steps in Biopharmaceutical industries
CO2	Explain the features of Transformation and selection of recombinants
CO3	Characterization of recombinant proteins
CO4	Chromosome engineering, Gene Therapy, Strategies of gene delivery, gene replacement/ augmentation
CO5	Role of Genetic Engineering in Forensic Medicine
CO6	Understand the steps in mutational studies

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			

4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016

UNIT I: SCOPE OF GENETIC ENGINEERING 12

Basics of Genetic Engineering. Milestones in Genetic Engineering, Bio safety issues – Genetic engineering guidelines. Molecular Tools in Genetic Engineering – Medical Genetics, Gene Therapy, Human Genome Project, Plant Genetic Engineering. Applications of Genetic Engineering in Biopharmaceutical industries. Recombinant DNA technology. Restriction mapping of DNA fragments and Map construction, Nucleic acid Amplification (PCR analysis) and its applications. Real time PCR.

UNIT II: GENE CLONING STRATEGIES 12

Restriction enzymes and DNA Modifying enzymes (Polymerases, Reverse Transcriptase, Ligases, Alkaline phosphatase, Terminal deoxynucleotide transferases, Nucleases - S1 nucleases etc.). Gene Cloning vectors (Plasmids, Bacteriophages, Cosmids, Phagemids, Artificial chromosomes), Gene Cloning strategies, Transformation and selection of recombinants; Construction of DNA libraries (Genomic library and cDNA library preparations –mRNA enrichment, reverse transcription, use of linkers and adaptors); and their screening; Alternative strategies of Gene cloning; Cloning of differentially expressed genes. Site directed Mutagenesis and Protein Engineering.

UNIT III: GENE EXPRESSION 12

Basics of Gene expression – hybridization techniques, Northern blot analysis, Primer extension, S1 mapping, RNAase protection assays, Reporter assays), Nucleic acid microarrays. Gene expression in bacteria and Yeast, expression in insects and insect cells, expression in mammalian cells, expression in plants – characterization of recombinant proteins, stabilization of proteins; Phage display, Yeast Two- and three Hybrid system.

UNIT IV: TRANSGENIC TECHNOLOGY 12

Principles of Transgene technology. Scope of Transgenic technology. Gene tagging (T-DNA tagging and Transposon tagging) in gene analysis (identification and isolation of gene), Transgenic and Gene Knockouts Technologies - Targeted gene replacement, Chromosome engineering, Gene Therapy, Strategies of gene delivery, gene replacement/ augmentation, gene correction, gene editing and silencing, Transgenic plants.

UNIT V: GENONIMCS AND FORENSICS 12

Role of Genetic Engineering in Forensic Medicine. Nucleic acid sequencing, Structure and functions of Enzymes.NGS, Genetic defects and detection; DNA profiling.

Total contact hours: 60

TEXT BOOKS:

1.Gene Cloning and DNA Analysis, An Introduction. T.A.Brown, Wiley –Blackwell publication, 2010.

2. Principles of Gene Manipulation and Genomics, Sandy B. Primrose, Richard M. Twyman, Blackwell Scientific Publication, 2009

REFERENCE BOOKS:

1. Molecular and Cellular Methods in Biology and Medicine, P.B. Kaufman, W. Wu. D. Kim and L.J; Cseke, CRC Press, Florida.

2. Molecular Cloning: a Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.

3. DNA Cloning: a Practical Approach, .M. Glover and B.D. Hames, IRL Press, Oxford.

4. Methods in Enzymology vol. 152, Guide to Molecular Cloning Techniques, S.L. Berger and A.R. Kimmel, Academic Press, Inc. San Diego.

5. Methods in Enzymology Vol 185, Gene Expression Technology, D.V. Goeddel, Academic Press, Inc., San Diego.

http://www.biotecharticles.com/

BBR 303	**IMMUNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Recombinant DNA technology, Principles of Genetics				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

1. To learn about the general concepts of immune system and immune organs
2.To understand the properties of antigens and antibodies and the concept of antigen-antibody interactions
3.To know about the mechanisms related to cell mediated immunity, complement system, Hypersensitivity and transplantation immunology.

COURSE OUTCOMES (COs)

CO1	Outline the general concepts of immune system and describe the cells and organs of the immune system
CO2	To understand molecular techniques of immunogens
CO3	Basic structures of Immunoglobulins – Ig classes and biological activities,

CO4	Antibody Affinity and activity – Antibody specificity - Precipitation reactions
CO5	Explain the concept of Structure and functions of T and B lymphocytes
CO6	Illustrate the Basics of Immune disorders and inflammation.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: OVERVIEW OF THE IMMUNE SYSTEM 9

Types of Immune responses. Innate Immunity, adaptive immunity, comparative immunity cells and organs of the immune system – Antigens. Cellular immunity.HLA antigens, MHC antigens

UNIT II: IMMUNOGLOBULIN STRUCTURE AND FUNCTIONS 9

Basic structures of Immunoglobulins – Immunoglobulin classes and biological activities, Antigenic determinants on Ig, Plasma cells and B Cell receptors, Monoclonal antibodies – cytokines – complement system

UNIT III: ANTIGEN – ANTIBODY INTERACTIONS 9

Antibody Affinity and activity – Antibody specificity - Precipitation reactions- agglutination reactions-Immunological network, Immunological techniques, Radio immunoassay- ELISA Western blotting, Immunoprecipitation, Immunofluroscence, Immunoelectron microscopes, Flow cytometers -MHC Antigen processing & presentations.

UNIT IV: T & B CELL MATURATION, ACTIVATION & DIFFERENTIATION 9

Structure and functions of T and B lymphocytes. Bone marrow and Hematopoeitic stem cells. T cell receptor, T Cell maturation, Dendritic cells, Lymphocyte activation and differentiation of B cells, activation and differentiation of cell mediated immune responses.

UNIT V: IMMUNE SYSTEM IN HEALTH & DISEASE 9

Basics of Immune disorders and inflammation, hypersensitive reactions, immune responses to infectious diseases, vaccines. Cancer immunology. Immunoinformatics, Clinical Immunology, Immunological databases.

Total contact hours: 45

TEXT BOOKS:

1. Kuby, Immunology by Richard A. Golds by Tharmas J. kindt fourth edition, 2000 and Barbara Osborne. W.H.Freeman and company
2. Text of Microbiology – Tortora, 10th edition

REFERENCE BOOKS

1. Roitt, Ivan. Essential Immunology, 9th ed., Blackwell Scientific, 1997
2. Roitt I, Brostoff J. and Male D. Immunology, 6thed. Mosby, 2001
3. Goldsby R.A., Kindt, T.J., Osbome, B.A. and Kerby J. Immunology, 5th ed., W.H.Freeman, 2003
4. Weir, D.M. and Stewart, J. Immunology, 8th ed., Cheerchill, Linvstone, 1997

https://www.immunology.org/

		L	T	P	C
BBR 304	**MICROBIOLOGY**				
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Immunology, Clinical Pathology and Microbiology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

1. To learn about the general concepts of Microbes.
2. To understand the properties of interactions between bacteria and Fungi.
3. To know about the microbial biochemistry and physiology.

COURSE OUTCOMES (COs)

CO1	Outline the general concepts of pure culture and cultural characteristics.
CO2	Basic structures of microbes and its properties.
CO3	To know about microbial genetics and pathology.
CO4	Explain the concept of Structure and functions of actinomycetes.

CO5	Illustrate the Basics of hospital acquired infections.
CO6	To describe the concept of fungal borne diseases.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION TO MICROBIOLOGY 9

Scope of Microbiology. Characterization, Classification and Identification of microorganisms, Microscopic examination of Microbes and their morphology. Fine structures of bacteria, cultivation of bacteria, reproduction & growth, pure cultures and cultural characteristics.

UNIT II: MICROBIAL BIOCHEMISTRY AND PHYSIOLOGY 9

Biochemistry of Microorganisms. Microbial metabolism, energy production, utilization of energy & biosynthesis, Bacterial genetics. Fungi – importance, characteristics, morphology, reproduction, physiology cultivation & classification of fungi, molds & repair association with other organisms. Algae – importance of algae – characteristics of algae, classification of protozoans.

UNIT III: MICROBIAL GENETICS AND PATHOLOGY 9

Organisation of Genetic materials in Microorganisms. Microbial Genetics. Bacterial Genomics. Reproduction in microorganisms. Microbial proteomics. Pathophysiological aspects of Microorganisms.

UNIT IV: VIRUSES OF BACTERIA, ANIMAL AND PLANTS 9

Viral Genomics. Virus infections in animals. Bacteriophages- General characteristics- Morphology and structure, Classification and Nomenclature-Bacteriophages of *E.coli*– Replication -viruses of plants - Structure- Replication- Classification, isolation and identification-fatal diseases associated with viruses in animals- Viroids

UNIT V: ENVIRONMENTAL AND INDUSTRIAL MICROBIOLOGY 9

Microbiology of soil – aquatic microbiology, Microbiology of domestic water and waste water. Microbiology of fuel and Industrial microbiology.

Total contact hours- 45

TEXT BOOKS

1. Text of microbiology by Tortara, 10th edition
2. Microbiology by Pelczar, JR E.C.S Chan and noel R. Krieg. Fifth edition Tata McGraw Hill - 2006

REFERENCE BOOKS

1. Microbiology – Harly and Prescott, 10th edition 2012
2. Microbiology by Sathyanarayana, 2010
3. http://www.vcom.edu/microbiology/links.html

BBR 305	**PRINCIPLES OF BIOCHEMISTRY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Microbiology, Bio-organic chemistry				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

1. To be able to employ biochemical and Bio molecules, structure of water & its importance.

COURSE OUTCOMES (COs)

CO1	Understand Classification, structure & properties of carbohydrates
CO2	Identify synthetic strategies Classification of Enzymes, Chemical nature, Active Site, Specificity of Enzyme catalyzed reactions
CO3	Identify the role of enzymes in organic synthesis
CO4	Understand the Hormones as chemical messengers: General assay of hormones – Bio assay, chemical assay & immuno assays.

CO5	Explain importance and influence of metal ions on protein function
CO6	To describe the concept of bio molecules.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION TO BIOCHEMISTRY 12

Biomolecules, structure of water & its importance – Important noncovalent forces – Hydrogen bonds, electrostatic, hydrophobic & Vanderwaals forces – Acid, base & buffers – pH, Henderson Hasselbalch equation. Biological buffers and their significance – Principle of viscosity – surface tension, adsorption, diffusion, osmosis & their applications in biological systems.

UNIT II: STRUCTURE & PROPERTIES OF CARBOHYDRATES 12

Classificationmono, di, oligo & polysaccharides. Classification, structure & properties of amino acids & proteins. Classification, structure & properties of Lipids – Simple lipids, Phospholipids, glycolipids & steroids . Transport of lipids: Lipoproteins Structure & functions of nucleic acids – Nucleosides , nucleotides – Cyclic AMP, cyclic GMP , ATP , GTP – DNA & RNA

UNIT III: CLASSIFICATION OF ENZYMES 12

, Chemical nature, Active Site, Specificity of Enzyme catalyzed reactions, Regulation: Feedback, Allosteric, Covalent modification, Hormonal regulation, co-enzymes. Assay of enzymes,

enzymes in clinical diagnosis of diseases. Introduction to Metabolism: Carbohydrate metabolism, Glycolysis Lipid metabolism: fatty acid, beta-oxidation, ketogenesis and cholesterol metabolism. TCA cycle: Structure of biological membranes, electron transport & Oxidative phosphorylation.

UNIT IV: HORMONES AS CHEMICAL MESSENGERS 12

Liver function and liver function tests, Kidney function and kidney functional tests, normal & abnormal constituents of urine and their clinical significance. General characteristics of hormones. Structure, functions & disorders of thyroid, parathyroid, pituitary, adrenal and pancreatic hormones. Hormones as chemical messengers: General assay of hormones – Bio assay, chemical assay & immunoassays.

UNIT V: ANALYTICAL TECHNIQUES 12

Principle and applications of electrophoresis – PAGE, SDS PAGE, Isoelectric focusing, Two Dimensional Electrophoresis. Chromatography: Principle of adsorption & partition chromatography, Size exclusion, Ion exchange & affinity chromatography. Spectro photometry, Fluorimetry, Flame photometry, Manometry, Microcalorimetry, Electrochemical methods, biosensors, automation in clinical laboratory, use of radio isotopes in biochemistry.

Total contact hours: 60

TEXT BOOKS:

1. Harper's review of biochemistry By David.W. Martin, Peter. A. Mayes, Victor. W. Rodwell .LANGE medical publications.
2. Practical Biochemistry – Principles & Techniques by Keith Wilson & John Walker. Oxford University Press.

REFERENCE BOOKS:

1. Understanding Enzymes by Trevor palmer. Published by Ellis Horwood Ltd.
2. Biochemistry Lippincott's Illustrated Reviews by Pamela. C. Champe & Richard. A. Harvey. Lippincott-Raven Publishers.
3. http://www.bioinfo.org.cn/book/biochemistry/

BMA 302	BIOSTATISTICS	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Maths-I, Analytical techniques.				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

1. To be able to employ for numerical problems

COURSE OUTCOMES (COs)

CO1	To Biostatistics and Basics of Bio Statistics. Applications of Biostatistics
CO2	Identify synthetic strategies Probability concepts – conditional probability – Baye's theorem
CO3	Introduction – Large sample tests based on normal distribution
CO4	Understand the ANOVA– one –way classification, Two-way classification.
CO5	Understand the Statistical Quality Control.
CO6	To identify numerical methods

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			

4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016

UNIT I: INTRODUCTION TO BIO-STATISTICS (numerical problems only) 12

Introduction and Basics of Bio Statistics. Applications of Biostatistics. Handling univariate and bi-variate data – Measures of central tendency – Measures of dispersion –Skewness & Kurtosis – Correlation and Regression.

UNIT II: PROBABILITY & THEORETICAL DISTRIBUTIONS 12

Probability concepts – Conditional probability – Baye's theorem – one – dimensional random variables –expectation, variance, moments. Theoretical distributions: Binomial, Poisson, Normal (Problems only).

UNIT III: TESTING OF HYPOTHESIS 12

Introduction – Large sample tests based on normal distribution - Test for single mean, difference between means, proportion, difference between proportion, standard deviation, difference between standard deviation. Chi-square test for goodness of fit, Independence of attributes.

UNIT IV: ANALYSIS OF VARIANCE 12

Small sample tests based on T and F distribution - Test for, single mean, difference between means, Paired t-test, test for equality of variances. ANOVA– One way classification, Two-way classification.

UNIT V: STATISTICAL QUALITY CONTROL 12

Introduction – Process control – control charts for variables - X and R, X and s charts control charts for attributes: P chart, NP chart, C chart.

Total contact hours: 60

TEXT BOOKS

1. S.C. Gupta &V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi, 2003.
2. Kapur J.N. And Saxena H. C. 'Mathematical Statistics". S. Chand and Co., New Delhi 2004.
3. Veerarajan T. "Probability Statistics and Random Process" Tata McGraw Hill, New Delhi 2003.
4. S.C. Gupta and V.K. Kapoor, "Applied Statistics". S. Chand and Sons, New Delhi 2004.

REFERENCE BOOKS:

1. Biostatistics, second edition: A Guide to Design, Analysis and Discovery by Ronals N. Forthofer, fun sel lee, and Mike Hemandez (Hardcover-Dec 28, 2006)

2. Biostatistics: Principles and Practice by B. Antonisamy Solomom Christopher, Prasanna Samuelson 1st edition Pub Date 14 Sep 09.
3. PN.Arora and S. Arora, 'Statistics for Management", S.Chand and sons, New Delhi 2003
4. http://www.dcscience.net/Lectures_on_biostatistics-ocr4.pdf

		L	T	P	C
BBR 3L1	**MICROBIOLOGY LABORATORY**				
	Total Contact Hours - 30	0	0	3	2
	Prerequisite – Basic Microbiology techniques				
	Course Designed by – Department of Genetic Engineering				

OBJECTIVES

1. Understand explicitly the concepts of microorganisms
2. Develop their skills in the preparation, identification and quantification of microorganisms

COURSE OUTCOMES (COs)

CO1	Understand and demonstrate the working principles, procedures of microbiology Lab experiments and equipments
CO2	To understand the concept of sterilisation
CO3	Observe and practice different types of culture media and broth for microbial cultivation
CO4	To know about disinfection methods
CO5	Differentiate microbes using different staining methods
CO6	Estimate and evaluate the microbial screening, identification and characterization

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

LIST OF EXPERIMENTS

1. Sterilization techniques
2. Media preparation
3. Preparation of nutrient broth
4. Preparation of nutrient agar media
5. Staining Techniques (Simple, Gram staining, spore staining)
6. Pure culture techniques (a) streak plate method (b) pour plate method (c) Spread plate method
7. Acid fast technique
8. Antibiotic Assay - Antimicrobial Sensitivity Test (Disc Diffusion Method)
9. Biochemical Characterization of Bacteria
   i) Oxidation/Fermentation Test
   ii) Catalase, Oxidase and Urease Tests
10. Lethal effect of bacteria
11. Motility test by hanging drop method

TEXT BOOKS

1. Microbiology Bio 204 Laboratory Manual
2. Laboratory Manual in general Microbiology (1916)
3. Microbiology Bio1 2421L Laboratory Manual (Donna Cain, Hershell Hanks, Mary Weis,
4. Carroll Bottoms, and Jonathan Lawson)
5. Basic Practical Microbiology (John Grainger)
6. http://www.biotopics.co.uk/microbes/tech1.html

BBR 3L2	BIOCHEMISTRY LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	3	2
	Prerequisite – Basic Biochemical Techniques				
	Course Designed by – Department of Genetic Engineering				

OBJECTIVES

1. Provides an opportunity to experimentally verify the theoretical concepts already studied. It also helps in understanding the theoretical principles in a more explicit and concentrated manner.
2. Understand explicitly the concepts
3. Develop their skills in the preparation, qualitative and quantitative analysis.

COURSE OUTCOMES (COs)

CO1	Determination of saponification number of lipids.
CO2	Estimation of Amino acids.
CO3	Separation of amino acids - Thin layer chromatography.
CO4	Separation of sugars - Paper chromatography
CO5	To detect proteins using Ramachandran Plot
CO6	Estimate and evaluate the Proteins and amino acids

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			

4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016

LIST OF EXPERIMENTS

1. pH measurements and preparation of buffers.
2. Qualitative tests for Carbohydrates.
3. Estimation of sugars.
4. Estimation of proteins by Lowry's method / Biuret method.
5. Estimation of cholesterol by Zak's method.
6. Determination of saponification number of lipids.
7. Estimation of Amino acids.
8. Separation of amino acids - Thin layer chromatography.
9. Separation of sugars - Paper chromatography
10. Biochemical estimation of DNA /RNA using Spectrophotometer

TEXT BOOKS

1. Biochemistry Laboratory Manual - Mark Brandt, Ph.D. 3rd edition , 2002
2. Biochemistry Laboratory Manual – Dr. Dennis Welsh**,** 2013
3. Biochemistry Laboratory Manual Che 4350. Andrew J. Bonham, Ph. D, 2013 https://www.liverpool.ac.uk/~agmclen/Medpracs/Prachomepage.html

		L	T	P	C
BBR 401	**RECOMBINANT DNA TECHNOLOGY**				
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Cell biology, Genetics, and Basic Biology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To learn various types of vector-host systems and steps in creating a recombinant DNA molecule.

COURSE OUTCOMES (COs)

CO1	Understand the steps in recombinant DNA/RNA modifying enzymes
CO2	Explain the features of various types of gene cloning vectors
CO3	Strategies for cloning PCR products
CO4	construction subtractive cDNA library
CO5	Plasmid expression vectors-general features, promoters used in expression vectors

CO6	To gain knowledge on various recombinant DNA techniques and their applications.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: MOLECULAR TOOLS FOR GENE CLONING 12

Restriction enzymes- Dam, Dcm and CpG methylation sensitivity of restriction enzymes-star activity of restriction enzymes. Modifying enzymes, DNA and RNA polymerases, reverse transcriptase, terminal transferase, DNA/RNA modifying enzymes- methylases- M. EcoR I. Ligases – E. coli DNA ligase, T4 DNA ligase, T4 RNA ligase. RNases- RNase I, RNase A, RNase H - Nucleases – RNase free DNAse- Exonuclease I, Exonuclease III Nucleases. Kinases - T4 polynucleotide kinase. Phosphatases- Topoisomerase.

UNIT II: VECTORS FOR GENE CLONING 12

Introduction to cloning vectors, plasmid vectors (high copy and low copy), phage vectors, cosmid vectors, phasmid vectors, BAC vectors and YAC vectors.

UNIT III: CLONING TECHNIQUES 12

Cloning after restriction digestion - blunt and cohesive end ligation – creation of restriction sites by PCR- cloning using linkers and adapters - cloning after homopolymer tailing. Strategies for cloning PCR products – TA cloning -TOPO-TA cloning-TOPO-Blunt cloning-cloning blunt end PCR product using SfrI restriction enzyme and T4 DNA ligase.

UNIT IV: CONSTRUCTION OF GENE LIBRARIES 12

Construction of cDNA library- Construction subtractive cDNA library – Construction of genomic DNA library – BAC library – YAC library.

UNIT V: EXPRESSION OF RECOMBINANT PROTEIN IN E.COLI 12

Plasmid expression vectors-general features, promoters used in expression vectors -cloning of genes in correct reading frame in expression vector- purification of recombinant protein using Histidine tag, GST tag, Chitin binding domain and intein. Codon use in different organisms-codon usage database- codon optimization to increase the expression of recombinant protein.

Total contact hours: 60

TEXT BOOKS:

1. Principles of gene manipulation by Old and Primrose
2. Molecular Cloning – A Laboratory Manual by Sambrook and Russell

REFERENCE BOOKS

1. Molecular and Cellular Methods in Biology and Medicine, P.B. Kaufman, W. Wu. D. Kim and L.J; Cseke, CRC Press, Florida.
2. Molecular Cloning: a Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
3. http://www.ncbi.nlm.nih.gov/books/NBK9950/

BBR 402	**MOLECULAR BIOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	0	0	3
	Prerequisite – Recombinant DNA technology, Genetics and Microbiology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To understand cellular organization, transport of molecules cell interactions and Signaling.

COURSE OUTCOMES (COs)

CO1	Scope and History. Structure of DNA-Nucleoside
CO2	Types and functions of DNA polymerases in Prokaryote and Eukaryote. Replication in prokaryote and Eukaryote.
CO3	Fine structure of prokaryotic and eukaryotic gene, structure and function of the promoters in mRNA, rRNA, tRNA genes
CO4	Genetic code and Wobble hypothesis. Translation in prokaryote and eukaryote
CO5	Understand the Principles of gene regulation- Transcriptional and post transcriptional gene regulation-activators, co-activators, suppressors, co-suppressors, moderators, silencers, insulators, enhancers

CO6	To describe DNA replication, gene expression at transcriptional and translational level gene regulation and DNA repair mechanisms

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: - INTRODUCTION TO MOLECULAR BIOLOGY 12

Scope and History, Structure of DNA-Nucleoside, Nucleotide, Base pairing, Base stacking, Double Helix, Features of Watson and Crick model, major and minor groove, Super coiling-twist, writhe and linking number, Forms of DNA- A, B, Z. Structure and function of mRNA, rRNA, and tRNA. Secondary structures in RNA.

UNIT II: REPLICATION AND REPAIR 12

Types and functions of DNA polymerases in Prokaryote and Eukaryote, Replication in prokaryote and Eukaryote. Proof reading activity, 5'-3' exonuclease activity, topoisomerase activity, Telomeric DNA replication and Plasmid Replication-theta model, strand displacement model and rolling circle model, DNA Repair- Nucleotide excision repair, base excision repair, mismatch repair, photo-reactivation, recombination repair and SOS repair.

UNIT III: POST TRANSCRIPTIONAL MODIFICATIONS 12

Fine structure of prokaryotic and eukaryotic gene, Structure and function of the promoters in mRNA, rRNA, tRNA genes. RNA polymerases in prokaryote and eukaryote, types and function. Transcription of mRNA, rRNA, and tRNA genes in Prokaryote and Eukaryote. Post transcriptional processing of mRNA – 5'capping, Splicing (including different types), polyadenylation and RNA editing.

UNIT IV: TRANSLATION AND POST TRANSLATIONAL PROCESSING 12

Genetic code and Wobble hypothesis, Translation in prokaryote and eukaryote, Post translational Modifications, Principles protein sorting and targeting into endoplasmic reticulum, mitochondria, chloroplast, and nucleus.

UNIT V: GENE REGULATION 12

Principles of gene regulation- Transcriptional and post transcriptional gene regulation - activators, co-activators, suppressors, co-suppressors, moderators, silencers, insulators, enhancers. Operon- lac operon, trp operon, ara operon and gal operon.

TEXT BOOKS:

1. S.S. Purohit "Cell and Molecular biology", 2008, Agrobios (India).
2. Harvey Ladish "Cell Biology" W.H. Freeman, 2007.
3. Molecular Biology of Gene - Watson
4. Molecular and Cellular Biology- Stefen Wolfe

REFERENCE BOOKS

1. Molecular and Cellular Methods in Biology and Medicine, P.B. Kaufman, W. Wu. D. Kim and L.J; Cseke, CRC Press, Florida.
2. Molecular Cloning: a Laboratory Manual, J. Sambrook, E.F. Fritsch and T. Maniatis, Cold Spring Harbor Laboratory Press, New York, 2000.
3. Molecular biology of Gene, Fifth edition Author James D. Watson 2004Benjamine Cumin (Publisher)
4. http://www.web-books.com/MolBio/

BCE 406	ENVIRONMENTAL STUDIES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Biology and Ecology				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

Genetic, Species and Ecosystem Diversity - Value Of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values.

COURSE OUTCOMES (COs)

CO1	Scope of Environmental education
CO2	Endangered And Endemic Species Of India, Conservation Of Biodiversity: In-Situ And Ex-Situ Conservations.
CO3	Hazardous Waste, Bio Medical Waste - Process Of Waste Management.
CO4	Environmental ethics -issues and possible solutions- population explosion, climatic change, ozone layer depletion, global warming, acid rain and greenhouse effect.
CO5	Understand the wild life conservation and forest act – functions of central and state pollution control boards
CO6	To describe Environmental ethics -issues and possible solutions

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			

4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016

UNIT I: ENIVRONMENT AND ECOSYSTEMS 9

Environmental education: definition - scope - objectives and importance. Concept of an ecosystem – types (terrestrial and aquatic ecosystems) – structure and function – ecological succession - food chains, food webs and ecological pyramids

UNIT II: BIODIVERSITY 9

Introduction: definition - genetic, species and ecosystem diversity - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - threats to biodiversity: habitat loss, poaching of wildlife - endangered and endemic species of India, Conservation of biodiversity: in-situ and ex-situ conservations.

UNIT III: POLLUTION AND WASTE MANAGEMENT 9

Air and water pollution – classification of pollutants and their effects – control measures of air pollution. Waste water treatment (general) – primary, secondary & tertiary stages. Solid waste management: causes - effects of municipal waste, hazardous waste, bio medical waste - process of waste management.

UNIT IV: CURRENT ENVIRONMENTAL ISSUES 9

Environmental ethics -issues and possible solutions- population explosion, climatic change, ozone layer depletion, global warming, acid rain and greenhouse effect. Sustainable development: definition, objectives and environmental dimensions of sustainable development-environmental audit for sustainable development.

UNIT I - ENVIRONMENTAL PROTECTION 9

National and international concern for environment: Important environmental protection acts in India – water, air (prevention and control of pollution) act, wild life conservation and forest act – functions of central and state pollution control boards - international effort – key initiatives of Rio declaration, Vienna convention, Kyoto protocol and Johannesburg summit.

TEXT BOOKS

1. Sharma. B.K. and Kaur, “Environmental Chemistry” Goel Publishing House, Meerut, 1994.
2. De. A. K., “Environmental Chemistry”, New Age International (p) lt., New Delhi, 1996.
3. Kurian Joseph & R. Nagendran, “Essential of Environmental Studies” Pearson Education, 2004.

REFERENCE BOOKS

1. Dara S.S., A Text Book of Environmental Chemistry and pollution control, S. Chand & Company Ltd., New Delhi, 2004.

2. Jeyalakshmi. R, Principles of Environmental Science, 1st Edition, Devi Publications, Chennai 2006.
3. Kamaraj. P & Arthanareeswari. M, Environmental Science – Challenges and Changes, 1st Edition, Sudhandhira Publications, 2007.
4. Arivalagan. K, Ramar. P & Kamatchi. P, Principles of Environmental Science, 1st Edition, Suji Publications, 2007.
5. www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf

BBR 404	**GENOMICS AND PROTEOMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	4	0	0	4
	Prerequisite – Molecular biology, Genetics, rDNA Technology, and Bioinformatics				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To Coding, non-coding chromosomes. To Applications of Proteome analysis-

COURSE OUTCOMES (COs)

CO1	To organization and structure of genomes, Genome Size
CO2	To Chromosomes Micro dissection and chromosomal mapping techniques.
CO3	To understand the Functional Genomics.
CO4	To understand the principle of Mass spectrometry
CO5	To Understand the Phosphoprotein analysis- Genomics Vs Proteomics.
CO6	To know the proteomics in drug discovery research.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION TO GENOMICS 9

Organization and Structure of Genomes, Genome Size – Genome Structure in Viruses and microbes, Coding, Non-coding chromosomes and high order structures – Genomes relatedness.

UNIT II: PHYSICAL MAPPING TECHNIQUES 9

Chromosomes Micro dissection, Chromosomal mapping techniques, Top down and bottom up approach – Linking and jumping of clones – Genome sequencing – Placing small fragments on map – STS assembly – Gap closure – Pooling strategies – Cytogenetic mapping techniques.

UNIT III: FUNCTIONAL GENOMICS 9

Gene finding – Annotation – ORF and functional prediction – Subtractive DNA library, screening – DNA sequencing - Hybridization techniques – Differential display and representational difference analysis – SAGE – TOGA, Analysis of RNA expression - Comparative genomics . Bioinformatics tools used in Genomics-

UNIT IV: PROTEOMICS TECHNIQUES 9

Proteome – Bridging Genomics and Proteomics - Analysis of Proteome - Protein level estimation – Edman protein micro sequencing – Protein cleavage – 2D gel electrophoresis – Metabolic labeling – Detection of proteins on SDS gels – Pattern analysis – Mass spectrometry – Principles of MALDI-TOF – Tandem MS-MS – Peptide mass fingerprinting.

UNIT V: PROTEIN PROFILING 9

Post translational modification – Protein-protein interaction –Protein Chips – Applications of Proteome analysis- Proteomics in drug discovery- Phage antibodies as tools – Proteomics in plant genetics and breeding - Glycoprotein analysis –Phosphoprotein analysis- Genomics Vs Proteomics.

Total Contact Hours – 45

TEXT BOOKS

1. Primrose, S.B. and Twyman, R.H., "Principles of Genome Analysis and Genomics", Blackwell Publishing Co., 2003.
2. Liebler, D.C., "Introduction to Proteomics", Humana Press, 2002.
3. Discovering Genomics, Proteomics, & Bioinformatics. Campbell & Heyer (2003) Pearson Education, ISBN: 0-8053-4722-4.
4. Bioinformatics, Methods of Biochemical Analysis Series Vol. 43, Baxevanis & Ouellette (2001) John Wiley & Sons, ISBN 0-471-38391-0
4. Computational Molecular Biology. Pevzner, P.A. (2000) MIT Press, ISBN: 0262.

REFERENCES

1. Pennington, S.R. and Dunn, M.J., "Proteomics", BIOS Scientific Publishers, 2001. 2. Hunt, S.P., Livesey, R. and Livesey, F.J., "Functional Genomics: A Practical Approach" Oxford University Press, 2000.
3. Suhai S., "Genomics and Proteomics: Functional and Computational Aspects", Springer, 2000.
4. Cantor, C.R. and Smith, C.L., "Genomics: The Science and Technology Behind the Human Genome Project", Wiley and Sons, 1999.
5. http://www.sciencedirect.com/science/book/9781907568107

BBR 405	**BIO-ORGANIC CHEMISTRY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Chemistry, Biology and protein engineering				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To enable understanding chemical principles governing biochemical reactions

COURSE OUTCOMES (COs)

CO1	To understand molecular interaction and chemical reactions of biomolecules
CO2	To identify synthetic strategies for proteins and oligonucleotides
CO3	To identify the role of enzymes in organic synthesis
CO4	To understand the orchestration of events during enzyme catalysis and the role of coenzymes
CO5	To explain importance and influence of metal ions on protein function
CO6	To know the lead synthesis methods and their types

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT 1: AMINO ACIDS AND PROTEINS 12

Structure, classification, Synthesis and Properties of amino acids, Biosynthesis of amino acids. Peptides: oligo and polypeptides, geometry of peptide linkage, N-terminal and C-terminal residue analysis, synthesis of peptides-amino and carboxyl protecting groups-solid phase peptide synthesis. Proteins: classification and properties (denaturation, isoelectric point and electrophoresis), collagen and triple helix.

UNIT II: Enzymes and Cofactors 12

Mechanism of enzyme catalysis, Factors influencing enzyme action, Examples of typical enzyme mechanisms: chymotrypsin, ribonuclease and lysozyme, Enzyme-catalyzed addition, elimination, condensation, carboxylation and decarboxylation, isomerization, group transfer and rearrangement reactions-structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD+, NADP+, FMN, FAD, lipoic acid and Vitamin B12. Mechanisms of reactions catalyzed by the above cofactors.

UNIT III: Nucleic Acids and Protein Synthesis 12

Nucleotides and nucleosides, DNA: primary and secondary structure-replication of DNA. RNA and protein synthesis: Messenger RNA synthesis-transcription, Ribosomes- rRNA, Transfer RNA, genetic code translation. Determination of base sequence of DNA, Polymerase Chain

Reaction (PCR).Antisense technology in chemotherapy and other nucleic acid-targeted drugs-intercalaters, sequence specific drugs.A brief account of ribosyme and iRNA.

UNIT IV: Lead and Analogue Synthesis-1 12

Designing organic synthesis-disconnection approach-Synthons and synthetic equivalents-one group disconnections: alcohol, olefin, ketone, acids-two group disconnections:1,2-, 1,3-, 1,4- and 1,5-difunctional compounds-convergent synthesis-functional group inter conversions- functional group additions-carbon heteroatom bonds-methods for 3- to 6-membered rings.

UNIT V: Lead and Analogue Synthesis-2 12

Combinatorial synthesis in medicinal chemistry: Solid phase techniques-methods of parallel synthesis-mix and split techniques-dynamic combinatorial chemistry-screening and deconvolution - limitations of combinatorial synthesis, Assymmetric synthesis: basic principles-stereoselective and stereospecific reactions and catalysts and their applications (wherever applicable)

Total Contact Hours: 60

TEXT BOOKS

1. Designing Organic Synthesis: The Disconnection Approach by Stuart Warren, Wiley, 2nd edition, 1984.
2. Asymmetric Synthesis by H. B. Kagan, Thieme Medical Publishers, 2003.

REFERENCE BOOKS

1. Bioorganic Chemistry: A Chemical approach to Enzyme action, Hermann Dugas and C. Penny, Springer-Verlag.
2. Fundamentals of Enzymology, N.C. Price and L. Stevens, Oxford University Press.
3. Enzymatic Reaction Mechanisms, C. Walsh, W.H. Freeman.
4. http://www.organic-chemistry.org/books/navi/bioorganicchemistry.shtm

BBR 406	BASICS OF BIOINFORMATICS	L	T	P	C
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Biology, Enzyme Technology, and Basic computer Science				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To understand the significance of string alignment. To construct the phylogenetic tree.

COURSE OUTCOMES (COs)

CO1	Explain various types of network protocols and biological databases
CO2	Demonstrate and interpret the string matching and dynamic program algorithms of macromolecular strings
CO3	Apply, solve and interpret the heuristics based pair wise and multiple sequence analysis of macromolecules
CO4	Construct and interpret the molecular phylogenetic trees
CO5	Predict and understand the gene and protein structures, and microarrays
CO6	To understand the fundamentals of protein structure prediction and microarray analysis

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: Introduction to Bioinformatics and Basics of Internet 12

Biology in the computer age - Introduction to Bioinformatics, Basics of computers - Servers, workstations, operating systems. UNIX, Linux, WWW. Search Engines, PubMed, Public Biological databases. Connecting to internet; Connecting to internet; Email; FTP; www; The NCBI data model: Introduction, BIOSEQ's, BIOSEQ- sets, SEQ- ANNOT, SEQ- DESCR.

UNIT II: BIOLOGICAL DATABASES 12

Biological databases-primary sequence databases - Composite sequence databases- Secondary databases composite protein pattern databases-structure classification databases. Genome Information Resources: DNA sequence databases-specialized genomic resources, GRAIL, GENSCAN.NCBI databases and PUBMED tools.

UNIT III: ALIGNMENT TECHNIQUES 12

Pair-wise Alignment Technique: Database searching-algorithms and programs-comparing two sequences identity and similarity-global and local alignment- Pair wise database searching. Multiple sequence Alignment: Goal of multiple sequence alignment-Computational Complexity-Manual methods-Simultaneous methods-Progressive methods-Databases of multiple alignment-Secondary database searching-Analysis packages.

UNIT IV: PROTEIN ANALYSIS 12

Protein Chips, Bioinformatics tools in proteomics - Protein identity based on composition, Motifs and patterns, secondary structure prediction, specialized secondary structures, tertiary structure

UNIT V: INTRODUCTION TO PERL 12

Using PERL to facilitate biological analysis, Strings, numbers, and variables, Basic input & output, File handles, Conditional Blocks & loops, Pattern matching, Arrays-Hashes.

Total Contact Hours: 60

TEXT BOOKS

1. Andreas D Baxevanis & B F Francis," Bioinformatics- A practical guide to analysis of Genes & Proteins", John Wiley, 2002.
2. T K Attwood, D J Parry-Smith," Introduction to Bioinformatics", Pearson Education.

REFERENCE BOOKS

1. Introduction to Bioinformatics, T. K. Attwood & D.J. Parry-Smith, Prentice Hall 2000.
2. Instant notes on Bioinformatics, D.R. West head.J.H. Parish R.M. Twyman, Liva Books, New Delhi, 2003
3. "Bioinformatics Sequence and Genome analysis", David W. Mount 2003.
4. "Bioinformatics Basics 'Applications in Biological science and Medicine" Hooman H. Rashidi &Lukas K. Buehie 2001.

5. Introduction to bioinformatics: A theoretical and practical approach by Stephen A wetz and David. D Woumble Publication: Humana Press. 2003
6. Sequence and Genome analysis. David W. Mount, 2004 Cold spring harbour laboratory press New York.

BBR 4L1	MOLECULAR BIOLOGY LABORATORY	L	T	P	C
	Total Contact Hours – 30	0	0	3	2
	Prerequisite – rDNA Technology, Microbiology, and Cell Biology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To familiarize with cell counting and cell separation techniques.

COURSE OUTCOMES (COs)

CO1	Demonstrate cell counting and cell separation techniques
CO2	Experiment to isolate DNA and RNA from various biological tissues.
CO3	Analyze and interpret DNA and RNA data.
CO4	Explain the activity of restriction enzymes and ligation of DNA.
CO5	Demonstrate bacterial genetics through conjugation experiment and Execute the effect of UV irradiation on bacterial genome
CO6	To gain hands on experience with action of restriction endonucleases and ligase on DNA

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			

	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

LIST OF EXPERIMENTS

1. Isolation of DNA from plant tissue
2. Isolation of DNA from animal tissue
3. Agarose gel electrophoresis
4. Effects of antibiotics by gradient method
5. UV induced mutagenesis
6. SDS page
7. Quantification of nucleic acids
8. Competent cell preparation
9. Transformation
10. Competent cell preparation
11. Polymerase Chain Reaction

TEXT BOOKS

1. Molecular biology laboratory manual - Hikmet Geckil.
2. Molecular Cloning – A Laboratory Manual by Sambrook and Russell.
4. https://www.inonu.edu.tr/Uploads/iys_dosyalar/1400/file/MBManual.pdf

BBR 4L2	CELL BIOLOGY LABORATORY	L	T	P	C
	Total Contact Hours – 30	0	0	3	2
	Prerequisite – Biology, Genetics and Microbiology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To give hands-on training in basic molecular biology techniques

COURSE OUTCOMES (COs)

CO1	To demonstrate cell counting and cell separation techniques
CO2	To experiment to isolate DNA and RNA from various biological tissues.
CO3	To analyze and interpret DNA and RNA data.
CO4	To explain the activity of restriction enzymes and ligation of DNA.
CO5	To demonstrate bacterial genetics through conjugation experiment and Execute the effect of UV irradiation on bacterial genome
CO6	To acquire practical skills related to DNA/ RNA isolation methods.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

LIST OF EXPERIMENTS

1. Introduction to principles of sterile techniques and cell propagation.
2. Principles of microscopy, phase contrast and fluorescent microscopy.
3. Identification of given plant, animal and bacterial cells and their components by microscopy,
4. Cell viability by Trypan Blue assay
5. Estimation of chlorophyll from plant tissue
6. Lacto phenol cotton blue staining
7. Hematology experiments

(a) Blood smear (b) blood count

8. Cell component (a) isolation of chloroplast (b) isolation of protoplast
9. Cryopreservation
10. Spotters

(a) Plant cell (b) animal cell (c) blood cell (d) Volvox (e) Oscillatoria
(f) Spirillum (g) Chlamydomonas (h) Nostoc

REFERENCE:

1. Laboratory Investigations in Cell and Molecular Biology, Allen Bregman Wiley, 2001.
2. Laboratory manual for Cell biology - E. Eugene Williams
   http://www.public.asu.edu/

BBR501	**INDUSTRIAL BIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite –Bioprocess Technology, Microbiology, and Basic Biology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To make the students aware of the overall industrial bioprocess so as to help them to manipulate the process to the requirement of the industrial needs

COURSE OUTCOMES (COs)	
CO1	Understand the bulk production of commercially important Bioproducts, Industrial Enzymes, Products of plant and animal cell cultures.
CO2	Explain the features of various types of gene cloning vectors
CO3	Strategies for Upstream and Downstream process in Bioprocess, Process flow sheeting.
CO4	Production of commercially important primary metabolites like organic acids, amino acids, alcohols and vitamins
CO5	Plasmid expression vectors-general features, promoters used in expression vectors
CO6	To gain knowledge on various recombinant DNA products and their applications.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION TO INDUSTRIAL BIOPROCESS 12

Fermentation - Bacterial, Fungal and Yeast, Biochemistry of fermentation. Traditional and Modern Biotechnology - A brief survey of organisms, processes, products. Basic concepts of upstream and downstream processing in Bioprocess, Process flow sheeting - block diagrams, pictorial representation.

UNIT II: PRODUCTION OF PRIMARY METABOLITES 12

Primary Metabolites- Production of commercially important primary metabolites like organic acids, amino acids, alcohols and vitamins.

UNIT III: PRODUCTION OF SECONDARY METABOLITES 12

Secondary Metabolites- Production processes for various classes of secondary metabolites: Antibiotics and Steroids.

UNIT IV: PRODUCTION OF ENZYMES AND OTHER BIOPRODUCTS 12

Production of Industrial Enzymes, Biopesticides, Biofertilizers, Biopreservatives, Biopolymers Biodiesel, Cheese, Beer, SCP & Mushroom culture. Bioremediation.

UNIT V: PRODUCTION OF MODERN BIOTECHNOLOGY PRODUCTS 12

Production of recombinant proteins having therapeutic and diagnostic applications, vaccines. Bioprocess strategies in Plant Cell and Animal Cell culture.

Total Contact Hours: 60

TEXT BOOKS:

1. Satyanarayana, U. "Biotechnology" Books & Allied (P) Ltd., 2005.
2. Kumar, H.D. "A Textbook on Biotechnology" 2 nd Edition. Affiliated East West Press Pvt.Ltd., 1998.
3. Balasubramanian, D. *et al.,* "Concepts in Biotechnology" Universities Press Pvt.Ltd., 2004.
4. Ratledge, Colin and Bjorn Kristiansen "Basic Biotechnology" 2 nd Edition Cambridge University Press, 2001.
5. Dubey, R.C. "A Textbook of Biotechnology" S.Chand & Co. Ltd., 2006.

REFERENCES:

1. A.H. Patel "Industrial Microbiology" Macmillan
2. Presscott, S.C. and Cecil G. Dunn, "Industrial Microbiology", Agrobios (India), 2005.
3.Cruger, Wulf and Anneliese Crueger, "Biotechnology: A Textbook of Industrial Microbiology", 2nd Edition, Panima Publishing, 2000.
4. Moo-Young, Murrey, "Comprehensive Biotechnology", 4 Vols. Pergamon Press, (An Imprint of Elsevier) 2004.
5. C.F.A Bryce and EL.Mansi, Fermentation microbiology & Biotechnology, 1999.
6. K.G.Ramawat & Shaily Goyal, Comprehensive Biotechnology, 2009, S.Chand publications.
7. https://app.knovel.com/

BBR 502	**RESEARCH METHODOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Biophysics				
	Course Designed by – Dept of Genetics Engineering				
1. Early entry graduate-level survey of research methods with an emphasis on comprehension of the educational research literature.					

2. Course includes scientific method, locating.
3. Summarizing published research, sampling, measurement, statistics.
4. Increase the knowledge on research design, and critique of published research.

COURSE OUTCOMES (COs)

CO1	Basic descriptive statistics including measures of central tendency, dispersion, and relationships.
CO2	Basic measurement concepts including validity and reliability and the role of measurement in inquiry.
CO3	Common and differentiating features of basic, applied, and evaluation research
CO4	Common and differentiating features of typical research designs (e.g. quantitative vs. qualitative, experimental vs. non-experimental, group vs. single-case).
CO5	Quality indicators in published research.
CO6	To Understand the research and development.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION TO RESEARCH 12

Introduction: Definition and objectives of Research – Types of research, Various Steps in Research process, Mathematical tools for analysis, Developing a research question-Choice of a problem, Literature review, Surveying, synthesizing, critical analysis, reading materials, reviewing, rethinking, critical evaluation, interpretation, Research Purposes, Ethics in research – APA Ethics code.

UNIT II: APPLICATIONS OF PROBABILITY DISTRIBUTIONS 12

Quantitative Methods for problem solving: Statistical Modeling and Analysis, Time Series Analysis Probability Distributions, Fundamentals of Statistical Analysis and Inference, Multivariate methods, Concepts of Correlation and Regression, Fundamentals of Time Series Analysis and Spectral Analysis, Error Analysis, Applications of Spectral Analysis.

UNIT III: FREQUENCY DISTRIBUTIONS 12

Tabular and graphical description of data: Tables and graphs of frequency data of one variable, Tables and graphs that show the relationship between two variables , Relation between frequency distributions and other graphs, preparing data for analysis

UNIT IV: NEURAL NETWORK ANALYSIS 12

Soft Computing: Computer and its role in research, Use of statistical soft ware SPSS, GRETL etc in research. Introduction to evolutionary algorithms - Fundamentals of Genetic algorithms, Simulated Annealing, Neural Network based optimization, Optimization of fuzzy systems.

UNIT V: RESEARCH REPORT ANALYSIS 12

Structure and components of research report, Types of report, Layout of research report, Mechanism of writing a research report, referencing in academic writing.

TOTAL CONTACT HOURS: 60

TEXT BOOKS

1. C.R. Kothari, Research Methodology Methods and Techniques, 2/e, Vishwa Prakashan, 2006
2. Donald H. Mc Burney, Research Methods, 5th Edition, Thomson Learning, ISBN:81-315-0047- 0,2006

REFERENCE BOOKS

1. Donald R. Cooper, Pamela S. Schindler, Business Research Methods, 8/e, Tata McGraw-Hill Co. Ltd., 2006.
2. Fuzzy Logic with Engineering Applications, Timothy J.Ross, Wiley Publications, 2nd Ed
3. Simulated Annealing: Theory and Applications (Mathematics and Its Applications, by P.J. van Laarhoven & E.H. Aarts
4. Genetic Algorithms in Search, Optimization, and Machine Learning by David E. Goldberg.

5.https://docs.google.com/viewer?a=v&pid=forums&srcid=MTAxNDI0NTM4NjczMzU3MTYzMTIBMTQyOTU2MzI2MDIwMDM2MTc5NDQBSm05QUZ1UENMOFVKATAuMQEBdjI

BBR 503	CYTOGENETICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Cell Biology, Cytology				
	Course Designed by – Dept of Genetics Engineering				

1. Early entry graduate-level survey of research methods with an emphasis on comprehension of the educational research literature.
2. Course includes scientific method, locating.
3. Summarizing published research, sampling, measurement, statistics.
4. Increase the knowledge on research design, and critique of published research.

COURSE OUTCOMES (COs)

CO1	Basic descriptive statistics including measures of central tendency, dispersion, and relationships.
CO2	Basic measurement concepts including validity and reliability and the role of measurement in inquiry.
CO3	Common and differentiating features of basic, applied, and evaluation research
CO4	Common and differentiating features of typical research designs (e.g. quantitative vs. qualitative, experimental vs. non-experimental, group vs. single-case).
CO5	Quality indicators in published research.
CO6	To Understand the research and development.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			

	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: MENDELIAN GENETICS 9

Genetic inheritance, Mendelian Genetics, Mendel's experiments, principles of segregation, monohybrid cross – Independent Assortment, Gene interaction, multiple alleles.

UNIT II: CHROMOSOME STRUCTURE AND ORGANIZATION 9

Chromosome structure and organization in prokaryotes and eukaryotes, Giant chromosomes, polythene and lampbrush, Sex determination and sex linkage, techniques in cytogenetic.

UNIT III: LINKAGE AND CROSSING OVER 9

Linkage, Crossing over, cytological basis of crossing over, chromosome mapping, two and three factor cross, interference, somatic cell hybridization.

UNIT IV: VARIATION IN CHROMOSOME STRUCTURE AND NUMBER 9

Deficiencies, duplication, inversion, translocation, positive effects-human chromosome techniques (karyotyping), chromosome aberration in humans-classification of mutation, classification of ploidy, variation in chromosome number, extra chromosomal inheritance-cytogenetical abnormalities in humans

UNIT V: RECOMBINATION IN BACTERIA 9

Bacterial Genomics, Transformation, Transduction, Conjugation – mapping, fine structure mapping in merozygotes- plasmids and episomes.

Total Contact Hours: 45

TEXT BOOKS

1. Principles of Genetics by Gardner, Simmons, Snustad, 8th edition – John Wiley and Sons, Inc., 2003.

2. The Cell: A molecular approach by Geoffrey M. Cooper. ASM Press, Pages: 673.

REFERENCE BOOKS

1. Molecular Cell Biology, Sixth Edition., by Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Anthony Bretscher, Hidde Ploegh, Paul Matsudaira Bioenergetics at a Glance: An Illustrated Introduction D. A. Harris, 1995 John Wiley & Sons Publishers, Inc

2. Biology of Microorganisms – Michael T. Madigan

BBR 504	**VIROLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite –Microbiology, Cell biology and Basic Biology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To make the students aware of the overall industrial bioprocess so as to help them to manipulate the process to the requirement of the industrial needs

COURSE OUTCOMES (COs)

CO1	Understand the bulk production of commercially important products of viral culture.
CO2	Explain the method of introducing viral genomes into the cells
CO3	Strategies for microbial metabolites from industries.
CO4	Understand the pathogenesis of viral infection
CO5	To know the viral vectors-general features, promoters used in expression vectors
CO6	To gain knowledge on prevention and treatment of viral infection.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: CULTIVATION OF VIRUSES 12

Cultivation of plant, animal and bacterial virus; one step growth curve; estimation of yields; methods for purification of viruses; quantitative measure of infectious centers: plaque assay; generation of transformed cell foci.

UNIT II: REPLICATION CYCLE 12

Entry of enveloped and non-enveloped animal virus; plant virus and bacteriophage; replication and expression of viral genome- dsDNA, ssDNA, dsRNA, +ssRNA; -ssRNA; bacteriophages-lytic and lysogenic cycle and its regulation; late events of viral infection- capsid assemble and virion release; non-specific method of introducing viral genomes into the cells.

UNIT III: PATHOGENESIS OF VIRAL INFECTION 12

Typical modes of virus spread; initial stages of infection; incubation period and spread; multiplication and occurrence of disease; the immune response; virus spread to the next individual; fate of the host; pathogenesis of hepatitis, HIV, EBV and influenza virus.

UNIT IV: PREVENTION AND TREATMENT OF VIRAL INFECTION 12

Vaccination strategy; chemotherapy of viral diseases; interferon-its induction and action.

UNIT V - PRIONS AND VIROIDS 12

General properties; hypothesis about prion generation; disease caused by prions and viroids. Viruses-promise and problems: Cloud of horizon-emerging disease; source and caused of emergent virus diseases; silver linings-virus as therapeutic agent; viruses for gene delivery.

Total Contact Hours: 60

Text books

1. Culture of Animal Cells: A Manual of Basic Technique. R. Ian Freshney. Latest edition / Pub. Date: September 2005. Wiley.
2. Culture of Cells for Tissue Engineering. R. Ian Freshney. Pub.Date: March 2006. Wiley.
3. Invertebrate Tissue Culture Methods. Jun Mitsuhashi. Latest edition /Pub. Date: February 2002. Publisher: Springer-Verlag New York, LLC.

Reference books

1. Essential Cell Biology. Bruce Alberts, Dennis Bray, Keith Roberts, Julian Lewis, Martin Raff. latest edition/Pub. Date: October 2003. Publisher: Taylor & Francis, Inc.

2. Molecular Cell Biology. Harvey Lodish, James Darnell, Paul Matsudaira, Arnold Berk, S. Lawrence Zipursky. Latest edition/Pub. Date: August 2003. Publisher: W. H. Freeman Company.

3. www.virology.net/Big_Virology/BVHomePage.html

BBR 505	PLANT TISSUE CULTURE	L	T	P	C
	Total Contact Hours - 45	4	0	0	4
	Prerequisite – Recombinant DNA Technology				
	Course Designed by – Dept of Genetics Engineering				

OBJECTIVES

1. This course deals with engineering gene of interest to produce transgenic animals and plants for human welfare
2. To make the students to understand the basic concepts and applications of plant tissue culture.
3. To impart knowledge on production of transgenic plants and exploiting it as bioreactors.
4. To improve awareness on the applications of transgenic plants

COURSE OUTCOMES (COs)

CO1	Acquired the concept and basics of plant tissue culture.
CO2	Improved the experience in preparation of tissue culture media.
CO3	To know the working principles of tissue culture techniques.
CO4	understood the plant transformation methods and its uses
CO5	Improved idea about the applications in transgenic plants
CO6	Understood the competency methods.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		

	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: BASICS OF PLANT TISSUE CULTURE 9

History of plant tissue culture- totipotency- Organizing a tissue culture lab-sterilization techniques- callus differentiation of cell and organs - clonal propagation- Regeneration and hardening-somatic clonal variation

UNIT II: PREPARATION OF TISSUE CULTURE MEDIA 9

Different media used for plant tissue culture-Composition of MS, Gamborg, White media-Use of hormones-Auxins- Cytokinins.

UNIT III : TISSUE CULTURE TECHNIQUES 9

Callus culture- suspension culture -micropropagation-somatic embryogenesis- embryo culture – protoplast fusion- synthetic seeds - anther culture. Applications of tissue culture.

UNIT IV: PLANT TRANSFORMATION 9

Agrobacterium – mechanism of T-DNA transfer -Ti plasmids derived vector system – biolistic gene transfer –reporter genes-GUS—marker genes-selectable and scorable markers-constitutive and tissue specific promoters strategies for developing marker free transgenic plants-chloroplast transformation.

UNIT V: APPLICATIONS OF TRANSGENIC PLANTS 9

Bt transgenics – virus resistant plants (coat protein, antisense RNA) – Glycophosate resistant transgenics – Genetic manipulation of flower pigmentation (Blue Rose) – Vitamin A and iron fortified rice – Plant-made antibodies and edible vaccines.

TEXT BOOKS

1. Molecular Biotechnology by Bernard R. Click and Jack. J. Pasternek

2. Plant Biotechnology by S. Ignacimuthu.
3. Text book of Plant tissue culture – Sathyanarayana

REFERENCE BOOKS

1. Introduction to Plant tissue culture – M.k. Razdan
2. Plant tissue culture – PR white
3. Plant propagation by plant tissue culture – EF George

BBR 5L1	**IMMUNOLOGY LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	3	2
	Prerequisite – Cell Biology lab				
	Course Designed by – Dept of Genetics Engineering				

OBJECTIVES

1. The students should be able to develop their skills.
2. Provides an opportunity to experimentally verify the theoretical concepts already studied.
3. It also helps in understanding the theoretical principles in a more explicit and concentrated manner.
4. Explore the antigen and antibody reaction methods.

COURSE OUTCOMES (COs)

CO1	Understood the blood grouping and types of blood groups.
CO2	Experienced in leucocytes count and PBMC preparation and their enumeration.
CO3	Production of polyclonal antibodies using immunization.
CO4	Antigen and Antibody reaction - types.
CO5	Blotting Techniques and ELISA types.
CO6	Antibody production

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			

	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

LIST OF EXPERIMENTS

1. Blood grouping
2. Leukocyte count
3. PBMC preparation and their enumeration
4. Production of polyclonal antibodies – preparation of antigen – protocol for immunization in rabbits /mice
5. Antigen-antibody reaction- Haemagglutination, precipitation- Widal and VDRL
6. Immunodiffusion, Immunoelectrophoresis.
7. Affinity chromatography for antibody purification.
8. ELISA-DOT and plate ELISA
9. Immuno Blotting techniques
10. Agglutination reactions (a) direct (b) indirect

REFERENCE BOOK

1. Immunology Laboratory methods manual, 2009
2. Cell biology and immunology manual, Dr. Bea Holton

BBR 5L2	PLANT GENETIC ENGINEERING LABORATORY	L	T	P	C
	Total Contact Hours – 30	0	0	3	2
	Prerequisite – Plant Tissue Culture lab				
	Course Designed by – Dept of Genetics Engineering				

OBJECTIVES

1. Provides an opportunity to understand the basic practices of plant tissue culture.
2. It also helps in understanding the theoretical principles of producing transgenic plants in a more explicit and concentrated manner.
3. The students should be able to Understand explicitly the concepts.
4. To develop their skills in the plant tissue culture techniques

COURSE OUTCOMES (COs)

CO1	Acquired the knowledge and experience on preparation of Tissue Culture Media.
CO2	Understood the callus induction, using rice embryo/endosperm culture and Transformation of Agrobacterium into plant
CO3	Selection and sub-culture of algal species
CO4	Bacterial antibiotic sensitivity and replica plate method
CO5	Transgene Analysis by PCR
CO6	Identification of Biofertilizer.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

LIST OF EXPERIMENTS

1. Preparation of Tissue Culture Media
2. Callus Induction, using rice embryo/endosperm culture
3. Transformation of Agro bacterium
4. Selection and sub-culture of algal species
5. Bacterial antibiotic sensitivity
6. Isolation of mutant clones by replica plate method – MSGEN208
7. Collection and culture of marine alga
8. Identification of bio-fertiliser activity using marine alga
9. GUS assay
10. Transgenic analysis by PCR

REFERENCE BOOK

1. Plant biotechnology Laboratory Manual (Dr. Lingaraj Sahoo).
2. Principles of Plant Genetics and Breeding - George Acquaah, 2007

BBR 601	**BIOPHARMACEUTICAL TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – Molecular modeling and drug designing				
	Course Designed by – Dept of Genetics Engineering				

OBJECTIVES

1. This programme will provide students with a solid foundation in Pharmaceutical Chemistry.
2. Pharmacology and Pharmacognosy as per the requirement of Pharmaceutical Industries, and also to pursue higher studies.
3.This programme will facilitate the students to acquire knowledge in fields such as genetic engineering.

4. It will also empower the students to have advanced focus on the molecular pathogenesis of infectious diseases and necessary pharmacological approach.

COURSE OUTCOMES (COs)	
CO1	Graduates of the program will be having fundamental knowledge in biosciences
CO2	chemical engineering and strong background in pharmaceutical technology
CO3	And be able to use these tools in industry and/or institutes where ever necessary.
CO4	It will also help the students to know about the pharmacokinetics of drug, its metabolism
CO5	Its immune pharmacological response through in depth understanding about the Human physiology.
CO6	Biopharamaceutical background

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION 12

Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses; economics and regulatory aspects. Various steps in new drug developments

UNIT II: DRUG ACTION, METABOLISM AND PHARMACOKINETICS 12

Mechanism of drug action; physico-chemical principles of drug metabolism; radioactivity; Pharmacology, Pharmacogenomics and Pharmaco kinetics.

UNIT III: MANUFACTURE OF DRUGS, PROCESS AND APPLICATIONS 12

Types of reaction process and special requirements for bulk drug manufacture. Toxicology. Fermentation technology. Bioprocess technologies.

UNIT IV: PRINCIPLES OF DRUG MANUFACTURE 12

Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oval liquids – vegetable drugs – topical applications; preservation of drugs; analytical methods and other tests used in drug manufacture; packing techniques; quality management; GMP.

UNIT V: BIOPHARMACEUTICALS 12

Various categories of therapeutics like Vaccines, life saving drugs, antibodies, vitamins, laxatives, analgesics, contraceptives, antibiotics, hormones and biologicals.

Total Contact Hours: 60

TEXT BOOKS

1. Gareth Thomas, Medicinal Chemistry. An introduction by .John Wiley. 2000.
2. Katzung B.G., Basic and Clinical Pharmacology, Prentice Hall of Intl. 1995.

REFERENCE BOOKS

1. Niazi, Sarfaraz K. “Handbook of Bio-generic Therapeutic Proteins: Regulatory, Manufacturing, Testing, and Patent Issues”. CRC Press, 2006.
2. Ho, Reedney J. Y., MiloGibaldi. “Biotechnology & Biopharmaceuticals Transforming Proteins and Genes into Drugs”. Wiley Liss, 2003.
3. **http://www.btci.org/aket.bt**

BBR 602	GENES AND DISEASES	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Gene theraphy, Bio-Pharmaceutical technology				
	Course Designed by – Dept of Genetics Engineering				

OBJECTIVES

To understand the genes that control or influence the heritable human diseases

1. To understand the pattern of inheritance of heritable diseases
2. To learn about the genetics of most prevalent cancers in India
3. To learn about the genetics of metabolic disorders and disease of nervous system
4. To learn about the genetics of ear, eye and blood disorders

COURSE OUTCOMES (COs)

CO1	Mechanism of Genetic Diseases.
CO2	Genetics of metabolic disorders
CO3	Genetics of the diseases of nervous system
CO4	Genetics of ear, eye and blood disorders
CO5	Congenital disorders and Neonatal diseases
CO6	Treatment of genetic disorders.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION TO DEFECTIVE GENES 12

Introduction to the diseases due to defective genes. Genomics and Health. Mechanism of Genetic Diseases, Types of Mutations. Dominance, recessive, co-dominance, autosomal and sex linked inheritance of diseases. Chromosomal maps.

UNIT II: GENETIC DISORDERS 12

Single Gene disorders, X-linked recessive, Y-linked and Mitochondrial disorders. Multifactorial and polygenic (complex) disorders. FIND base (the Frequency of Inherited Disorders database). Genetic epidemiology. Inborn errors of metabolism. List of genetic disorders. Medical genetics. Population groups in biomedicine. Mendelian error.

UNIT III: GENETIC TESTING 12

Genetic Testing, Genetic diseases prevention, Genetic counselling. Pharmacogenomics. Public Health Genomics at CDC. OMIM — Online Mendelian Inheritance in Man, a catalog of human genes and genetic disorders. Genetic and Rare Diseases Information Center (GARD) Office of Rare Diseases (ORD), National Institutes of Health (NIH). CDC's National Center on Birth Defects and Developmental Disabilities. Genetic Disease Information from the Human Genome Project.Global Genes Project, Genetic and Rare Diseases Organization

UNIT IV: GENETIC DISEASES 12

Genetic diseases of Blood and lymph diseases, cancers, diseases of the digestive system. Diseases of ear, nose and throat, Diseases of the eye, female-specific diseases, diseases of glands and hormones. Diseases of heart and blood vessels, diseases of the immune system, male specific diseases, disease of muscle and bone

UNIT V: GENETIC DISORDERS 12

Congenital disorders and Neonatal diseases, Diseases of the nervous system, nutritional and metabolic diseases. Respiratory diseases, diseases of skin and connective tissue, Chromosome map. Prognosis and treatment of genetic disorders

TEXT BOOKS

1. Genes and Diseases, NCBI Bookself, free e-book.
2. The principles of gene manipulation (Primrose – sixth edition).

REFERENCE BOOKS

1. Genes, Benjamin and Lewin, 8th edition. Pearson Prentice Hall, 2004
2. Rodney J Y Ho, MILO Gibaldi, Biotechnology & Biopharmaceuticals Transforming proteins and genes into drugs, 1st Edition, Wiley Liss, 2003.
3. Human Genetics and Genomics, Third Edition - Bruce R. Korf
4. Human Genetics: Principles and Approaches - Friedrich Vogel and Arno G. Motulsky
5. http://www.ncbi.nlm.nih.gov/books/bookres.fcgi/gnd/tocstatic.html

BSS 601	**VALUE EDUCATION AND PROFESSIONAL ETHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	prerequisite – social values (individual and social welfare				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
- To teach professional ethical values, codes of ethics,
- To take responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)

CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing
CO4	To learn more of Engineer as Responsible Experimenter.
CO5	To learn more of Risk and Safety assessment with case studies.

CO6	To learn more of Responsibilities and Rights as Professional and facing Global Challenges

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: **PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9**

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II: SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE) 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.

UNIT III: **MIND CULTURE & TENDING PERSONAL HEALTH 9**

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelising the Mind, Stages - Meditation, Spiritual Value. Structure of the

body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV: EXPERIMENTATION AND ENGINEERS RESPONSIBILITIES 9

Engineering as experimentation - Engineer as responsible Experimenters – Codes of Ethics – The Challenger, case study. Assessment of safety and Risk –Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies.

UNIT V: RIGHTS AND GLOBAL ISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination. Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership

Total Contact Hours: 45

TEXT BOOKS:

1. Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata Mcgraw Hill, New york 2005 (Units IV & V)

REFERENCE BOOKS:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2.Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road, Thanjavur (for Units I - III)
3. R S Nagarajan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004
5. www.ncert.nic.in/new.../**value_education**/**value**_edu.../**value**_edu2005.pdf
https://books.google.co.in/books?isbn=9048186757

BBR 6L1	GENE CLONING LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	3	2
	Prerequisite – Molecular Biology laboratory				
	Course Designed by – Dept of Genetics Engineering				

OBJECTIVES

1.The practical deals with creating recombinant DNA molecules

2.To give hands-on training in creating recombinant DNA molecules

3. Molecular analysis indirectly by restriction digestion and PCR as well as directly by DNA sequencing.

4. To give hands-on training Ligation and transformation

COURSE OUTCOMES (COs)

CO1	The studentcan able to isolate total DNA, Plant DNA and plasmid DNA.
CO2	The studentcan able to do molecular digestion and gel elution of vector and inserts and Ligation and transformation.
CO3	The studentcan able to do plasmid isolation from PCR positive colonies
CO4	The studentcan able to do Confirmation of cloning by restriction digestion
CO5	The studentcan able to do Ligation and transformation
CO6	Sequencing product

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

LIST OF EXPERIMENTS

1. Isolation of total DNA.
2. Isolation of plasmid DNA.
3. Microbial cultures
4. Digestion and gel elution of vector and inserts
5. Ligation and transformation
6. Verification of cloning by colony PCR and patching the positive colonies
7. Plasmid isolation from PCR positive colonies
8. Confirmation of cloning by restriction digestion
9. Set up DNA sequencing reaction
10. Cleaning the sequencing reaction product

REFERENCE BOOK

1. Molecular Cloning - A Laboratory Manual. 4th ed, 2012 - Cold Spring Harbor Laboratory Press.
2. Molecular Biology I Biochemistry Level II: Practical Manual. Dr Peter Kille.
3. Molecular cloning – A laboratory manual. Joseph sambrook and David w. Russell
4. http://www.mclab.com/

BBR 6L2	BIOINFORMATICS LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	3	2
	Prerequisite – Molecular modeling laboratory				
	Course Designed by – Dept of Genetics Engineering				

OBJECTIVES

1.To know about databases and their use
2. To understand sequence alignment and programming
3. To analyze the protein sequence using bioinformatics tools
4. To understand the use of PERL, Python in programming and executing research

COURSE OUTCOMES (COs)

CO1	The student can able to perform Sequence retrieval from biological database
CO2	The student can able to perform Identification of protein sequence
CO3	The student can able to perform Sequence similarity searching of protein sequences
CO4	The student can able to perform dynamic programming method- global and local alignment
CO5	The student can able to perform Phylogenetic analysis with Clustal W and Blast software
CO6	Phylogenetic analysis.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

LIST OF EXPERIMENTS

1. Knowledge of different biological database
2. Sequence retrieval from biological database
3. Identification of protein sequence
4. Sequence similarity searching of protein sequences
5. Variants of Blast
6. Multiple sequence alignment
7. Dynamic programming method- local alignment
8. Dynamic programming method- global alignment
9. Pattern finding in proteins
10. Phylogenetic analysis with Clustal W and Blast software

REFERENCE BOOK

1. “Introduction to Bioinformatics”, T.K. Attwood & D.J.Parry-Smith, Prentice Hall 2000.
2.”Instant notes on Bioinformatics”, D.R. West head. J.H.Parish R.M. Twyman, Lviva Books, New Delhi, 2003
3. “Bioinformatics Sequence and Genome analysis”, David W. Mount 2003.
4. “Bioinformatics Basics 'Applications in Biological science and Medicine” Hooman H. Rashidi & Lukas K. Buehie 2001.
5. https://www.amc.nl

BBR 701	BIOSAFETY, BIOETHICS, IPR & PATENTS	L	T	P	C
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Intellectual property rights				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES:

To enable understanding chemical principles governing biochemical reactions

COURSE OUTCOMES (COs)

CO1	Understand Handling of recombinant DNA process and products.
CO2	Biosafety assessment of biotech pharamaceutical products.
CO3	Understand the moral status of animal
CO4	Understand the intellectual property rights.
CO5	understand the patent registeration
CO6	Advanced updated of IPR

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION TO BIOSAFETY 12

Laboratory associated infections and other hazards, assessment of biological hazards and levels of biosafety, Handling of recombinant DNA processes and products in institutions and industries, biosafety assessment procedures in India and abroad.

UNIT II: BIOETHICS 12

Legality, morality and ethics, the principles of bioethics: autonomy, human rights, beneficence, privacy, justice, equity etc. Transgenic and Bioethics: Ecological safety assessment of recombinant organisms and transgenic crops, case studies of relevance (Eg. Bt cotton). Biosafety assessment of biotech pharmaceutical products such as drugs / vaccines etc.

UNIT III: ANIMAL BIOTECHNOLOGY 12

Chronology of Biotechnological studies on animals – Law & legislation on animal experimentation in India and world Moral status of animals as objects of experiments –Moral responsibility of scientists over animal experiments. Personhood – Abortion – Bioethical issues in reproduction, population explosion and control – Voluntary euthanasia & physician assisted suicide – Organ donation & Transplantation.

UNIT IV: INTELLECTUAL PROPERTY RIGHTS 12

Sovereignty rights, CBD, bioethics and patenting General agreement on trade and tariffs Indian sui-generis system for animal variety and farmer's rights protection act. WTO with reference to biotechnological affairs, TRIPs.

UNIT V: PATENT SYSTEMS 12

General Introduction: Patent claims, the legal decision, Basic Requirements of Patentability**:** Patentable subject matter, novelty and the public domain, non obviousness Special issues in Biotechnology Patents**:** Disclosure requirements, Collaborative research, Competitive research, Recent Developments in Patent System and Patentability of biotechnological inventions.

Total Periods : 60

TEXT BOOKS

1. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd., 2007
2. Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra, Information Solution Pvt. Ltd., 2007
3. S.S. Kanka Entrepreneurship Development, S. Chand and Co, New Delhi 1997

REFERENCE BOOKS

1. Beier, F.K., Crespi, R.S. and Straus, T. Biotechnology and Patent protection-Oxford and IBH Publishing Co. New Delhi.
2. Sasson A, Biotechnologies and Development, UNESCO Publications.

3. Singh K, Intellectual Property rights on Biotechnology, BCIL, New Delhi
4. Regulatory Framework for GMOs in India (2006) Ministry of Environment and Forest, Government of India, New Delhi
5. www.nordic**ipr**.com
6. www.ip-**links**.de

BBR **702**	**ANIMAL CELL CULTURE AND TRANSGENIC TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Transgenic technology, animal science, techniques				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES:

To enable understanding chemical principles governing biochemical reactions

COURSE OUTCOMES (COs)

CO1	Understand Importance of aseptic techniques
CO2	Preservation And Characterization Of Cell Lines.
CO3	Understand the Cell quantification
CO4	Understand the Methodology of production of transgenic animals.
CO5	understand the the production of recombinant proteins
CO6	Principles and advanced methods of animal cell culture techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: BIOLOGY OF CULTURED ANIMAL CELLS 12

Cell culture-Introduction-the use, advantages & disadvantages-Cell types & its characters, differentiation- Growth of cells in culture-Importance of aseptic techniques. Culture media & culture conditions-Maintenance and storage of cell cultures- Biosaftey and biohazards.

UNIT II: PRESERVATION AND CHARACTERIZATION OF CELL LINES 12

Primary culture, subculture, and cell lines-Cloning and selection-Cell separation and characterization- Differentiation -Transformation and Immortalization-Contamination-Cryopreservation techniques.

UNIT III: SCALING UP OF ANIMAL CELL CULTURE 12

Cell quantification methods-Cell viability measurements-Growth kinetics-Scale up of suspension & monolayer cultures-Air lift bioreactors.

UNIT IV: PRODUCTION OF TRANSGENIC ANIMALS 12

Methodology of production of transgenic animals – Retroviral vector method – DNA micro injection – Engineered embryonic stem cell method, Oocyte culture and Transgenic animals-Dolly – Transgenic Cattle – Transgenic Goat and Pigs – Transgenic Birds.

UNIT V : APPLICATIONS OF ANIMAL CELL CULTURE 12

Animals cells as bioreactors – therapeutic proteins – Enzymes – Vaccines– applications of transgenic animals for the production of recombinant proteins, better nutrition, bioindicator-ornamental transgenic fish.

Total Periods: 60

TEXT BOOKS

1. Culture of Animal cells by R.I. Freshney, Fifth edition
2. Culturing of Animal cells. Biotol publications

3. Molecular Biotechnology by Bernard R. Click and Jack. J. Pasternek

REFERENCE BOOKS

1. Davis J.M. Basic Cell Culture: A Practical Approach, IRL Press, 1998
2. Freshney R.I. Animal Cell Culture- a practical approach, 1987
3. Bernhard Palsson and Sangeetha N Bhatia, Tissue Engineering, 2nd Edition, Prentice Hall, 2004.
4. Pamela Greenwell, Michelle McCulley, Molecular Therapeutics: 21st century medicine, 1st Edition, Springer, 2008.
5. biology.tutorvista.com/organism/animal-tissue.html
6. www.ivyroses.com/HumanBody/**Tissue**/**Tissue**_4-**Tissue**-Types.php

BBR 703	**GENE THERAPY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – Genes and diseases, Molecular evolution and Phylogeny				
	Course Designed by – Dept of Genetics Engineering				

COURSE OUTCOMES (COs)	
CO1	Principles Of Gene Therapy
CO2	Somatic And Germline Gene Therapy
CO3	Viral And Non Viral Vectors For Gene Therapy
CO4	Classical Gene Therapy
CO5	Applications Of Gene Therapy
CO6	cardiovascular gene therapy

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: PRINCIPLES OF GENE THERAPY 12

Gene therapy – concepts- Principals of Gene therapy- Basics and Advanced techniques in Gene therapy- vector for gene therapy- ex vivo and in vivo gene therapy somatic gene therapy – germ line gene therapy.

UNIT II: SOMATIC AND GERMLINE GENE THERAPY 12

Prenatal somatic gene therapy- embryo somatic gene therapy-fetal somatic gene therapy-postnatal somatic gene therapy- germ line gene therapy.

UNIT III: VIRAL AND NON VIRAL VECTORS FOR GENE THERAPY 12

Gene transfer agents – Viral- Retro, adeno associated and herpes virus-non-viral agents- modes of gene delivery

UNIT IV: CLASSICAL GENE THERAPY 12

Increasing gene dose in deficient cell- on suppressor genes – Disease with recessive heredity-direct killing by suicide gene therapy- indirect killing – secretion gene therapy

UNIT V: APPLICATIONS OF GENE THERAPY 12

Gene repair- stem cells and gene therapy- application – treatment of genetic diseases – cancer-bone regeneration – cardiovascular gene therapy – neurological diseases

Total Contact Hours: 60

TEXT BOOK

1. Gene therapy by Keith Green berg
2. Stem cells biology and gene therapy by Peter J. Quesen Horry
3. Medical Genetics 3rd Edition- Jorde, Carey, Bamshad& White.

REFERENCE BOOKS

1. Pamela Greenwell, Michelle McCulley, Molecular Therapeutics: 21st century medicine,

1st Edition, Springer, 2008.
2. Winnacker E.L. Frome Genes to clones: Introduction to Gene Technology, Panima, 2003.
3. Lemonie, N.R. and Cooper, D.N. Gene therapy, BIOS Scientific, 1996
4. https://ghr.nlm.nih.gov/

BBR **704**	**STEM CELL BIOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Stem Cell In Drug Discovery, tissue engineering				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES:
To enable understanding chemical principles governing biochemical reactions

COURSE OUTCOMES (COs)

CO1	Understand Unique properties of stem cells.
CO2	Invitrofertilization
CO3	Understand the Somatic stem cells
CO4	Understand the Target identification differentiation pathways.
CO5	understand the production of complete organ
CO6	Characteristics of application in stem cell theraphy

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: STEM CELL BASICS 9

Unique properties of stem cells – embryonic stem cells - adult stem cells – umbilical cord stem cells – similarities and differences between embryonic and adult stem cells. Properties of stem cells – pluripotency – totipotency – multipotency.

UNIT II: EMBRYONIC STEMCELLS 9

Invitro fertilization – human embryonic stem cells – blastocyst – innercell mass – growing ES cells in lab – laboratory tests to identify ES cells – stimulation ES cells for differentiation – properties of ES cells – human ES cells – Monkey and Mouse ES cells.

UNIT III: ADULT STEM CELLS 9

Somatic stem cells – test for identification of adult stem cells – adult stem cell differentiation – trans differentiation – plasticity – different types of adult stem cells.

UNIT IV: STEM CELL IN DRUG DISCOVERY AND TISSUE ENGIEERING 9

Target identification – Manipulating differentiation pathways – stem cell therapy Vs cell protection - stem cell in cellular assays for screening – stem cell based drug discovery platforms, drug screening and toxicology.

UNIT V: GENETIC ENGINEERING AND THERAPEUTIC APPLICATION OF STEM CELLS 9

Gene therapy – genetically engineered stem cells – stem cells and Animal cloning – transgenic animals and stem cells – Biomarkers in Cancer – Therapeutic applications – Parkinson disease - Neurological disorder – limb amputation – heart disease - spinal cord injuries – diabetes –burns Matching the stem cell with trans plant recipient - HLA typing Alzheimers disease – spinal cord injuries tissue engineering application – production of complete organ - kidney – eyes - heart – brain.

Total Contact Hours: 45

TEXT BOOKS

1. Stem cells Hand Book by Stewart Sell
2. Stem cell Research by Nancy E. Snow

REFERENCE BOOKS

1. Human Embryonic Stem cells by Ann.A. Kiessling
2. Stem cell and future of regenerative medicine. National Academic press
3. Stem cell and Cloning by David A. Prentice and Michael A. Palladin.
4. www.nature.com/**stemcells**/**links**.html
5. www.ukaachen.de/.../division-of-**stem-cell-biology**-and-**cellular**-engineer

BBR 7L1	**GENOME ANALYSIS LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	0	0	3	2
	Prerequisite – BLAST, Database, Protein targeting signal sequence				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES:

To enable understanding chemical principles governing biochemical reactions

COURSE OUTCOMES (COs)

CO1	Knowledge on variants of BLAST
CO2	Gene prediction
CO3	Translation the sequences and ORF finding
CO4	Splice site junction prediction
CO5	Protein targeting signal sequence prediction
CO6	Pattern searching

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

LIST OF EXPERIMENTS

1. Sequence retrieval from biological database
2. Knowledge on variants of BLAST
3. Gene prediction
4. Translation the sequences and ORF finding
5. Splice site junction prediction
6. Protein targeting signal sequence prediction
7. Pattern searching
8. Comparative genome analysis
9. Phylogeny analysis
10. FASTA Variance analysis

REFERENCE BOOK

1. Basics of Molecular Cloning – promega
2. Sequence and Genome anlysis David W. Mount, 2004. Cold spring harbor laboratory press New york.
3. Molecular cloning – A laboratory manual. Joseph sambrook and David w. Russell
4. www.plant**genome**.uga.edu/**links**.htm

BBR **7L2**	**ANIMAL CELL CULTURE LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	0	0	3	2
	Prerequisite – animal Cell Culture, anti cancer agent in cell culture				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES:

To enable understanding chemical principles governing biochemical reactions.

COURSE OUTCOMES (COs)

CO1	Preparation of culture media
CO2	Sterilization techniques of cell and tissue culture labwares/Glasswares
CO3	Adaptation of Animal virus in cell lines.
CO4	Study of effect of anti cancer agent in cell culture.
CO5	Preparation of culture media
CO6	Sterilization techniques of cell and tissue culture labwares/Glasswares

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

LIST OF EXPERIMENTS

1. Preparation of culture media
2. Sterilization techniques of cell and tissue culture labwares/Glasswares
3. Adaptation of Animal virus in cell lines.
4. Study of effect of anti cancer agent in cell culture.
5. Organ Culture
5. MTT Assay
6. Live cell counting
7. Leukocyte culture
8. Culturing of spleen cells
9. PBMC or Myeloma cell culture
10. Fusion of cells by PEG

REFERENCE BOOK

1. Basics of Cell Culture - A student laboratory manual By Golnar Afshar PhD Laboratory Manual
2. Introduction to animal Cell Culture, John A Ryan
www.anl.gov/safety/biosafety/biosafety-**links**
www.bio-**link**.org/home/sites/files/instructor_manualv8.pdf

ELECTIVES

BBR 001	**HUMAN GENETICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Principles of Genetics, Microbiology				
	Course Designed by – Department of Genetic Engineering				

OBJECTIVES

1. To understand fundamental laws of genetics.
2. To know techniques in *in situ* genetic analysis for mutation and aberration studies.
3. To identify and relate phenotype to changes in chromosome structure and number.

COURSE OUTCOMES (COs)

CO1	This course introduces the principles of genetics.
CO2	It discusses the basics laws of inheritance.
CO3	It gives chromosome structure and cytological techniques.
CO4	Properties of chromosome variation, linkage mapping and population genetics.

CO5	To understand the linkage analysis and recombination mapping.
CO6	To study population genetics and analyze quantitative characters.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: GENOME ORGANIZATION AND INHERITANCE 9

Organization, Human multigene families and repetitive coding DNA, Extragenic repeated DNA sequences and transposable elements, Inheritance-Autosomal Dominant Inheritance-Autosomal Recessive Inheritance- Factors that May Complicate Inheritance Patterns- Consanguinity in Human Populations, Sex-Linked and Mitochondrial Inheritance, X inactivation- Sex-Linked Inheritance- Sex-Limited and Sex-Influenced Traits- Mitochondrial Inheritance.

UNIT II: GENOME MAPPING AND DEVELOPMENTAL GENETICS 9

Physical Mapping - Low resolution physical mapping, High resolution physical mapping, Genetic mapping- Two-point mapping, Multipoint mapping, parametric linkage analysis, Nonparametric linkage analysis, Development genetics- Genetic Mediators of Development, the Molecular Toolbox- Pattern Formation.

UNIT III: MEDICAL GENETICS **9**

The Chromosomal Basis of Human Disease- Nomenclature-Abnormalities of Chromosome Number- Abnormalities of Chromosome Structure- Pregnancy Loss- Cancer genetics- Cancer Genes- Oncogenes, Activation of proto-oncogenes, Tumor suppressor genes, Molecular Basis of Cancer, Control of the cell cycle, Defects of Metabolic Processes- Pharmacogenetics.

UNIT IV: IDENTIFICATION OF DISEASE GENES **9**

Identifying human disease genes - Principles and strategies in identifying disease genes, Position-independent strategies for identifying disease genes, positional cloning, Positional candidate strategies to identify candidate genes by a combination of their map position and expression, function or homology, confirming a candidate gene

UNIT V: THE GENETICS OF COMMON DISEASES **9**

Genetic Screening, Genetic Diagnosis, and Gene Therapy, Population Screening for Genetic Diseases, Molecular Tools for Screening and Diagnosis, Prenatal Diagnosis of Genetic Disorders and Congenital Defects, Fetal Treatment, Pedigree analysis and Genetic Counseling.

Total Contact Hours: 45

TEXT BOOKS

1. Human Molecular Genetics – Tom Strachan and Andrew P. Read
2. Medical Genetics 3rd Edition- Jorde, Carey, Bamshad& White.

REFERENCE BOOKS

1. Human Genetics and Genomics, Third Edition - Bruce R. Korf
2. Human Genetics: Principles and Approaches - Friedrich Vogel and Arno G. Motulsky
3. Watson, J.D., Gilman, M., Witowski J.and Zoller, M. Recombinant DNA, 2nd ed., Scientific American Books, 1983
4. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1684911/

BBR 002	**ANIMAL TISSUE ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	0	0	3
	Prerequisite –Microbiology, Animal biotechnology, Tissue Engineering, Cell biology and Basic Biology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To make understand of the animal tissue culture engineering so as to help them to manipulate the cell to the requirement of the grafting needs

COURSE OUTCOMES (COs)

CO1	Understand the bulk development of serum free media.

CO2	Explain the method of Organ cultures and types of organ cultures
CO3	Strategies for gene transfer techniques in mammalian cells.
CO4	Understand the commercial production of monoclonal antibodies and their use for mankind
CO5	To know the viral vectors-general features, promoters used in expression vectors
CO6	To gain knowledge on Medical devices used for animal tissues cultures..

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

Unit I: **INTRODUCTION TO SEROLOGY** **9**

Biology of cells in culture, Origin and characterization of different cell types, Characteristics of cultured cells, Subculture, selection of medium, Chemically defined and serum free media, Development of serum free media Advantages and disadvantages of serum free media

Unit II: STERILIZATION AND DISINFECTION **9**

Aseptic techniques, Media preparation, Cell counting methods, Growth of adherent and suspension cultures, survival curves of primary cell culture, Sub culturing techniques, Measurement of growth parameters of cultured cells, Maintenance and cryopreservation of cell lines, Mycoplasma and virus testing, Cell transfection, Characterization of cells and cell products, types of substrates for cell growth Scale-up of adherent and suspension cultures. Identification of specific cell lines, Organ cultures and types of organ cultures.

Unit III: ANIMAL CELL CULTURE 9

Animal handling techniques and care, Preparation of established cell lines, Mass cell cultivation, Mouse embryo fibroblast culture, staining techniques for animal cells, preparation of mice splenocytes, culture of virus in chick embryo, adaptation of virus in animal (in vitro) cell culture.

Unit IV: HYBRIDOMA TECHNOLOGY 9

Hybridomas and cell transformation: The basis of hybridoma technology, Storage of hybridoma cells, Monoclonal antibodies and their commercial production, Commercial production of monoclonal antibodies and their use for mankind.

Unit V: MAMMALIAN CELL CULTURE 9

Genetic engineering of mammalian cells: Gene transfer techniques in mammalian cells, Sexing of embryos, Somatic cell nuclear transfer and transgenic animals, Basic characteristics of cancer cell growth in culture and senescence. Cell banks, Medical devices used for animal tissues cultures.

Total Contact Hours: 45

Text Books:

1. Campbell, N. A. and Jane B. Reece. Biology. 6th Edition. USA. Pearson Education, Inc. 2002. 198 199 199 Freshney, R.I. Culture of Animal Cells: A Manual of basic techniques. 5th Edition. USA. Wiley-Liss Inc. 2005.
2. Gamborg, O. L. and G. C. Phillips. Plant cell, tissue, and organ culture: fundamental methods. Germany. Springer-Verlag. 1995.

Reference Books:

1. Masters J. R. W. (2000): Animal cell culture 3. iz. Oxford University Press, Oxford Butler M (2004): Animal cell culture & technology, 2. iz. Bios Scientific Publishers, London i New York
2. Freshney R. I. (2000): Culture of animal cells: A manual of basic technique. 4. iz. Willey-Lys, J.Willey & Sons. New York
3. Culture of Animal Cells: A Manual of Basic Technique (5th Edition) R. Ian Freshney. Wiley-Liss. It is in your best interest to bring this book to class.
4. www.zora.uzh.ch

BBR 003	CLASSICAL AND MOLECULAR PLANT BREEDING	L	T	P	C
	Total Contact Hours – 60	3	0	0	3
	Prerequisite – Molecular biology, plant biotechnology				
	Course Designed by – Dept of Genetic Engineering				

COURSE OUTCOMES (COs)

CO1	To understand the molecular biology
CO2	To know the methods of plant breeding.
CO3	To understand the Breeding methods in cross pollinated crops
CO4	To know Concept of plant ideo type and its role in crop improvement
CO5	To understand how to Maintain of experimental records
CO6	Learning techniques in hybrid seed production using male-sterility in field crops.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I : INTRODUCTION TO PLANT BREEDNG 12

History of Plant Breeding (Pre and post-Mendelian era); Objectives of plant breeding, Characteristics improved by plant breeding; Patterns of Evolution in Crop Plants- Centers of Origin-biodiversity and its significance. Genetic basis of breeding self- and cross - pollinated crops including mating systems and response to selection - nature of variability, components of variation; Heritability and genetic advance, genotype environment interaction; General and specific combining ability; Types of gene actions and implications in plant breeding; Plant introduction and role of plant genetic resources in plant breeding.

UNIT II: PEDIGREE ANALYSIS 12

Self-incompatibility and male sterility in crop plants and their commercial exploitation. Pure line theory, pure line selection and mass selection methods; Line breeding, pedigree, bulk, backcross, single seed descent and multi-line method; Population breeding in self pollinated crops (diallel selective mating approach).

UNIT III: BREEDING METHODS 12

Breeding methods in cross pollinated crops; Population breeding-mass selection and eartorow methods; S1 and S2 progeny testing, progeny selection schemes, recurrent selection schemes for intra and inter-population improvement and development of synthetics and composites; Hybrid breeding - genetical and physiological basis of heterosis and inbreeding, production of inbreds, breeding approaches for improvement of inbreds, predicting hybrid performance; seed production of hybrid and their parent varieties/inbreds. Breeding methods in asexually/clonally propagated crops, clonal selection apomixes, clonal selection.

UNIT IV: **CROP IMPROVEMENT 12**

Concept of plant ideotype and its role in crop improvement; Transgressive breeding. Special breeding techniques- Mutation breeding; Breeding for abiotic and biotic stresses. 8 Cultivar development- testing, release and notification, maintenance breeding, Participatory Plant Breeding, Plant breeders' rights and regulations for plant variety protection and farmers rights.

UNIT V: ADVANCE BREEDING ANALYSIS 12

Practical Floral biology in self and cross pollinated species, selfing and crossing techniques. Selection methods in segregating populations and evaluation of breeding material; Analysis of variance (ANOVA); Estimation of heritability and genetic advance; Maintenance of experimental records; Learning techniques in hybrid seed production using male-sterility in field crops.

Total Contact Hours: 45

Text Books:

1. Allard RW. 1981. Principles of Plant Breeding. John Wiley & Sons.
2. Chopra VL. 2001. Breeding Field Crops. Oxford & IBH.
3. Chopra VL. 2004. Plant Breeding. Oxford & IBH.
4. Gupta SK. 2005. Practical Plant Breeding. Agribios.

5. Pohlman JM & Bothakur DN. 1972. Breeding Asian Field Crops. Oxford & IBH. • Roy D. 2003. Plant Breeding, Analysis and Exploitation of Variation. Narosa Publ House.

Reference Books:

1. Sharma JR. 2001. Principles and Practice of Plant Breeding. Tata McGraw-Hill.
2. Simmonds NW. 1990. Principles of Crop Improvement. English Language Book Society
3. Singh BD. 2006. Plant Breeding. Kalyani. • Singh P. 2002. Objective Genetics and Plant Breeding. Kalyani.
4. Singh P. 2006. Essentials of Plant Breeding. Kalyani.
5. Singh S & Pawar IS. 2006. Genetic Bases and Methods of Plant Breeding CBS.
6. http://sharebooks.com/system/files/Crop-Histories.pdf

BBR 004	**CANCER BIOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – System Biology, Genomics and proteomics				
	Course Designed by – Department of Genetic Engineering				

OBJECTIVES

1 To provide knowledge about biological aspects of cancer.
2. To impart basic concepts of cancer biology.
3. Various stages in carcinogenesis, molecular cell biology of cancer.

COURSE OUTCOMES (COs)

CO1	Fundamentals Of Cancer Biology
CO2	Principles Of Carcinogenesis
CO3	Principles Of Molecular Cell Biology Of Cancer
CO4	Principles Of Cancer Metastasis
CO5	New Molecules For Cancer Therapy
CO6	Cancer metastasis and cancer therapy.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		

	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: FUNDAMENTALS OF CANCER BIOLOGY 9

Regulation of cell cycle, mutations that cause changes in signal molecules, effects on receptor, signal switches, tumor suppressor genes, modulation of cell cycle in cancer, different forms of cancers, diet and cancer. Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer. Cancer Epidemiology

UNIT II: PRINCIPLES OF CARCINOGENESIS 9

Theory of carcinogenesis, Chemical carcinogenesis, metabolism of carcinogenesis, principles of physical carcinogenesis, x-ray radiation-mechanisms of radiation carcinogenesis.

UNIT III: PRINCIPLES OF MOLECULAR CELL BIOLOGY OF CANCER 9

Signal targets and cancer, activation of kinases; Oncogenes, identification of oncogenes, retroviruses and oncogenes, detection of oncogenes, Oncogenes/ proto oncogene activity, Growth factors related to transformation, Telomerases.

UNIT IV: PRINCIPLES OF CANCER METASTASIS 9

Clinical significances of invasion, Heterogenicity of metastatic phenotype, metastatic cascade, basement membrane disruption, three step theory of invasion, Proteinases and tumor cell invasion.

UNIT V: NEW MOLECULES FOR CANCER THERAPY 9

Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer; Gene therapy.

Total Contact Hours: 45

TEXT BOOKS

1. Maly B.W.J, “Virology. A Practical Approach”, IRLl Press, Oxford, 1987.
2. Dunmock N. J and Primrose S.B., “Introduction to Modern Virology”, Blackwell Scientific Publications, Oxford, 1988.

REFERENCE BOOKS

1. An Introduction Top Cellular and Molecular Biology of Cancer, Oxford Medical Publications, 1991.
2. Molecular Cell Biology, Sixth Edition by Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Matthew.
3. An Introduction to Molecular Biotechnology: Molecular Fundamentals, Methods and Applications in Modern Biotechnology Michael Wink (Editor) 2006, John Wiley & Sons Publishers, Inc
4. **https://biology.mit.edu/research/cancer_biology**

BBR 005	AGRI,VETERINARY AND MEDICAL INFORMATICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Biopharmaceutical technology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

1. To introduce the basic principles of computerized patent record
2. To understand the recent trends in medical informatics

COURSE OUTCOMES (COs)

CO1	To learn about HIS
CO2	It also gives knowledge on veterinary informatics
CO3	To understand the clinical information system
CO4	It deals with CPR in radiology
CO5	It imparts health care information
CO6	Ability to do docking methods

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: AGRICULTURAL INFORMATICS 9

Introduction – plant genome, and Analysis of plant genome sequence, analysis of metabolites in plants, targeting study of compound against plant pathogens using bioinformatics tools.

UNIT II: VETERINARY INFORMATICS 9

Introduction - history of pathogens, interaction between pathogens and host cell molecules using bioinformatics tools. Genome analysis for identification of diseases. Study of molecules and functional domain structure using bioinformatics tools

UNIT III: MEDICAL INFORMATICS 9

Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues , Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, e-health services, Health Informatics – Medical Informatics, Bioinformatics

UNIT IV: COMPUTERISED PATIENT RECORD 9

Introduction - History taking by computer, Dialogue with the computer, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.

UNIT V: RECENT TRENDS IN MEDICAL INFORMATICS 9

Virtual reality applications in medicine, Computer assisted surgery, Surgical simulation, Telemedicine - Tele surgery computer aids for the handicapped, computer assisted instrumentation in Medical Informatics - Computer assisted patient education and health - Medical education and health care information.

Total No. of Contact Hours: 45

TEXT BOOKS:

1.R.D. Lele Computers in medicine progress in medical informatics, Tata McGraw Hill Publishing computers Ltd,2005, New Delhi

2.Mohan Bansal, Medical informatics Tata McGraw Hill Publishing computers Ltd, 2003 New Delhi

REFERENCE BOOKS

1. Role of bioinformatics in agricultural - Santosh Kumar, 2014

2. Bioinformatics Sequence and Genome analysis - David W. Mount, 2003.

3. Bioinformatics Basics 'Applications in Biological science and Medicine" Hooman H. Rashidi & Lukas K. Buehie 2001.

http://www.omicsonline.org/

BBR 006	**GENETIC ENGINEERING OF PLANTS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	0	0	3
	Prerequisite – Genetics, plant biotechnology, Genomics.				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To impart theoretical knowledge and practical skills about plant breeding objectives, modes of reproduction and genetic consequences, breeding methods for crop improvement

COURSE OUTCOMES (COs)

CO1	To understand the Importance of plant genetic resources;
CO2	To know the Basic genetic resources and transgenes
CO3	To understand the Germplasm conservation
CO4	To know the Role of CGIAR system in the germplasm exchange
CO5	To understand how to Maintain of experimental records
CO6	Learning techniques of Intellectual property, Patents, copyrights, trademarks and trade secrets. .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			

	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I : PGR CONSERVATION METHODS 9

Historical perspectives and need for PGR conservation; Importance of plant genetic resources; Taxonomical classification of cultivated plants; Gene pool: primary, secondary and tertiary; Centers of origin and global pattern of diversity; Basic genetic resources and transgenes.

UNIT II: GERM PLASM THEORY 9

Principles, strategies and practices of exploration, collection, characterization, evaluation and cataloging of PGR; Plant quarantine and phytosanitary certification; Germplasm introduction and exchange; Principles of in vitro and cryopreservation.

UNIT III: GERMPLASM CONSERVATION 9

Germplasm conservation- in situ, ex situ, and on-farm; short, medium and long term conservation strategies for conservation of orthodox seed and vegetatively propagated crops; Registration of plant genetic resources.

UNIT IV: DATABASE MANAGEMENT 9

PGR data base management; Multivariate and clustering analysis, descriptors; National and international protocols for PGR management; PGR for food and agriculture (PGRFA); PGR access and benefit sharing; Role of CGIAR system in the germplasm exchange; PBR, Farmers rights and privileges; Seed Act, sui generis system; Geographical indicators, Intellectual property; Patents, copyrights, trademarks and trade secrets.

UNIT V : GENE ENHANCEMENT METHODS 9

Journey from wild to domestication; Genetic enhancement- need for genetic enhancement; Genetic enhancement in pre Mendelian era and 21st century; Genetic enhancement and plant

breeding; Reasons for failure in genetic enhancement; Sources of genes/ traits- novel genes for quality.

Total Contact Hours: 45

Text Books:

1. Frankel OH & Bennett E. 1970. Genetic Resources in Plants – their Exploration and Conservation. Blackwell. Gautam PL, Dass BS, Srivastava U & Duhoon SS. 1998. Plant Germplasm Collecting: Principles and Procedures. NBPGR, New Delhi.
2. Painting KA, Perry MC, Denning RA & Ayad WG. 1993. Guide Book for Genetic Resources Documentation. IPGRI, Rome, Italy.

Reference Books:

1. Paroda RS & Arora RK. 1991. Plant Genetic Resources, Conservation and Management. Concepts and Approaches. IPGRI Regional office for South and South Asia, New Delhi. Puzone L & Hazekamp TH. 1996. Characterization and Documentation of Genetic Resources Utilizing Multimedia Database. NBPGR, New Delhi.

2. Rana RS, Sapra RL, Agrawal RC & Gambhir R. 1991. Plant Genetic Resources, Documentation and Information Management. NBPGR, New Delhi. Singh RJ & Jauhar PP. 2005. Genetic Resources, Chromosomal Engineering and Crop Improvement. Vol. I. Grain Legumes, Vol. II. Cereals. CRC Press, Taylor & Francis Group, USA.
3.http://50.30.47.15/Ebook/Course_SUST_BMB/BMB_328/An_Introduction_to_Genetic_Engineering.pdf

BBR 007	**MOLECULAR MEDICINE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Molecular modelling				
	Course Designed by – Dept of Genetics Engineering				

OBJECTIVE:

1. To gain knowledge of basic cytogenetic techniques.
2. To learn about biochemical method used to detect metabolic changes.
3. To learn about molecular methods to detect changes in the DNA.
4. To learn about molecular methods to detect changes in the RNA and protein

COURSE OUTCOMES (COs)

CO1	To learn about various diagnostic strategies to detect large deletions in chromosomes.
CO2	It also gives knowledge on efficient utilization of changes in gene expression at RNA and protein level.

CO3	It deals with protein truncation.
CO4	It imparts determination of splicing variants
CO5	Molecular pharmacology
CO6	Transgeneic animals study

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION TO MOLECULAR MEDICINE 9

Introduction to Molecular Medicine: Overview of the subject -Molecular mechanisms in development and differentiation -Molecular and biomedical aspects of ageing

UNIT II: GENE EXPRESSION AND PROTEIN FUNCTIONAL DEFECTS IN DISEASE 9

Vesicle trafficking in cells -Abnormal protein function and disease -Diseases of DNA repair and genomic instability -RNA processing and disease-Oncology-Chromosomal translocations and leukemia: identification of novel therapeutic targets -Lymphoma -Skin cancer-Solid tumors': renal carcinoma-Lung and circulatory disease-Coagulation and hemophilia -Atherosclerosis -Cystic fibrosis -Molecular aspects of neurodegenerative disease-Prion proteins -Alzheimer's and Huntington's diseases

UNIT III: MOLECULAR PHARMACOLOGY 9

Pharmacogenetics -Drug discovery -Drug design and development -Molecular aspects of infectious diseases- Intracellular pathogens: Bacillary dysentery Extracellular pathogens: Botulism and tetanus -Viral pathogens: Dengue hemorrhagic fever

UNIT IV: IMMUNOLOGICAL ASPECTS OF MOLECULAR MEDICINE 9

Autoimmunity and transplantation -Human genome and predisposition to autoimmunity -Transgenic models of autoimmunity-Lessons from animal models for manipulation of the immune system.

UNIT V: MOLECULAR BIOTECHNOLOGY 9

Recombinant proteins; state of the art, problems, new developments -Antibodies, design production, engineering -Peptides and derivatives as therapeutic agents-Gene therapy and delivery – Nanotechnology and pharmaceuticals – Drug delivery systems-Commercialization -Clinical trials/ethics

Total Contact Hours: 45

TEXT BOOKS

1. Medical Genetics 3rd Edition- Jorde, Carey, Bamshad & White.
2. Molecular pharmacology A short course by Jerry Kenatin: John Wiley and Sons publications.

REFERENCES:

1. Gary Walsh – "Proteins – Biochemistry and Biotechnology" Robert A. Meyers – Encyclopedia of Molecular Cell Biology and Molecular Medicine (Ed) – Vol I, II ed.
2. Barry Halliwell - Free Radicals in Health and Disease.
3. http://molmed.org/

BBR 008	**MICROBIAL GENETICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	0	0	3
	Prerequisite – Cell biology, Genetics, and Basic Biology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To learn various types of physical organization of bacterial genomes; genotype and phenotype

COURSE OUTCOMES (COs)

CO1	Understand the steps in dominance and recessive characters

CO2	Explain the features of various types of Gene transfer
CO3	mechanism of transposition
CO4	gene expression; transcriptional control;
CO5	Plasmid expression vectors- restriction and modification
CO6	To gain knowledge on various Genetics of yeast and their applications.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION 9

Differences between eukaryotic and prokaryotic Genetics; physical organization of bacterial genomes; genotype and phenotype; dominance and recessive characters, molecular biology of bacterial cell division and plasmid replication.

UNIT II: GENE TRANSFER METHODS 9

Molecular mechanism of transformation, conjugation and transduction; consequences of recombination; gene mapping; mosaic genes and chromosome plasticity.

UNIT III: MOVABLE GENETIC ELEMENTS 9

Plasmids: structure, properties, functions and stability; transposons; mechanism of transposition; phase variation; CRISPR.

UNIT IV: REGULATION OF GENE EXPRESSION 9

Induction and repression; operon model of gene expression; transcriptional control; promoter, terminator, attenuator and anti-terminator; two component regulatory pathway; global regulatory systems; translational control. Bacteriophage structure; ssDNA bacteriophage; RNA containing phages; dsDNA phages; genetics and molecular biology of λ (lambda) phage; lytic and lysogenic cycle; restriction and modification; and bacterial resistance to phage attack.

UNIT V: GENETICS OF YEAST 9

Yeast as a model organism; advantages, life cycle, mating type switching in yeast; transformation and recombination; yeast artificial chromosome; yeast two-hybrid systems.

Text Book:

1.Briggs D. 1997. Plant Variation and Evolution. Science Publ.
2.Cronquist AJ. 1981. An Integrated System of Classification of Flowering Plants. Columbia Univ. Press.24
3.Dhillon BS, Varaprasad KS, Kalyani S, Singh M, Archak S, Srivastava U & Sharma GD. 2001. Germplasm Conservation A Compendium ofAchievements. NBPGR, New Delhi.
4.Castri F & Younes T. 1996. Biodiversity Science and Development: Towards New Partnership. CABI & International Union for Biol.Sci. France.
5.Gurcharan Singh. 2004. Plant Systematics: An Integrated Approach. Science Publ.

Reference Book:

1. Lawrence GMH. (Ed.). 1951. Taxonomy of Vascular Plants. London.

2. Paroda RS & Arora RK. 1991. Plant Genetic Resources Conservation and Management Concepts and Approaches. IPGRI Regional office for South and South Asia, New Delhi.

3. www.lamission.edu/lifesciences/steven/micro20%20chapter%208.**pdf**

BBR 009	**HERBAL DRUGS AND GENOMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	0	0	3
	Prerequisite – Herbal studies, Principles of genomics, Plant biology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To learn various types of physical organization of Medicinally important Plants

COURSE OUTCOMES (COs)

CO1	Understand the steps in Herbarium techniques
CO2	Explain the Current approaches for drug discovery from herbal medicines.

CO3	Definition and scope of pharmacognosy
CO4	Chemistry of drugs and its evaluation
CO5	drug interactions and their influence in gene expression
CO6	To gain knowledge on various Psychoactive drugs

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION TO HERBAL DRUGS 9

Introduction to Medicinally important Plants. Plant parts: Fruits, Leaves, Stem and its modifications. Plant identification – Herbarium techniques. Medicinal plants – role in human health care. Medicinally important plant families : Meliaceae, Myrtaceae, Apiaceae, Asclepiadaceae, Solanaceae,Lamiaceae, Euphorbiaceae, Zingiberaceae, Musaceae and Poaceae. Current approaches for drug discovery from herbal medicines.

UNIT II: SCOPE OF ETHNOMEDICINE 9

Ethnomedicine – definition, history and its scope – Traditional knowledge and utility of some medicinal plants in Tamilnadu – Solanum trilobatum, Cardiospermum halicacabum, Adathoda vasica, Azadirachta indica, Phyllanthus fraternus and Boerhaavia diffusa. Plants in day to day life – Ocimum sanctum, Aloe vera,Amla, Neem. Nutritive and medicinal value of some fruits (Guava, Sapota, Orange, Mango, Banana, Lemon, Pomegranate) and vegetables - Greens (Moringa, Solanum nigrum)

UNIT III: PHARMOCOGNOSY 9

History, Definition and scope of pharmacognosy; Systems of Indian Medicines – Siddha, Unani, Ayurveda, Homeopathy; Terminologies. Ayurveda, Traditional Chinese medicine and Korean medicines. Classification of Crude drugs – Taxonomical, Morphological, Pharmacological and chemical classifications; Chemistry of drugs and its evaluation. Current extraction techniques in herbal medicines. Biological testing of herbal drug.

UNIT IV: HERBAL MEDICINE GENOMICS 9

Introduction to Herbal medicine genomics, Pharmacogenomics of Herbal drugs, application of Bioinformatics tools in Herb- drug interactions and their influence in gene expression, Herbal drugs used for Asthma, cancer , genetic disorders,antimicrobials, acute and chronic diseases. Psychoactive drugs –Depressants, Stimulants, hallucinogens – sources, effects, basic mechanism of action.

UNIT V: GENE EXPRESSION METHODS 9

Ayugenomics, Plant medicine genomics, case studies on herbal medicines and their effects in gene expression.

Tex Books:

1. Kumar, N.C. (1993). An Introduction to Medical botany and Pharmacognosy. Emkay Publications, New Delhi. 2. Rao, A.P. Practicals:
2. Gokhale, S.S., C.K.Kokate and A.P. Purohit (1994) Pharmacognosy. Nirali Prakashan. Pune.
3. Tyagi, Dinesh Kumar (2005) Pharma Forestry. Field Guide to Medicinal Plants. Atlantic Publishers and Distributors, New Delhi.
3. Faroogi, A.A., and B.S. Sreeramu (2004). Cultivation of Medicinal and Aromatic Crops. University Press (India) Pvt. Ltd., Hyderabad.

Reference:

1. Ethnobiology – R.K.Sinha & Shweta Sinha – 2001. Surabhe Publications – Jaipur.
2. Tribal medicine – D.C. Pal & S.K. Jain 1998, Naya Prakash, 206, Bidhan Sarani, Calcutta – 700 006.
3. Contribution to Indian ethnobotany – S.K. Jain 1995, 3rd edition, Scientific publishers, P.B.No. 91, Jodhpur, India.
4. A Manual of Ethnobotany – S.K.Jain, 1995, 2nd edition.
5. https://www.sciencemag.org/.../art-and-science-traditional-medicine-part

BBR 010	**Pharmacogenomics**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	0	0	3
	Prerequisite –Pharmacology, Principles of genomics,				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To learn various Pharmaceutical industry & development of drugs

COURSE OUTCOMES (COs)

CO1	Understand the steps in Various steps in new drug developments
CO2	Explain the Current approaches for Mechanism of drug action.
CO3	special requirements for bulk drug manufacture
CO4	Chemistry of drugs and its evaluation
CO5	Tests used in drug manufacture; packing techniques
CO6	Various categories of therapeutics like Vaccines

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION 9

Pharmaceutical industry & development of drugs; types of therapeutic agents and their uses; economics and regulatory aspects. Various steps in new drug developments

UNIT II: DRUG ACTION, METABOLISM AND PHARMACOKINETICS 9

Mechanism of drug action; physico-chemical principles of drug metabolism; radioactivity; Pharmacology, Pharmacogenomics and pharmaco kinetics.

UNIT III: MANUFACTURE OF DRUGS, PROCESS AND APPLICATIONS 9

Types of reaction process and special requirements for bulk drug manufacture. Toxicology. Fermentation technology. Bioprocess technologies.

UNIT IV: PRINCIPLES OF DRUG MANUFACTURE 9

Compressed tablets; dry and wet granulation; slugging or direct compression; tablet presses; coating of tablets; capsule preparation; oval liquids – vegetable drugs – topical applications; preservation of drugs; analytical methods and other tests used in drug manufacture; packing techniques; quality management; GMP.

UNIT V: BIOPHARMACEUTICALS 9

Various categories of therapeutics like Vaccines, life saving drugs, antibodies, vitamins, laxatives, analgesics, contraceptives, antibiotics, hormones and biologicals.

Total Contact Hours: 45

TEXT BOOKS

1. Gareth Thomas, Medicinal Chemistry. An introduction by .John Wiley. 2000.
2. Katzung B.G., Basic and Clinical Pharmacology, Prentice Hall of Intl. 1995.
3.Brahmankar, D.M., "Biopharmaceutical and Pharmacokinetics: A Treatise", Vallabh Prakashan, 1995.

REFERENCE BOOKS

1. Niazi, Sarfaraz K. "Handbook of Bio-generic Therapeutic Proteins: Regulatory, Manufacturing, Testing, and Patent Issues". CRC Press, 2006.
2. Ho, Reedney J. Y., MiloGibaldi. "Biotechnology & Biopharmaceuticals Transforming Proteins and Genes into Drugs". Wiley Liss, 2003.
3. http://www.btci.org/aket.bt

BBR 011	PROTEIN ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Genomics and Proteomics, System Biology				
	Course Designed by – Department of Genetic Engineering				

OBJECTIVES

1. To understand the principle of nucleic acid isolation.

2. To understand the principles of PCR and their uses in genetic engineering.						
COURSE OUTCOMES (COs)						
CO1	This course imparts the knowledge on the principles on nucleic acid isolation and purification.					
CO2	It also gives knowledge on history and latest methods of DNA sequencing..					
CO3	It deals with the protein – protein interaction.					
CO4	It imparts protein sequencing methods.					
CO5	To gain a thorough knowledge about nucleic acid hybridization.					
CO6	To learn history of DNA sequencing and current methods and gene synthesis.					
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION TO PROTEIN ENGINEERING 9

Introduction to proteins. Genes and proteins. Proteomics. Basics of protein synthesis. Types and classification of proteins. Primary structure, secondary structure, tertiary structure, quaternary structure, Ramachandran plot.

UNIT II: PROTEIN STRUCTURE PREDICTION 9

Strategies for design of novel proteins-strategies for the design of structure and function, computer methods in protein modelling. Bioinformatics tools in protein studies.

UNIT III: PRODUCTION OF NOVEL PROTEINS 9

Site and strategies for heterologous expressions, methods for expressing recombinant proteins in yeast, in vitro mutagenesis. Yeast two Hybrid system.

UNIT IV: CHARACTERIZATION OF PROTEINS 9

Traditional and advanced methods in protein characterizations. NMR spectroscopy, crystallography, spectroscopic and calorimetric methods.

UNIT V: APPLICATIONS OF PROTEIN ENGINEERING 9

Application of protein engineering in industries. Design of polymeric biomaterials, nicotinic acetylcholine receptors as a model for a super family of ligand - gated ion channel proteins

Total Periods: 45

TEXT BOOK:

1. Protein engineering and design by Paul R. Carey, academic press, 1996, 361 pages
2. Baxevanis A.D. and Oullette, B.F.F. A Practical Guide to the Analysis of Genes and Proteins, 2nd ed., John Wiley, 2002
3. Models of Proteins and Nucleic Acids. Cambridge University Press, 1998

REFERENCE BOOKS

1.Proteomics from protein sequence to function: Edited by S.R.Pennington and M.J.Dunn,Taylor and Francis Group, 2001.
2.Biophysical Chemistry, Cantor and Schimmel, part I and II, W.H. Freeman and co 1997.
3. http://nptel.ac.in/courses/102103017/pdf/lecture%2022.pdf

BBR 012	BIOCONFINEMENT OF GENETICALLY MODIFIED ORGANISMS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Biology, Plant and animal biotechnology and rDNA Technology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

Gain knowledge on basic developmental aspects of plant that can be transformed into research application.

COURSE OUTCOMES (COs)	
CO1	The course imparts advanced knowledge on genetically modified organisms.
CO2	It also gives knowledge on efficient utilization of the principles of bioconfinement.
CO3	It deals with transgenic algae.
CO4	It imparts determination of bioconfinement research.
CO5	To apply the modular approach and regulatory networks present in a cell.
CO6	To Possess requisites for plant signal transduction research.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION TO BIOCONFINEMENT 9

Genetically Engineered Organisms – Applications of Genetically modified organisms in medicine and Agriculture. Bio confinement - Methods of Bio confinement, International Aspects - History of Confinement - Social Acceptability of Bio confinement Methods,

UNIT II: NEED FOR BIOCONFINEMENT 9

Risk factors - Effects on Non-target Species - Delaying the Evolution of Resistance - Food Safety and Other Issues - Need for Bio confinement

UNIT III: BIOCONFINEMENT OF PLANTS AND ANIMALS 9

Genetically Engineered Trees - Transgenic Grasses - Transgenic Algae-Effectiveness at Different Spatial and Temporal Scales - Monitoring and Managing Confinement Failure -bio confinement of fish, and insects.

UNIT IV: BIOCONFINEMENT OF VIRUSES, BACTERIA, AND OTHER MICROBES 9

Introduction - Potential Effects or Concerns, and Need for Bio confinement in Viruses, Fungi, and Bacteria

UNIT V: BIOLOGICAL AND OPERATIONAL CONSIDERATIONS FOR BIOCONFINEMENT 9

Execution of Confinement - International Aspects - Bio confinement - Bio confinement Research

Total Contact Hours: 45

TEXT BOOK

1.Biological confinement of genetically engineered organisms by national research council: National Academic press.
2. Piefzer F.M. Food Microbiology, Academic Press, 1989.

REFERENCE BOOKS

1. Sasson A, Biotechnologies and Development, UNESCO Publications

BBI 506	**MOLECULAR EVOLUTION AND PHYLOGENY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	1	0	3
	Prerequisite – rDNA Technology, Microbiology, and Cell Biology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To familiarize with cell counting and cell separation techniques.

COURSE OUTCOMES (COs)

CO1	To learn about Nature of molecular evolution -driving forces in evolution
CO2	It also gives knowledge on Phylogenetic models-Universal phylogeny
CO3	It deals with protein truncation
CO4	It imparts determination of splicing variants

CO5		It impliments of the genetic variation				
CO6		It gives the Knowledge about the Neutral theory				
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION 9

Introduction in molecular evolution- Archaeology of the genome-Nature of molecular evolution - driving forces in evolution.

UNIT II: INTRODUCTION TO PHYLOGENETICS 9

Fundamental elements of phylogenetic models-Identifying Orthologs and Paralogs-Trees and distances-Molecular Phylogenetic models-Universal phylogeny

UNIT III: EVOLUTIONARY CHANGE 9

Measuring genetic change-Genetic distance- Substitution models-Tree building methods-Distance based methods-Character based methods-Tree evaluation-Randomized trees Bootstrap-Phylogenetic software's

UNIT IV: MODELS OF MOLECULAR EVOLUTION 9

Models of evolutionary process-Functional constraints-Molecular clocks Evaluation of molecular clock hypothesis-Neutral theory-Genetic variation with species

UNIT V: PHYLOGENETIC APPLICATIONS 9

Applications of molecular phylogenetics -Gene trees and Species trees, Organism phylogeny-Age and rates of diversification-Host parasite co-specification.

Total Contact Hours: 45

TEXT BOOK:

1."Evolution and population genetics" by Rashma sisodia 2006 (pg no.175 - 297)

REFERENCE:

1. Fundamentals of Molecular evolution", Dan Graur and Wen-Hsiung Li, Iled, 2000, Sinauer associates.

2. Molecular evolution: A Phylogenetic approach", Roderic D. M. Page, Edward C. Holmes Blackwell science Inc 2003. (pg no 1-172)(280-312).

3.www.ncbi.nlm.nih.gov/pubmed/1784710

4. https://www.biomedcentral.com/

BBR 013	**BIOPROCESS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Biology, Enzyme Technology and Bioreactors design				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To understand the basic concepts of filtration and agitation and mixing. To study the nature of fluids and flow characteristics.

COURSE OUTCOMES (COs)

CO1	To learn about design and analysis of bioreactors.
CO2	It also gives knowledge on bioreactor scale up.
CO3	It deals with modern biotechnological processes.
CO4	It imparts modeling and simulation of bioprocesses
CO5	To familiarize the mass transfer operations like molecular diffusion
CO6	4. To understand the principles extraction and distillation processes involved in industries

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: DESIGN AND ANALYSIS OF BIOREACTORS 9

Modeling of Non-ideal Behavior in Bioreactors-Tanks-in-series and Dispersion models-applications to design of continuous sterilizers; Design and operation of novel bioreactors-Air-lift loop reactors; Fluidized bed bioreactors; Stability analysis of bioreactors.

UNIT II: BIOREACTOR SCALE-UP 9

Transport phenomena in Bioprocess systems, Regime analysis of bioreactor processes, Correlations for oxygen transfer; Scale-up criteria for bioreactors based on oxygen transfer and power consumption.

UNIT III: MONITORING OF BIOPROCESSES 9

On-line data analysis for measurement of important physio-chemical and biochemical parameters; Methods of on-line and off-line biomass estimation; microbial calorimetry; Flow injection analysis for measurement of substrates, products and other metabolites; State and parameter estimation techniques for biochemical processes; computers and interfaces, Computer-based data acquisition, monitoring and control-LABVIEW Software.

UNIT IV: MODERN BIOTECHNOLOGICAL PROCESSES 9

Recombinant cell culture processes, guidelines for choosing host-vector systems, plasmid stability in recombinant cell culture, limits to over expression, Modeling of recombinant bacterial cultures; Bioreactor strategies for maximizing product formation; Bioprocess design considerations for plant and animal cell cultures.

UNIT V: MODELLING AND SIMULATION OF BIOPROCESSES 9

Study of structured models for analysis of various bioprocesses; Model simulation using MATLABS IMULINK and ISIM software packages.

Total Contact Hours: 45

TEXT BOOKS

1. Alba S., Humphrey E and Milli N.R., "Bio Chemical Engineering" Academic Press, 1973.
2. Scragg. A.H "Bioreactors in Biotechnology"- A Practical approach
3. Bailey and Ollis, "Biochemical Engineering Fundamentals", McGraw Hill (2nd Ed.). 1986.
4. Peter F. Stanbury, Allan Whitaker, "Principles of Fermentation Technology"

BBR 014	**FOOD PROCESS TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	0	0	3
	Prerequisite – Biotechnology, Food Toxicology, microbiology, Food Engineering				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

Impart education in the field of Food processing Technologies in order to generate competent resources to meet the demands of the fast-growing Dairy and Food Industry.

COURSE OUTCOMES (COs)

CO1	To gain knowledge on storage, preparation, preservation and packaging of food products and beverages
CO2	Understand the Food Laws, food rules and standards, Statistical Quality Control
CO3	To learn about commercial handling of fish
CO4	To gain knowledge on slaughtering techniques and meat products
CO5	Impart knowledge on dairy and food industry
CO6	Know about the importance and processing of oil

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e

2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I : QUALITY CONTROL ANLYSIS 12

Storage of cereals, Processing of rice and rice products. Milling of wheat and production of wheat products, Processing of tea, coffee and cocoa, Storage and handling of fresh fruits and vegetables, Preservation of fruits and vegetable by heat treatment. Production and preservation of fruits and vegetable juices, Preparation of Jam, Jelly and marmalade, pickles, vinegar and tomato product, Non-alcoholic beverages; Food Laws, food rules and standards, Statistical Quality Control; Various types of packaging.

UNIT II: PRESERVATION METHODS 12

Classification of fresh water fish and marine fish; Commercial handling, storage and transport of raw fish; Average composition of fish; Freshness criteria and quality assessment of fish; Spoilage of Fish; Methods of Preservation of fish: Canning, Freezing, Drying, Salting, Smoking and Curing.

UNIT III: FERMENTATION TECHNOLOGY 12

10L Slaughtering technique of animal; Meat cuts and portions of meat, muscle; Color of meat; Post mortem changes of meat; Meat processing - curing and smoking; Fermented meat products (meat sausages & sauces); Frozen meat & meat storage; By-products from meat industries and their utilization; Meat industries in India.

UNIT IV: FERMENTATION TECHNOLOGY 12

Composition of milk; Varieties of milk; Checks for purity of milk; Handling of fresh milk. Module II: 10L Pasteurization of milk; HTST and UHT techniques; Packaging of milk;

Fermentation of milk and fermented milk products. Manufacture of milk products like evaporated milk, powder milk, condensed milk, cream butter, cheese, yogurt, ice cream, ghee, baby food and sweet meat. Quality control of milk and milk products; Milk plant hygiene and sanitation.

UNIT V : EXTRACTION METHODS 12

Importance of fats and oils in foods; Sources of fats and oils; Extraction of fats and oils – rendering, pressing, solvent extraction; Processing of oils – degumming, refining, bleaching, deodorization, fractionation; Reversion and rancidity of fats and oils

Total Contact Hours: 45

TEXT BOOKS:

1. Food Science by Potter
2. Technology of Food Preservation by Desrosier
3. Principles of Food Science, Vol-I by Fennma Karrel
4. Preservation of Fruits & Vegetables by Girdhari Lal, Sidhapa and Tandon
5. Post Harvest Technology of cereal pulse and oil seeds by Chakraborty, AC 6. Food Science by Mudambi.

REFERENCE BOOKS

1. Processed Meats; Pearson AM & Gillett TA; 1996, CBS Publishers.
2. Meat; Cole DJA & Lawrie RA; 1975, AVI Pub.
3. Egg and poultry meat processing; Stadelman WJ, Olson VM, Shemwell GA & Pasch S; 1988, Elliswood Ltd.
4. Fish as Food; Vol 1 & 2; Bremner HA; 2002, CRC Press.
5. Robinson RK; 1996; Modern Dairy Technology, Vol 1 & 2; Elsevier Applied Science Pub
6. The Chemistry & Technology of Edible Oils and Fats; Devine J & Williams PN; 1961, Pergamon Press.
7. https://www.uoguelph.ca/foodscience/book-page/dairy-science-and-technology-ebook

BBR 015	**Metabolism and Metabolomics**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biopharmaceutical technology				
	Course Designed by – Dept of Genetics Engineering				

OBJECTIVES

1. This course provides the fundamental knowledge on upcoming field of metabolomics
2. The metabolic engineering in post genomic era.

3. Understand Regulation of metabolic pathways and examples of pathway manipulations **4.** Provides knowledge about the metabolic engineering in database.						
COURSE OUTCOMES (COs)						
CO1	Metabolic engineering					
CO2	Comprehensive models cellular reactions					
CO3	Metabolic flux analysis and its applications					
CO4	Metabolomics and its study					
CO5	Applications of metabolomics					
CO6	Metabolism of Plants and animals					
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION 9

Introduction to metabolic engineering-Metabolism- Stoichiometry, reaction rates and dynamic mass balances-Growth Energetic-Yield coefficients and linear rate equations-Material balances and data consistency. Permeability control passive diffusion, active transport group transportation

UNIT II: METABOLIC PATHWAY REGULATION 9

Regulation of metabolic pathways-Examples of pathway manipulations. Metabolic engineering in practical metabolic pathway synthesis. Alteration of feedback regulation, limiting accumulation of end products. Induction-jacob & monod model, catabolic regulation. Strain selection, improving fermentation,

UNIT III: METABOLIC FLUX ANALYSIS 9

Metabolic flux analysis-Methods for the experimental determination of metabolic flux using isotope labelling-Applications of Metabolic flux labelling. Metabolic control analysis-Regulation of Metabolic network

UNIT IV: BIOCONVERSIONS 9

Advantages of bioconversions, specificity, yields, factors important to bioconversion, regulation of enzyme synthesis, mutation, permeability, co-metabolism, avoidance of product inhibition, mixed or sequential bioconversions, conversion of insoluble substances.

UNIT V: PLANT METABOLIC ENGINEERING 9

Metabolic Engineering in plants- Metabolomics and Metabolic engineering-Introduction to Databases on the web.

Total Contact Hours: 45

TEXT BOOKS

1.Fermentation and Enzyme Technology, John Wiley and Sons, 1980.
2.Stanbury P.F., and Whitaker A., "Principles of Fermention Technology", Pergamon Press, 1984.

REFERENCE

1.Zubay G., "Biochemistry ", Macmillan Publishers, 1989.
2.Harper's review of biochemistry By David, W. Martin, Peter.A.Mayes, Victor.W. Rodwell, LANGE medical publications.
3. Practical Biochemistry – Principles & Techniques By Keith Wilson & John Walker. Oxford University press.
4.Gregory N. Stephanopoulos, Aristos A. Aristidou, Jens Neilsen, Metabolic engineering: Principles and Methodologies San Diege: Academic Press, 1998.

BBR 016	INDUSTRIAL MICROBIOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioprocess technology, Industrial Biotechnology				

	Course Designed by – Department of Genetic Engineering

OBJECTIVES

1. To develop their practical skills in microbial fermentation techniques.
2. To evaluate enzyme kinetics.

COURSE OUTCOMES (COs)

CO1	Enables the student to develop their skills in the field of microbial fermentation technology.
CO2	It also gives knowledge on history and latest methods of enzyme kinetics.
CO3	It deals with the antibiotic production.
CO4	It imparts anaerobic fermentation methods.
CO5	To carry out enzyme immobilized reaction.
CO6	To develop the practical skills in solid substrate fermentation in wine production.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION AND HISTORY **9**

Definition, scope and roles of microbiology and its relation to other disciplines; fundamentals and characteristics of the roles of microbes in bioprocess technology; nomenclature and classification of microbes; review of microbes commonly used in bioprocess industries: bacteria, actinomycetes, yeasts, fungi, viruses and algae; history of industrial microbiology; Role of microorganisms in petroleum degradation and bioleaching.

UNIT II: MICROORGANISMS OF INDUSTRIAL IMPORTANCE 9

Selection of Microorganisms; Primary and Secondary Screening; Types of stock culture, Strain Improvement Strategies; Strain Identification & Strain Preservation of Industrial Microorganisms for overproduction of Primary and Secondary metabolites; Medium requirements for fermentation process-carbon, nitrogen, minerals, vitamins and other nutrients-examples of simple and complex media.

UNIT III: PRODUCTION OF PRIMARY AND SECONDARY METABOLITES 9

A brief outline of processes for the production of some commercially important Organic acids (citric acid, tartaric acid , lactic acid , acetic acid , gluconic acid) and amino acids (glutamic acid , lysine, aspartic acid, phenylalanine etc.) and Alcohols (ethanol, 2,3,-butanediol etc.) Study of production process for various classes of low molecular weight secondary metabolites: Antibiotics-beta-lactams (Penicillins, Cephalosporins etc.), Aminoglycosides (streptomycin, kanamycin etc.), macrolides (erythromycin), quinines, aromatics etc.; Vitamins and Steroids.

UNIT IV: PRODUCTION OF COMMERCIALLY IMPORTANT ENZYMES AND PROTEINS 9

Proteases, Amylases, Lipases, Cellulases, Pectinases, Isomerases and other commercially important enzymes for the food and pharmaceutical industries; Production of recombinant proteins having therapeutic and diagnostic applications; production of vaccines.

UNIT V: FERMENTATION 9

Definition of fermentation; fermentor/bioreactor; fermentation media; raw materials – molasses and types, corn steep liquor, sulphite waste liquor and whey. Buffers, precursors, inhibitors, and antifoam agents, inoculum preparation. Types of Fermentation Processes: Surface, Submerged and Solid state fermentation, Batch and Continuous fermentation. Downstream processing – Precipitation, filtration, centrifugation, distillation, cell disruption, solvent recovery, drying.

Total Contact Hours: 45

TEXT BOOKS

1. L. E. Casida, Industrial Microbiology. Wiley Eastern Ltd., 1989
2. Text book of microbiology by Tortara, 2005

REFERENCE BOOK

1. G. Reed, Prescott and Dunn’s Industrial Microbiology (4th Ed.).CBS Publishers, 1987.

2. H. J. Rehm, G. Reed and H. Pape (Eds.) Biotechnology (A Comprehensive Treatise vols. 1-8). VCH, 1986
3. Crueger and A. Crueger; Biotechnology: A Textbook of Industrial Microbiology (Eng. Ed. T. D. Brook). Sinaeur Associates, 1990.
4. http://www.sysmex-partec.com/applications/microbiology-industrial-applications.html

BBR 017	PLANT PHYSIOLOGY	L	T	P	C
	Total Contact Hours – 60	3	0	0	3
	Prerequisite – Cell biology, Genetics, Phytochemistry and Botany				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To learn various aspects of plant physiology, such as respiration, enzyme action, and water relations

COURSE OUTCOMES (COs)

CO1	To learn about plant breeding
CO2	To gain knowledge on tissue culture and hybridization techniques
CO3	Understand Genotyping and Sequencing techniques
CO4	To know about Molecular mapping and tagging of agronomical traits
CO5	To learn about Gene pyramiding
CO6	To gain knowledge on Genomics and genoinformatics for crop improvement.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION TO PLANT PHYSIOLOGY 12

Biotechnology and its relevance in agriculture; Definitions, terminologies and scope in plant breeding. Generation of EDVs.

UNIT II: TISSUE CULTURE TECHNOLOGY 12

Tissue culture- History, callus, suspension cultures, cloning; Regeneration; Somatic embryogenesis; Anther culture; somatic hybridization techniques; Meristem, ovary and embryo culture; cryopreservation.

UNIT III: RFLP ANALYSIS 12

Techniques of DNA isolation, quantification and analysis; Genotyping; Sequencing techniques; Vectors, vector preparation and cloning, Biochemical and Molecular markers: morphological, biochemical and DNA-based markers (RFLP, RAPD, AFLP, SSR,SNPs, ESTs etc.), mapping populations (F2s, back crosses, RILs, NILs and DH).

UNIT IV: MOLECULAR MAPPING METHODS 12

Molecular mapping and tagging of agronomically important traits. Statistical tools in marker analysis, Robotics; Marker-assisted selection for qualitative and quantitative traits; QTLs analysis in crop plants, Gene pyramiding.

UNIT V: CROP IMPROVEMENT METHODS 12

Marker assisted selection and molecular breeding; Genomics and genoinformatics for crop improvement; Integrating functional genomics information on agronomically/economically important traits in plant breeding; Marker-assisted backcross breeding for rapid introgression.

Total Contact Hours: 45

TEXT BOOKS:

1. Chopra VL & Nasim A. 1990. Genetic Engineering and Biotechnology:Concepts, Methods and Applications. Oxford & IBH.
2. Gupta PK. 1997. Elements of Biotechnology. Rastogi Publ.

3. Hackett PB, Fuchs JA & Messing JW. 1988. An Introduction to Recombinant DNA Technology - Basic Experiments in Gene Manipulation. 2nd Ed. Benjamin Publ. Co.

REFERENCE BOOKS

1. Sambrook J & Russel D. 2001. *Molecular Cloning* - a Laboratory Manual. 3rd Ed. Cold Spring Harbor Lab. Press.
2. Singh BD. 2005. *Biotechnology, Expanding Horizons*. Kalyani.
3. https://archive.org/details/PlantPhysiology_201408

BBA001	PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Management				
	Course Designed by – Department of Management Studies				

OBJECTIVES

Familiarize the students with the fundamental concepts of Management and to highlight the approaches in organization behavior

COURSE OUTCOMES (COs)

CO1	Understanding the concepts of Management
CO2	Knowledge on Management Function
CO3	Understanding the Organization Theory & Approach.
CO4	Knowledge on the Concepts of Motivation
CO5	Clear insight on the factors contributing to discipline
CO6	In-depth Understanding about the concepts of Group Behavior

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			

	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√	
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: NATURE OF MANAGEMENT 9

Nature of management – definition – theory and practice – effective management – Management : Science of Art – Management in India. Development of Management thoughts – Taylor's – Henry Fayol – Hawthrone experiment – Barnard & Social system – Herbert Simon – Peter Drucker – Various approaches – Management thoughts.

UNIT II: MANAGEMENT FUNCTIONS 9

Management process and co-ordination – Functions of management – Managers and environment – External and internal Business Ethics – Planning – Fundamentals – Definitions & Features – Steps in planning – types of planning – Objectives – Concepts and features – Hierachy of objectives – role – Process of MBO – Policy & Strategy – Decision making process – Individual Vs Group Decisions.

UNIT III: ORGANIZATION STRUCTURE 9

Organizing – Theory & Approach – Organization Structure – Authority & Responsibility – Delegation – Centralization & Decentralization – Line & Staff Relationship – Staffing – Fundamentals – System approach – Manpower Planning – Recruitment & Selection – Training and development – Performance appraisal – Direction – Fundamentals Motivation – Theories of Motivation-Maslow's Hersberg's MaClelland's theory X,Y & Z leadership – Theories and Styles – Communication – Type – Controlling – System and Process.

UNIT IV: ORGANIZATIONAL BEHAVIOUR 9

Organizational Behaviour – Definition – Organization – Managerial Role and Functions – Organizational Approaches, Individual behaviour – Causes – Environmental effect – Behaviour and performance, perception – Organizational implications, Personality – Contributing factors –

Dimension, Motivation – Need Theories – Process Theories – Job satisfaction, Learning and Behaviour – Learning Curves, Work Design and Approaches.

UNIT V : GROUP BEHAVIOUR 9

Group Behaviour – Groups – Contributing factors –Group Norms, types – Causes – Intergroup relations – Conflict and Resolution – Change Process –Resistance to change.

Total Contact Hours: 45

REFERENCES:

1. Herald Knootz and Heinz weihrich, 'Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition, 2004.
2. Ties AF, Stoner and R. Edward Freeman, "Management" Prentice Hall of India Pvt. Ltd., New Delhi -110011, 1995.
3. Joseph I. Massie 'Essentials of Management', Prentice Hall of India Pvt. Ltd., New Delhi -110 011, 2004.
4. L.M. Prasad "Principles and Practice of Management", Sultan Chand & Sons.2001
5. Uma Sekaran, "Organizational Behaviour", Tata McGraw Hill, 2007.

BBI 608	**BIOPHYSICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Molecular modeling, Bio organic chemistry				
	Course Designed by – Dept of Genetics Engineering				

OBJECTIVE:

1. To gain knowledge of basic cytogenetic techniques.
2. To learn about biochemical method used to detect metabolic changes.

COURSE OUTCOMES (COs)

CO1	To learn about various light and optics method.
CO2	It also gives knowledge on electricity and magnetism
CO3	It deals with electromagnetic radiation
CO4	It imparts determination of alternating current circuits
CO5	To know about basic electronics
CO6	Atomic and nuclear physics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√	
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: LIGHT AND OPTICS 9

Light: Reflection and Refraction; Wave nature; Interference; Diffraction; Polarizaion; Geometrical Optics: Thick lenses and lens defects; Focussing action of human eye; Fiber optics and insect eyes. Optical and Acoustical Wave Interference: Diffraction from a circular aperture; applications in animal vision;Interference in thin films; Polarization of light; Acoustic diffraction; use by bats for echolocation. The eye and optical instruments – Microscopes.

UNIT II: ELECTRICITY AND MAGNETISM 9

The nature of electric charge; Electric field; Capacitance; Electric energy; Emf; Ohm's law; Resistivity; Electrical power; Direct current; Electric circuits; Alternating current circuits; Electromagnetic wave; Relevance to biology; Dynamic electrical properties of biological membranes; The electric organ of Mora eels.

UNIT III: ELECTROMAGNETIC WAVES 9

The electromagnetic spectrum; Blackbody radiation; Radiant emission from a human; the greenhouse effect; Infrared radiation and ultraviolet radiation in biology.

UNIT IV: BASIC ELECTRONICS 9

Overview of vacuum tube technology; Solid state electronics devices and their applications; Diodes; Transisters and amplifiers; oscillators; Introduction to operational amplifiers; Integrated

circuits; Digitial electronics; Special electronics devices like photocells; photomultipliers; Cathode ray tubes.

UNIT V : ATOMIC AND NUCLEAR PHYSICS 9

Determination of the charge and mass of an electron; The photoelectric effect; De Broglie waves; The Heisenberg uncertainty principle; Electron microscopy; The nuclear atom model; The Bohr model for the hydrogen atom; Quantum mechanics; Characteristic X-rays: X-ray diffraction; Absorption spectra and colour vision; Radiation effect in biology; Radiation dosage; Diagnostic use of X-ray.

Total Contact Hours: 45

TEXT BOOKS:

1. Biophysical Chemistry, Cantor and Schimmel, Part I and II, W.H. Freeman and co 1997
2. "Biophysics" by Dr.S. Thiraviaraj Saras publications 2004 (Pg no 1- 71, 88 – 137, 147 – 209).
3. "Biochemistry and Biophysics" by N. Arumugam& Annie Ragland by Saras publications 2004 (Pg no. 248 – 297).

REFERENCE BOOKS:

1. "Essentials of Biophysics" by P. Narayanan New age international publishers second edition 2007 (pg no. 2 -12, 168 -186, 192 – 216,340 – 368).
2. "Biophysical chemistry" by Upadhyay Nath Himalaya publishing house Delhi Reprint 2003. (pg no. 90 – 280).
3. "Biophysics" Vasanthapattabhi and N. Gautham. Narosa publishing house. Reprint 2004 (pg no. 2-140).
4. **http://www.biophysics.org/**

BBM 001	BIOMEDICAL ENGINEERING	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Biomechanics, Anatomy				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

1. To understand the working principle of various equipments.
2. To analyze the results of different spectrophotometer and identify the chemical nature of the samples.
3. To analyze the results of MS spectrophotometer and able to calculate the mass by interpreting the results.
4. To understand the differences in the application of different microscopic methods.

COURSE OUTCOMES (COs)

CO1	Enables the student to develop their skills in the medical devices
CO2	To learn diagnosis and therapy; biomedical information storage and retrieval
CO3	Provides knowledge on muscular structure and functions
CO4	It also gives knowledge on rehabilitation biomechanics
CO5	It deals with bio signal analyzer biosystem modelling
CO6	It imparts determination of ultrasound in diagnosis

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√	
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: INTRODUCTION 9

Anatomy of human-various bones-functions-muscles-types-function. Medical devices. Medical imaging. Implants. Bionics. The improvement of diagnosis and therapy; biomedical information storage and retrieval.

UNIT II: MUSCLE STRUCTURE AND ITS FUNCTIONS 9

Muscle structure and its attachment with skeleton-rate of contraction and force generation-Activation contraction-locomotion-stability-forces on ground-forces on muscles-energy requirement-mechanisms of walking, running and trotting-sports.

UNIT III: BIOMECHANICS 9

Mechanical analysis of performance- rehabilitation biomechanics-mechanics of prosthetics and orthotics biomechanics of human injury and orthopaedics fixation-mechanics of bones and joint-dynamics of man machine interaction.

UNIT IV: BIOSYSTEM MODELING 9

Electrical impedance Cephalography- biotelemetry-biosignal analyzer-biosystem modelling.

UNIT V: ULTRASOUND IN DIAGNOSIS 9

Ultrasound in diagnosis-limb prosthetics and orthotics-sensory aids for the blinds-assisting the heart and kidney- ECG-EEB-Physiological equipments.

Total Contact Hours: 45

TEXT BOOKS:

1. AtillaHincal A., Suheylakas, H, BiomedicalScience & Technology, Plenum Press NewYork.
2. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007.

REFERENCES BOOKS

1. Ernest Doebelin and dhanesh N manik, Measuremet systems, Application and design,5th edition ,McGraw-Hill, 2007.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2003.
3. Standard Handbook of Biomedical Engineering & Design – Myer Kutz, McGraw-Hill Publisher, 2003.
4. http://accessengineeringlibrary.com/browse/biomedical-engineering-and-design-handbook-volume-1

BBR 018	BIOREACTOR DESIGN	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Genetics and Microbiology, Biotechnology, Instrumentation				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

1. To study the historical development of bio process technology, design of fermenter and types of fermentation process.
2. To gain knowledge about formulation of medium and principles of sterilization.
3. To study the stoichiometry and energetics of cell growth and product formation.

4. To evaluate the kinetics and mechanism of microbial growth.						
COURSE OUTCOMES (COs)						
CO1	Improves ability to analyse, design and construct bioreactors					
CO2	Enables the student to develop their skills in the field of hydrodynamics					
CO3	It also gives knowledge on Kinetics of cell growth in batch culture					
CO4	It deals with the temperature measurement control					
CO5	It imparts determination of biomass and application of biosensors					
CO6	Enhances the skills in modeling and programming plant and animal cell bioreactors					
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√	
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: BIOREACTOR DESIGN 9

Introduction to Bioreactor and Fermentor. Types of Bioreactor, Heat transfer, Scale – up, Airlift Bioreactors, Introduction, Design and construction of the airlift – loop reactor, Hydrodynamics, Three – phase flow, Mixing, Oxygen transfer.

UNIT II: BATCH AND CONTINUOUS GROWTH 9

Growth, Measurement of microbial growth (direct), Measurement of microbial growth (indirect), Kinetics of cell growth in batch culture, Continuous culture.

UNIT III: MIXING, MASS TRANSFER AND INSTRUMENTATION CONTROL OF BIOREACTORS 9

Introduction, Mass transfer, Theory of mixing, Rheological properties, Bioreactor sensor characterizes, Temperature measurement control, principles of dissolved oxygen measurement and control, principles of PH / redox measurement and control, deduction and prevention of foam, determination of biomass and application of biosensors.

UNIT IV: BIOREACTOR OFF – GAS ANALYSIS 9

Introduction, generalized gas balance equations, Steady – state balancing, Derived quantities based on combined gas analysis and gas mass balancing techniques, Gas analysers.

UNIT V: MODELING OF PLANT AND ANIMAL CELL BIOREACTORS 9

Modelling, digital simulation, formulation and solution of problems by simulations, digital simulation programming languages, ISIM (interactive simulation language) Plant cells, Animal cells.

Total Contact Hours: 45

TEXT BOOKS:

1. "Bioreactors in Biotechnology", Ellis Horwood series, 1991. A. H. SCRAGG.
2. Peter, Max S. and Timmerhaus, Klaus D. Plant Design and Economics for Chemical Engineers, 4th ed., McGraw Hill, 1991.

REFERENCE BOOKS

1. Bailey, J.E. and Ollis, D.F. Biochemical Engineering Fundamentals", 2nded.,McGraw Hill 1986.
2. Stanbury, P.F., Stephen J. Hall & A. Whitaker, Principles of Fermentation Technology, Science & Technology Books.
3. Nielsen, J. and Villadsen, J. "Bioreaction Engineering Principles". Springer, 2007.
4. http://www.freebookcentre.net/biology-books-download/Biotechnology-Fundamentals.html

BBR 019	DEVELOPMENTAL BIOLOGY	L	T	P	C
	Total Contact Hours – 60	3	0	0	3
	Prerequisite – Cell biology, Molecular Biology, Biology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

To gain knowledge on animal development and places special emphasis on mammalian and human development.

COURSE OUTCOMES (COs)						
CO1	Understand the mechanism of animal development					
CO2	Explain the structure, function and regulation of Actin filaments					
CO3	To know how cell's fate is determined					
CO4	Understand Drosophila Development and organogenesis					
CO5	To learn about Blastula and Gastrulation					
CO6	To gain knowledge on Neurulation in embryos					
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√	
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: DEVELOPMENT OF MULTI-CELLULAR ORGANISMS 12

Universal mechanisms of animal development; basic anatomical features of animal; genes controlling developmental processes; cell fate and determination, positional values, inductive interaction and morphogenic effects.

UNIT II : CYTOSKELETON 12

Assembly and dynamic structure of actin filaments, microtubules and intermediate filaments; effects of drugs on filament polymerization; regulation of cytoskeletal filaments; molecular motor proteins- structural features and function of myosins, kinesins and dyenins.

UNIT III: APOPTOSIS PROCESS 12

Caenorhabditis elegans- Cell fates; asymmetric division of egg; pattern formation; developmental signal and changes in cell; apoptotic cell death.

UNIT IV: *DROSOPHILA MELANOGASTER* SYSTEM ANALYSIS 12

Synopsis of Drosophila development; syncytium development; genes involved in early patterning- role of egg-polarity genes, dorsoventral signaling genes, mutations and segmentation genes, homeotic selector genes and patterning of anteroposterior axis, organogenesis and patterning of appendages.

UNIT V: NEURAL DEVELOPMENT IN HIGHER ANIMALS 12

Synopsis of Xenopus development; asymmetries of Xenopus egg, blastula formation and gastrulation; convergent extension; neural tube formation. Neurulation in chick and human embryos.

Total Contact Hours: 45

TEXT BOOKS:

1. Blum A. 1988. *Plant Breeding for Stress Environments*. CRC Press.
2. Christiansen MN & Lewis CF. 1982. *Breeding Plants for Less Favourable Environments*. Wiley International.
3. Fritz RS & Simms EL. (Eds.). 1992. *Plant Resistance to Herbivores and Pathogens: Ecology, Evolution and Genetics*. The University of Chicago Press.

REFERENCE BOOKS

1. Li PH & Sakai A. 1987. *Plant Cold Hardiness*. Liss, New York Luginpill P. 1969. D*eveloping Resistant Plants - The Ideal Method of Controlling Insects*. USDA, ARS, Washington DC.
2. Maxwell FG & Jennings PR. (Eds.). 1980. Breeding Plants Resistant to Insects. John Wiley & Sons.
3. Painter RH. 1951. *Insect Resistance in Crop Plants*. MacMillan, New York.
4. Russel GE. 1978. *Plant Breeding for Pest and Disease Resistance*. Butterworths.
5. Sakai A & Larcher W. 1987. *Frost Survival in Plants*. Springer-Verlag.
6. an der Plank JE. 1982. *Host-Pathogen Interactions in Plant Disease*. Academic Press.
7. http://www.aazea.com/book/developmental-biology-6th-edition

BBI404	FOOD AND MEDICAL MICROBIOLOGY	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Microbiology, Industrial microbiology, Food Toxicology				
	Course Designed by – Dept of Genetic Engineering				

OBJECTIVES

1. To learn about micro organisms and their impact

2. To gain knowledge on the importance of microbes in fermentation, antibiotics

3. To identify clinical microbes, diagnose microbial infections and treatment

COURSE OUTCOMES (COs)

CO1	To learn Bergey's mannual of classification and identification of micro organisms
CO2	To know about food poisoning and preservation techniques
CO3	Analyse the medically important microbes
CO4	The impact of microbial infections
CO5	Understand the microbial borne diseases and treatment
CO6	To gain knowledge in uses of microbes in drug production-

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e
2	CO1	M	H			
	CO2		M			
	CO3			M		
	CO4		M			
	CO5		H	M		

3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√	
4	Approval	37th , 38th & 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I: GENERAL MICROBIOLOGY 12

Morphology of bactgerial, Viruses and actinomycetes-bactrial stainings, structure of bacteria-viruses-actinomycetes-Bergey's mannual of classification identification of bacteria Biochemical text culture techniques-sterilization and disinfection-growth and nutrition of bacteria-biochemical tests.

UNIT II: FOOD AND INDUSTRIAL MICROBIOLOGY: 12

General spoilage of foods by bacteria, fungi, Preservation techniques. Microblal spoilage of milk and milk products, meat and fish products, canned foods-industrial production of vitamins, amino acids, antibiotics of microorganisms-fermentation-aerobic and anaerobic-Fermentors-applications-microbial production of wine, beer and miscellaneous beverages

UNIT III: MEDICAL MICROBIOLOGY 12

Identification of medically important microbes-Staphylococcus aureus, Streptococcus, E.coli, Proteus, Shigella Salmonella, Vibrio, Pseudomonas, Clostridium- Cornyebacterium-Mycobacterium tuberculosis. Viruses- Herpes viruses, Adeno viruses-Rhabdo viruses-Bacteriophage.

UNIT IV: CLINICAL MICROBIOLOGY: 12

Normal flora of human body-urinary tract infections-respiratory infections-food poisoning-sexually transmitted diseases-hospital required infections-diagnosis and treatment of fungal infections-mycosis and super mycosis.

UNIT V: ENVIRONMENTAL MICROBIOLOGY: 12

Microbiology of air-airborne diseases and treatment-microbiology of water(fresh water),waterborne diseases-cholera, diarrhea, Waste water treatment-marine microbiology-microbes in marine mater, role of microbes in desalination-uses of microbes in desalination-uses of microbes in drug production-reclamation of marine water microbiologically for domestic purposes.

Total Contact Hours: 45

TEXT BOOK:

1. “Text book of Microbiology” by Dubey C. Maheshwari DK. S. Chand Publications,2006.

2. “Microbiology- A laboratory Manual by Cappucino 2004.

REFERENCES:

1. “Medical Microbiology” a guide to Microbial infections” by David green wood, Richard C.B. Stock practical medical Microbiology, 2002

2. “Modern food Microbiology” by Jay, Loernsner, David A. Golden Springer Publications 2005.

http://www.academia.edu/

CURRICULUM AND SYLLABUS (R2015)

CHOICE BASED CREDIT SYSTEM

B.TECH – INDUSTRIAL BIO TECHNOLOGY

I – VIII SEMESTERS

SEMESTER I							
SL NO	**SUB.CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1.	BEN101	HS	English – I	3	1	0	3
2.	BMA101	BS	Mathematics - I	3	1	0	3
3.	BPH101	BS	Engineering Physics - I	3	0	0	3
4.	BCH101	BS	Engineering Chemistry - I	3	0	0	3
5.	BBT101	ES	Cell Biology	2	1	0	3
6.	BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
7.	BSS101	HS	Personality Development	1	1	0	2
8.	BCE101	ES	Basic Civil Engineering	2	0	0	2
9.	BME103	ES	Basic Mechanical Engineering	2	0	0	2
PRACTICAL							
10.	BCM1L1	ES	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	3	1
11.	BCS2L2	ES	Computer Practices Lab	0	0	3	1
12	BPC1L1	BS	Physics and Chemistry Laboratory#	0	0	3/3	0
13	BSS1L4/ BSS1L5/ BSS1L6	HS	NCC/ NSS/ NSO (to be conducted during weekends)				1
Total Instruction Periods per week=35						**Total No. of Credits = 27**	
# Laboratory Classes on alternate weeks for Physics and Chemistry. The Lab examinations will be held only in the second semester (including the first semester experiments also)							

SEMESTER II							
SL. NO	**SUB. CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1.	BEN201	HS	English – II	3	1	0	3
2.	BMA201	BS	Mathematics - II	3	1	0	3
3.	BPH201	BS	Engineering Physics - II	3	0	0	3
4.	BCH201	BS	Engineering Chemistry – II	3	0	0	3
5.	BCS201	ES	Internet Programming	2	0	0	2
6.	BFR201*	HS	Foreign / Indian Language	3	0	0	3
7.	BBT201	ES	Principles of Genetics	2	0	0	2
8.	BEE201	ES	Basic Electrical and Electronics Engineering	2	0	0	2
PRACTICAL							
9.	BCS2L1	ES	Internet Practices Lab	0	0	3	1
10.	BEE2L1	ES	Basic Electrical and Electronics Engineering Practices Laboratory	0	0	3	1
11.	BPC2L1	BS	Physics and Chemistry Laboratory#	0	0	3/3	1
12	BSS1L7	HS	Yoga	0	0	2	1
Total Instruction Periods per week=34				**Total No. of Credits = 25**			

*Any one of the following courses: BFR201 – French, BGM201-German, BJP201 – Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 – Tamil**.**

Laboratory Classes on alternate weeks for Physics and Chemistry. The Lab examinations will be held only in the second semester (including the first semester experiments also)

SEMESTER III						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BBT304	PC	Waste Management Technology	3	0	0	3
BBT306	PC	Principles of Chemical	4	0	0	4
BBT307	PC	General Biochemistry	3	0	0	3
BBT308	PC	General Microbiology	3	0	0	3
BBT309	PC	Instrumentation for Biotechnology	3	0	0	3
BBT310	PC	Immunology	3	0	0	3
PRACTICAL						
BBT3L3	PC	Biochemistry Lab	0	0	3	2
BBT3L2	PC	Instrumental Methods of Analysis	0	0	3	2
BBT3L1	PC	Cell Biology Lab	0	0	3	2
TOTAL HOURS : 28			**CREDITS : 25**			

SEMESTER IV						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BBT401	PC	Bioorganic chemistry	3	0	0	3
BBT403	PC	Introduction to Industrial Biotechnology	3	0	0	3 3
BBT404	PC	Principles of Chemical	4	0	0	4
BBT405	PC	Unit Operations	4	0	0	4
BBT406	PC	Introduction to Molecular biology	3	0	0	3
BCE406	HS	Environmental studies	3	0	0	3
PRACTICAL						
BBT4L1	PC	Microbiology Lab	0	0	3	2
BBT4L2	PC	Bioorganic chemistry Lab	0	0	3	2
BBT4L3	PC	Molecular Biology Lab	0	0	3	2
BBT4S1	PR	Technical Seminar I	0	0	2	1
TOTAL HOURS : 31			**CREDITS: 27**			

SEMESTER V						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BMA501	BS	Biostatistics	4	0	0	4
BBT501	PC	Genetic Engineering	3	0	0	3
BBT502	PC	Principles of Bioprocess	3	0	0	3
BBT503	PC	Chemical Reaction Engineering	4	0	0	4
BBT505	PC	Plant Biotechnology	3	0	0	3
	CE	Core Elective -I	3	0	0	3
PRACTICAL						
BBT5L1	PC	Genetic Engineering Lab	0	0	3	2
BBT5L2	PC	Chemical Engineering lab	0	0	3	2
BBT5L3	PC	Plant & Animal Biotechnology Lab	0	0	3	2
BBT5C1	PR	Comprehension - I	0	0	0	1
TOTAL HOURS : 29CREDITS : 27						

SEMESTER VI						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BBT601	PC	Animal Biotechnology	3	0	0	3
BBT602	PC	Enzyme Engineering and Technology	3	0	0	3
BBT603	PC	Environmental Biotechnology	3	0	0	3
BSS601	HS	Value Education and Professional ethics	3	0	0	3
	CE	Core Elective-II	3	0	0	3
	NE	Non Major Elective I	3	0	0	3
PRACTICAL						
BBT6L1	PC	Bioprocess Engineering Lab I	0	0	3	2
BBT6L2	PC	Environmental Biotechnology Lab	0	0	3	2
BBT6L3	PC	Immuno technology Lab	0	0	3	2
BBT6P1	PR	Mini Project	0	0	4	2

TOTAL HOURS:31		CREDITS: 26				
SEMESTER VII						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BBT701	PC	Research Methodology and Instrumentation	3	0	0	3
BBT703	PC	Down Stream processing	3	0	0	3
BBT705	PC	Bioprocess Engineering	3	0	0	3
	CE	Core Elective III	3	0	0	3
	NE	Non Major Elective II	3	0	0	3
	OE	Open Elective I	3	0	0	3
PRACTICAL						
BBT7L1	PC	Bioprocess Engineering Lab II	0	0	3	2
BBT 7L2	PC	Downstream processing Lab	0	0	3	2
BBT7P1	PR	Term Paper	0	0	4	2
BBT7V1	PR	In-plant Training Note: Students to get trained in an industry for a period of two weeks at the end of VI semester)	0	0	0	1
TOTAL HOURS:28			**CREDITS: 25**			

SEMESTER VIII						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
	OE	Open Elective –II	3	0	0	3
	NE	Non Major Elective III	3	0	0	3
PRACTICAL						
BBT8C1	PR	Comprehension – II	0	0	0	1
BBT8P1	PR	Project work	0	0	18	9
TOTAL HOURS:24			**CREDITS: 16**			

OVERALL CREDITS = 198

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	6	7	-	3	-	3	-	-	19	9.60
2	Basic Sciences (BS)	9	10	-	-	4	-	-	-	23	11.62
3	Engineering Sciences (ES)	12	8	-	-	-	-	-	-	20	10.10
4	Professional Core (PC)	-	-	25	23	19	15	13	-	95	47.98
5	Core Electives (CE)	-	-	-	-	3	3	3	-	9	4.55
6	Non major Electives (NE)	-	-	-	-	-	3	3	3	9	4.55
7	Open Electives (OE)	-	-	-	-	-	-	3	3	6	3.03
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	-	1	1	2	3	10	17	8.59
	Total Credit	27	25	25	27	27	26	25	16	198	100
	Total Contact Hour	35	34	28	31	29	31	28	24	240	

LIST OF ELECTIVES

CORE ELECTIVE(CE) I					
BBTE01	Food Process Technology	3	0	0	3
BBTE02	Cancer biology	3	0	0	3
BBTE03	Bioreactor design	3	0	0	3
CORE ELECTIVE(CE) II					
BBTE04	Dairy Technology	3	0	0	3
BBTE05	Medical biotechnology	3	0	0	3
BBTE06	Bioprocess Economics& Plant Design	3	0	0	3
CORE ELECTIVE(CE) III					
BBTE07	Food safety and quality control	3	0	0	3
BBTE08	Stem cell and Tissue Engineering	3	0	0	3
BBTE09	Biosensor Technology	3	0	0	3
NON MAJOR ELECTIVE(NE) I					
BBTE10	Proteogenomics and Bioinformatics	3	0	0	3
BBTE11	Alternate energy	3	0	0	3
BBTE12	Developmental Biology	3	0	0	3
NON MAJOR ELECTIVE(NE) II					
BBTE13	Biopharmaceutical Technology	3	0	0	3
BBTE14	Biofuel Technology	3	0	0	3
BGE006	Biomedical Engineering	3	0	0	3
NON MAJOR ELECTIVE(NE) III					
BBTE15	Metabolic Engineering	3	0	0	3
BBA005	Energy Engineering Management	3	0	0	3
BBTE16	Nanobiotechnology	3	0	0	3
OPEN ELECTIVE(OE) I					
BCE057	Industrial Waste Treatment and Disposal	3	0	0	3
BBTE17	Engineering Optimization	3	0	0	3
BBA008	Total Quality Management	3	0	0	3
	NSS Paper I	2	0	2	3
OPEN ELECTIVE(OE) II					
BBA009	Intellectual Property Rights	3	0	0	3
BCE059	Environmental Health Engineering	3	0	0	3
BBTE18	Industrial Safety Engineering	3	0	0	3
BBTE19	Bio entrepreneurship Development	3	0	0	3
	NSS Paper II	2	0	2	3
	Massive Open Online Course	3	0	0	3

BEN101	ENGLISH - I	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Dept of English				

OBJECTIVES

To make the students learn the basic modes of communication for fluency and attainment of confidence in speech, reading and writing.

COURSE OUTCOMES (COs)

CO1	Understand the importance of being responsible, logical, and thorough.
CO2	Respond to the situations where short reports and instructions are required.
CO3	Explain "how things work", and what to suggest when "things don't work
CO4	Develop our confidence and authority in the practical use of language.
CO5	Understand the importance of being responsible, logical, and thorough.
CO6	Able to Face interviews and competitive examinations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H	H	H	H	H	M	L	L	H	H	H	H
	CO2							L					
	CO3	H						H		H			H
	CO4	H	M				M	L	H	H			H
	CO5							L					
	CO6	H		H	H	H	H	L		H	H	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective	Open Elective (OE)	Project/ Term Paper/ Seminar/
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I STRUCTURES **12**

Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT II TRANSCODING **12**

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT III REPORTING 12

Degrees of comparison – Positive, Comparative, Superlative - questions- SI units -Lab reports - Physics chemistry, workshop and Survey report for introducing new product in the market.

UNIT IV FORMAL DOCUMENTATION 12

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT V METHODOLOGY 12

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives , prepositional relatives.

TEXT BOOK

1. Department Of Humanities and Social Sciences Division, Anna University, Oxford University Press, 2013.

REFERENCES:

1. S.P.Danavel, English and Communication for Students of Science and Engineering, Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007.
3. Murali Krishna and Sunitha Moishra, Communication Skills for Engineers . Pearson, New Delhi, 2011.

BMA101	**MATHEMATICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – + 2 Level Mathematics				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To make the students learn Mathematics in order to formulate and solve problems effectively in their respective fields of engineering.

COURSE OUTCOMES (COs)

CO1	Study the fundamentals of mathematics
CO2	Students learn multiple integral techniques
CO3	Students gain knowledge in application of variables
CO4	Find area and volume based on a function with one or more variables.
CO5	Apply matrix operations to solve relevant real life problems in engineering.
CO6	Formulate a mathematical model for three dimensional objects and solve

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	D	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2			M		H							
	CO3		H				M						
	CO4								L				
	CO5							H			L		
	CO6											L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT 1 MATRICES 12

Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes- Envelopes- Applications of Evolutes and Envelopes.

UNIT 1V FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives- Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobians- Taylor's expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates-Area as double integral- Volume as triple integral.

TEXT BOOK:

1. Ravish R.Singh and Mukkul Bhatt, "Engineering Mathematics-I" First Reprint, Tata McGraw Hill Pub Co., New Delhi. 2011.
2. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi. 2007.

REFERENCES:

1. Ramana.B.V. "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons, New York, 2003.
4. Murray R.Spiegel, "Advanced Calculus", Schaum's Outline Series, First Edn, McGraw Hill Intl Book Co.,New Delhi, 1981.

PH101	**ENGINEERING PHYSICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES:

To enhance the fundamental knowledge in Physics and its applications relevant to various stream Engineering and Technology

COURSE OUTCOMES (COs)

CO1	Understand the Principles and Laws of Physics
CO2	To understand the impact of Crystal Physics
CO3	Learn the Properties of Elasticity and Heat transfer.
CO4	Acquire Knowledge on Quantum Physics.
CO5	Understand the concepts on Laser & Ultrasonic's and its Applications
CO6	Understand the Principle of Laser and its Applications in Engineering and Medicine.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	A	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M			H		
	CO2		L	H		M				M		L	H
	CO3												
	CO4	H		M	L						L		M
	CO5		L	L								L	L
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity-Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion –Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO_2, Semiconductor lasers (homo junction & hetero junction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TEXT BOOKS:

1. Jayaraman D Engineering Physics I. Global Publishing House, 2014.
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai Publishers, 2009.
4. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.

4. http://ocw.mit.edu/courses/find-by-topic
5. http://nptel.ac.in/course.php?disciplineId=122
6. https://en.wikipedia.org/wiki/Engineering_physics

BCH101	ENGINEERING CHEMISTRY - I	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level Chemistry				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Understand the principles of water characterization and treatment for portable and industrial purposes.
CO2	To impart knowledge on the essential aspects of Principles of polymer chemistry and engineering applications of polymers
CO3	Having a sound knowledge in the Field of the Conventional and non-Conventional energy
CO4	To impart knowledge on the essential aspects of electrochemical cells, emf and applications of EMF measurements
CO5	To make the students understand the Principles of corrosion and corrosion control .
CO6	To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	L
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I WATER TECHNOLOGY 9

Introduction-Characteristics : Hardness of water – types - temporary and permanent hardness - estimation by EDTA method Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –Domestic water treatment – disinfection methods (Chlorination, Ozonation , UV treatment) Boiler feed water – requirements – disadvantages of using hard water in boilers Internal conditioning (Calgon Conditioning method) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

UNIT II POLYMERS 9

Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization– Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III ELECTRO CHEMISTRY 9

Introduction CELLS: types of Electrochemical cells , Electrolytic cells – Reversible and irreversible cells EMF – measurement of EMF– Single electrode potential – Nernst equation Reference electrodes : Standard Hydrogen electrode -Calomel electrode Ion selective electrode :Glass electrode and measurement of pH using Glass electrode Electrochemical series – significance Titrations :Potentiometer titrations (redox - Fe^{2+}vs dichromate titrations) Conduct metric titrations (acid-base – HCI vs, NaOH titrations)

UNIT IV CORROSION AND CORROSION CONTROL 9

Introduction: Chemical corrosion Definition - Chemical Corrosion - Electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion control – sacrificial anode and impressed cathodic current methods – Protective coatings :Paints– constituents of the paint and their functions Metallic coatings – electroplating of Gold and electro less plating of Nickel.

UNIT V NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Introduction : Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor Solar energy conversion – solar cells – wind energy Fuel cells – hydrogen – oxygen fuel cell Batteries :Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries :Lead–acid storage battery –working –uses Nickel–cadmium battery - working – uses Solid – state battery : Lithium battery

TEXT BOOKS:

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara “A text book of engineering chemistry” S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).

REFERENCES :

1. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).

3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Electrochemistry

BBT 101	CELL BIOLOGY	L	T	P	C
	Total Contact Hours - 45	2	1	0	3
	Prerequisite – Higher Secondary level biology, basic concepts in cell signaling				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of cell, its structure, function, types and about its culture

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals of the structure of cells
CO2	To study the types and functions of cell organelles
CO3	To comprehend the methods involved in the cellular transport
CO4	To know the cause, and methods of cell signaling
CO5	To give a basic knowledge of cell culture and its applications
CO6	To understand about signal transduction

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2				M								
	CO3	M											
	CO4							H				M	
	CO5	H											
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I: CELL STRUCTURE **9**

Cells-definition, Eukaryotic cell and prokaryotic cell – differences and key organelles, Relationship and evolution of Eukaryotic cell and prokaryotic cell, plant cells and animal cells–differences and general structure- Cellular environment, tissues, various types of cell, Extra cellular matrix, cytoskeletal proteins, Cell cycle-Mitosis and meiosis

UNIT II: CELL ORGANELLES **9**

Cell Organelles and function – Nucleus, Cytoplasm, Endoplasmic reticulum, Golgi complex, lysosomes, cell membranes, chloroplast, mitochondria – structure, importance and function

UNIT III: CELLULAR TRANSPORT 9

Transport across cell membranes – importance, classification – Active and passive, passive transport – movement of water, small lipid across membrane. Active – Na+ K+ ATPase Pump, Lysosomal and Vacuolar pumps. Cotransport – Symport, antiport – examples, Endocytosis and Exocytosis transport across prokaryotic membrance, entry of viruses and toxins

UNIT IV: CELL SIGNALING AND SIGNAL TRANSDUCTION 9

Cell signaling – process importance, various kinds of Receptors and ligands – Examples, Different modes of action of ligands, Qualification and characterization of receptors, different modes of signal transduction and amplification with examples, signaling through G-Proteins (Monomeric and trimeric), signaling for growth factors, second messengers, protein kinases, Ca ions and cAMP molecule in signaling.

UNIT V: CELL CULTURE 9

Definition, Media preparation, Propagation of eukaryotic and prokaryotic cell, cell lines, primary cultures, stock cell cultures, maintenance of cell lines in cell culture, explants cultures, differentiation and contamination

TEXT BOOKS:

1. P.K. Gupta, "Cell and Molecular Biology", Rastogi Publication, 2003
2. Molecular Biology of the Cell, Bruce Albert et al., Taylor and Francis, 2002

REFERENCE BOOKS:

1. Molecular Biology of the Cell, Baltimore, Damell J., Lodish, H. Baltimore, D., Freeman Publications, 2003
2. The Cell, T. Coopper, John Wiley and Sons, 2005
3. Cytology,Vermaand Aggarval, S. Chand Publications, 2003

.

BCS101	**FUNDAMENTALS OF COMPUTING AND PROGRAMMING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES

Students will understand the basics of computers and solve computer oriented problems using various computing tools.

COURSE OUTCOMES (COs)

CO1	Learn the fundamental principles in computing.
CO2	Learn to write simple programs using computer language
CO3	To enable the student to learn the major components of a computer system.
CO4	Computing problems

CO5	To learn to use office automation tools.
CO6	To interpret and relate programs

		Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low											
1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	L
2	CO1	H					H						
	CO2		L	H		M							
	CO3		L		S								
	CO4	M		M	W		M						
	CO5		L	L									
	CO6	H					H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO COMPUTER 9

Introduction- Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers- Basic Computer Organization-Number system. Computer Software: Types of Software—System software-Application software-Software Development Steps

UNIT II PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program – Purpose – Algorithm – Flowcharts– Pseudo code Introduction to Office Packages: MS Word, Spread Sheet, Power Point, MS Access, Outlook.

UNIT III INTRODUCTION TO C 9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions. Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV ARRAYS AND STRUCTURES 9

Overview of C-Constants, Variables and Data types-Operators and Expressions -Managing Input and Output operators-Decision making-Branching and Looping.

UNIT V INTRODUCTION TO C++ 9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TEXT BOOKS:

1. Ashok, N.Kamthane,"Computer Programming", Pearson Education (2012).
2. Anita Goel and Ajay Mittal,"Computer Fundamentals and Programming in C", Dorling V Kindersley (India Pvt Ltd).,Pearson Education in South Asia,(2011).
3. Yashavant P. Kanetkar, "Let us C",13th Edition,BPB Publications(2013).
4. Yashavant P. Kanetkar,"Let us C++"10th Edition, BPB Publications (2013**).**

REFERENCES:

1. Pradeep K.Sinha, Priti Sinha "Foundations of Computing", BPB Publications (2013).
2. Byron Gottfried, "Programming with C", 2nd edition, (Indian Adapted Edition), TMH Publication.
3. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in 'C' First Edition, Oxford University Press(2009).
4. The C++ Programming Language , 4th Edition, Bjarne Stroustrop, Addison-Wesley Publishing Company (2013).

BSS101	**PERSONALITY DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	1	1	0	2
	Prerequisite – +2 Level Knowledge				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To make students groom their personality and prove themselves as good Samaritans of the society.

COURSE OUTCOMES (COs)

CO1	Individual or in-group class presentations pertaining to the applications of conce theories or issues in human development..
CO2	Scores obtained from essay and or objective tests.
CO3	Attendance, classroom participation, small group interactions.
CO4	Research and write about relevant topics.
CO5	Design and complete a research project that can take the form of a developmental intervi an observation or assessment through service learning.
CO6	Develop and maintain a Reflection

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	L
2	CO1	L		H				M					
	CO2		H	H				M					
	CO3							M	H				
	CO4									H	H		
	CO5							M			H	H	
	CO6							M					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 9

The concept personality- Dimensions of theories of Freud & Erickson- personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analyses.

UNIT II ATTITUDE & MOTIVATION 6

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III SELF-ESTEEM 9

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV OTHER ASPECTS OF PERSONALITY DEVELOPMENT 9

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics –Good manners and etiquette.

UNIT V EMPLOYABILITY QUOTIENT 9

Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TEXT BOOKS:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition, Prentice Hall.

REFERENCE BOOKS:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002

3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

BCE 101	**BASIC CIVIL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Civil Engineering				

OBJECTIVES: Understand the basic concepts of civil engineering.

COURSE OUTCOMES (COs)

CO1	Will gain knowledge in Design, concept preparation
CO2	Loading calculation
CO3	Structural component design
CO4	Drawing and chart preparation
CO5	Will understand the components of buildings.
CO6	Will learn the engineering aspects to dams , water supply and sewage disposal.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H	H			H		L					
	CO2					H	H						
	CO3							H	L				
	CO4									L			
	CO5										H	L	
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CIVIL ENGINEERING MATERIALS 8

Introduction – Civil Engineering – Materials – Stones – Bricks – Sand – Cement – Plain Concrete – Reinforced Cement Concrete – Steel Sections – Timber – Plywood – Paints – Varnishes (simple examples only)

UNIT II SURVEYING 5

Surveying – objectives – classification – principles of survey-Measurement of distances – Chain survey – Determination of areas – Use of compass – Use of leveling Instrument – (simple examples only)

UNIT III FOUNDATION FOR BUILDING 5

Bearing Capacity of Soil – Foundation – Functions – Requirement of good foundations – Types of foundations – Merits & Demerits.

UNIT IV SUPERSTRUCTURE 7

Stone Masonry – Brick Masonry – Columns – Lintels – Beams – Roofing – Flooring – Plastering– White Washing (Simple examples only)

UNIT V MISCELLANEOUS TOPICS 5

Types of Bridges –Dam- purpose – selection of site - Types of Dams – Water Treatment & Supply sources – standards of drinking- distribution system. – Sewage Treatment (simple examples only)

TEXT BOOKS:

1. Raju.K.V.B, Ravichandran .P.T, "Basics of Civil Engineering", Ayyappa Publications, Chennai, 2012.
2. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, (1st ed. 2005).
3. Dr.M.S.Palanisamy, "Basic Civil Engineering" (3rded. 2000), TUG Publishers, New Delhi/Tata McGrawHill Publication Co., New Delhi

REFERENCE BOOKS:

1. Rangwala.S.C, "Engineering Materials", Charotar Publishing House, Anand, 41st Edition: 2014.
2. National Building Code of India, Part V, "Building Materials", 2005
3. Ramesh Babu"A Textbook on Basic Civil Engineering" (1998). Anuradha Agencies, Kumbakonam.
4. RamamruthamS., "Basic Civil Engineering", DhanpatRai Publishing Co. (P) Ltd. (1999).

BME101	BASIC MECHANICAL ENGINEERING	L	T	P	C
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

- The program educational objectives (PEOs) for the mechanical-engineering program are to educate graduates who will be ethical, productive, and contributing members of

society.

- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- The ability to apply principles of engineering, basic science, and mathematics to design and realize physical systems, components, or processes

COURSE OUTCOMES (COs)

CO1	an ability to apply knowledge of mathematics
CO2	an ability to apply knowledge of science, and engineering
CO3	Ability to design and conduct experiments, as well as to analyze and interpret data.
CO4	an ability to function on multi-disciplinary teams
CO5	ToprovidebasicKnowledgeofbasicmanufacturingprocess.
CO6	ability to identify, formulate, and solve engineering problems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ENERGY RESOURCESANDPOWER GENERATION 6

RenewableandNon-renewableresources-solar,wind,geothermal,steam,nuclearandhidepowerplants-Layout,
majorcomponentsandworking.ImportanceofEnergystorage,Environmentalconstraintsofpowergeneration usingfossil fuelsandnuclearenergy.

UNIT II IC ENGINES 6

Classification,workingprinciplesof petrol anddiesel engines-twostroke andfourstroke cycles,functionsofmain componentsofI.Cengine.Alternatefuelsandemissioncontrol.

UNIT III REFRIGERATION AND AIR-CONDITIONINGSYSTEM 6

Terminologyof Refrigerationand Air-Conditioning,PrincipleofVaporCompression& Absorptionsystem- Layoutoftypicaldomesticrefrigerator-window&Splittyperoomairconditioner.

UNITIV MANUFACTURING PROCESSES 6

BriefdescriptionofMouldmakesandcastingprocess,Metalforming,Classification typesofforging, forging operations, Briefdescription ofextrusion,rolling,sheetforging,anddrawing.Briefdescription ofwelding,brazing andsoldering.Principalmetalcuttingprocessesandcuttingtools,Brief descriptionofCentrelatheandradial drillingmachine.

UNITV MECHANICALDESIGN 6

Mechanicalpropertiesofmaterial-Yieldstrength,ultimatestrength,endurancelimitetc.,Stress-Strain curvesof materials.Stresses inducedinsimpleelements.Factorofsafety-Design ofShaftsandbelts. Typesofbearingsand itsapplications.Introductionto CAD/CAM/CIM&Mechatronics.

TEXTBOOKS:

1. T.J.Prabhuetal, "BasicMechanicalEngineering", SciTechPublications(p)Ltd,2000

REFERENCES:

1. NAGPAL,G.R,"PowerplantEngineering",KhannaPublishers,2004.
2. RAO.P.N,"ManufacturingTechnology",TataMcGraw-HillEducation,2000.
3. Kalpakjian,"ManufacturingEngineeringandTechnology",AdissoWesleypublishers,1995.
4. Ganesan.V,"Internalcombustionengines",TataMcGraw-HillEducation,2000.
5. C.P.Arora,"RefrigerationandAir Conditioning",TataMcGraw-HillEducation,2001.
6. V.B.Bhandari,"DesignofMachineelements",TataMcGraw-HillEducation,2010.

BCM1L1	**BASIC CIVIL & MECHANICALENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Department of Mechanical Engineering& Civil Engineering				

OBJECTIVES

To provide exposure to the students with hands on experience on various basic Civil & Mechanical Engineering practices.

COURSE OUTCOMES (COs)

CO1	Learn Basic concepts
CO2	Students will get exposure regarding pipe connection for pumps & turbines and to study the joint used in roofs, doors, windows and furniture's.
CO3	Students will get exposure regarding smithy, foundry operations and in latest welding operations such as TIG, MIG, CO2, spot welding etc.,
CO4	Students will get hands on experience on basic welding techniques, machining and sheet metal works.
CO5	Students will get hands on experience on basic machining techniques
CO6	Students will get hands on experience on basic sheet metal techniques

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H	L										
	CO2				H								
	CO3					H	L	L					
	CO4		H				M		L			H	
	CO5		H				M		L			H	
	CO6		H				M		L			H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS

I. CIVILENGINEERINGPRACTICE

Buildings:

a) Studyofplumbingandcarpentrycomponentsofresidentialandindustrialbuildings.Safetyaspects.

PlumbingWorks:

a) Studyofpipelinejoints,itslocationandfunctions:valves,taps,couplings,unions,reducers,elbowsin householdfittings.

b) Studyofpipeconnectionsrequirementsforpumpsandturbines.

c) Preparationofplumbinglinesketchesforwatersupplyandsewageworks.

d) Hands-on-exercise:Basicpipeconnection ofPVCpipes&G.I.Pipes–Mixedpipematerialconnection–Pipe connectionswithdifferentjoiningcomponents.

e) Demonstrationofplumbingrequirementsofhigh-risebuildings.

CarpentryusingHandtoolsandPowertools:

a) Studyofthejointsinroofs,doors,windowsandfurniture.

b) Hands-on-exercise:Woodwork,jointsbysawing,planningandcutting.

c) Preparationofhalfjoints,MortiseandTenonjoints.

II MECHANICALENGINEERINGPRACTICE

Welding:

a) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

BasicMachining:

a) Simple Turning and Taper turning

b) Drilling Practice

SheetMetalWork:

a) Forming&Bending:

b) Modelmaking–Trays,funnels, etc.

c) Differenttypeofjoints
d) Preparationofair-conditioningducts
e) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

Machineassemblypractice:

a) Assembling,dismantlingand Studyofcentrifugalpump
b) Assembling,dismantlingand Studyofairconditioner
c) Assembling,dismantlingandStudyoflathe

Moulding:

a) Mouldingoperationslikemouldpreparationfor gearandstepconepulleyetc

Fitting:

a) Fitting Exercises–Preparationofsquarefittingandvee–fittingmodels.

Demonstration:

a) Smithyoperations,upsetting,swaging,settingdownandbending.Example–Exercise–Productionofhexagonalheaded bolt.
b) Gaswelding.

REFERENCES:

1. K. Jeyachandran, S. Nararajan& S, Balasubramanian, "A Primer on Engineering Practices Laboratory" ,Anuradha Publications, (2007).
2. T.Jeyapoovan, M. Saravanapandian& S. Pranitha, "Engineering Practices Lab Manual",Vikas Publishing House Pvt. Ltd. (2006)
3. H. S. Bawa, "Workshop Practice", Tata McGraw–Hill Publishing Company Limited, (2007).
4. A. Rajendra Prasad & P. M. M. S Sarma, "Workshop Practice", SreeSai Publication, (2002).
5. P. Kannaiah& K.L. Narayana, "Manual on Workshop Practice", Scitech Publication, (1999).

	PHYSICS AND CHEMISTRY LABORATORY	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
BPC 1L1/2L1	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				

OBJECTIVES: To impart knowledge to the students in practical physics and chemistry

COURSE OUTCOMES (COs)

CO1	Students will understand the concept of hall effect
CO2	Students will understand the concept of semiconductors. .
CO3	Student will understand the working of spectrometer.
CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M

	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective	Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
				√									
4	Approval	37th Meeting of Academic Council, May 2015											

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS 1L5 /2L5 NSS PRACTICAL L T P C

0 1 2 1

OBJECTIVES

1. Understand the community in which they work and their relation
2. Identify the needs and problems of the community and involve them in problem-solving

3. Develop capacity to meet emergencies and natural disasters
4. Practice national integration and social harmony and
5. Utilize their knowledge in finding practical solutions to individual and community problems.

1. Regular Activities Programme

1) Traffic regulation
2) Working with Police Commissioner's Office
3) Working with Corporation of Chennai
4) Working with Health Department
5) Blind assistance
6) Garments collection
7) Non-formal education
8)Environmental Education, Awareness and Training (EEAT)
9) Blood donation

2.Special camp Programme

A) Legal awareness
B) Health awareness
C) First-aid
D) Career guidance
E) Leadership training - cum - Cultural Programme
F) Globalization and its Economic Social Political and Cultural impacts.

REFERENCE BOOKS:

1. National Service Scheme Manual, Government of India.
2. Training Programme on National Programme scheme, TISS.
3. Orientation Courses for N.S.S. Programme officers, TISS.
4. Case material as Training Aid for field workers, Gurmeet Hans.
5. Social service opportunities in Hospitals, Kapil K.Krishan,TISS.
6. Social Problems in India, Ram Ahuja.

BEN 201	**ENGLISH II**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – English I				
	Course Designed by – Department of English				

OBJECTIVES	
Students will be able to actively participate in group discussions. Students will have Telephonic Skills, Giving Directions and Information Transfer	
COURSE OUTCOMES (COs)	
CO1	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)
CO2	To make students comprehend the habit of intelligent Reading as well as Computer-based competitive exams glob
CO3	To achieve a reasonably good level of competency in Report Writing.
CO4	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)

CO5	To achieve a reasonably good level of competency in group discussions												
CO6	To achieve a reasonably good level of competency in public speaking												
	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	M	L	H	L	M			H		M	L	
	CO2			H	L				H		M	L	
	CO3			H	L	M			H		H	L	
	CO4			H	L	M			H		M	L	
	CO5			H	L	M			H		M	L	
	CO6			H	L	M			H		M	L	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Professional Elective (PE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship	
		√											
4	Approval			37th Meeting of Academic Council, May 2015									

UNIT I ORIENTATION 12

Numerical adjectives - Meanings in context - Same words used as different parts of speech -Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II ORAL SKILL 12

Listening to audio cassettes - C.Ds , News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - and Giving Instructions - Reading Comprehension answering questions. Inferring meaning.

UNIT III THINKING SKILL 12

Self- introduction describing –Group Discussion – Debate –Role play- Telephone- Things- etiquette- Recommendation and Sequencing jumbled sentences to make a suggestions-paragraph-advertisement and notice, Designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV WRITING SKILL 12

Definitions - Compound nouns - Abbreviations and acronyms – (a) business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) Letters to the editor (giving suggestions on an issue) .

UNIT V FORMAL INFORMATION 12

Editing – Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

TEXT BOOK:

1. Meenakshi Raman, Sangeetha Sharma , Technical English for Communication: Principle and Practice, OUP, 2009.

REFERENCE BOOKS:

1. Sumanth , English for Engineers, Vijay Nicole , Imprints pvt ltd.2013.
2. Meenakshi Raman and Sangeetha Sharma , Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binodmishra , Communication skills for engineers and scientists , PHI Learning Pvt Ltd, New Delhi, 2010.

BMA 201	**MATHEMATICS – II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – Mathematics I				
	Course Designed by – Department of Mathematics				

OBJECTIVES

Ability to apply these principles of mathematics in projects and research works.

COURSE OUTCOMES (COs)

CO1	Student shall be able to Solve differential equations, simultaneous linear equations, and sc special types of linear equations related to engineering.
CO2	Relate the use of mathematics in applications of various fields namely fluid flow, heat fl solid mechanics, electrostatics, etc.
CO3	Ability to test hypothesis
CO4	Find intensity of degree of relationship between two variables and also bring out regress equations.
CO5	Understand to solve matrix problems related to real life problems.
CO6	Formulate mathematical models

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H		L									
	CO2		H				H		L	L		M	
	CO3		H				H		L	L		M	
	CO4					M						M	
	CO5										M	M	
	CO6										M		

3	Category	Humanities & Social	Basic Sciences	Engg Sciences	Professional Core	Professional Electi	Non-Major Electi	Open Electi ve	Project/Term
			√						

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I ORDINARY DIFFERENTIAL EQUATION 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters **– Cauchy's** and L**egendre's linear equations** - simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient, divergence and curl –Directional derivatives –Irrotational and solenoidal vector fields – vector integration**– Green's theorem in a plane , Gauss divergence theorem and** S**toke's theorem (**without proofs) **–** simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable **–** Analytic functions **–** Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) **–** Harmonic and orthogonal properties of analytic functions **–** Harmonic conjugate **–** construction of analytic functions **–** conformal mapping: W= Z+C, CZ, 1/Z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration **– Statement and application of Cauchy's integral theorem and Cauchy's integral formula –**Taylor and Laurent expansions **–** Singular points **–** Residues **–** Residue theorem **–** Application of Residue theorem to evaluate real integrals **–** Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V STATISTICS 12

Mean, Median, Mode **–** Moments **–**Skewness and Kurtosis **–** Correlation **–** Rank Correlation **–** Regression **–**Chi square test for contingency tables.

TEXT BOOK:

1. R.M.Kannan and B.Vijayakumar" Engineering Mathematics–II "2nd Edition, SRB Publication, Chennai 2007.
2. Bali.N.P and Manish Goyal , "Engineering Mathematics", 3rd Edition, Laxmi Publications (P) Lltd, 2008 .
3. Grewal .B/S "Higher Engineering Mathematics", 40th Editon, Khanna Publications, Delhi, 2007

REFERENCES :

1. Ramana.B.V, "Higher Engineering Mathematic", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Gupta SC, and VK.Kapoor, "Fundamentals Mathematical Statistics", 11th edition, Sultan Chand Sons, New Delhi, 2014.

BPH201	**ENGINEERING PHYSICS -II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING PHYSICS -I				

	Course Designed by – Department of Physics

OBJECTIVES

- To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications
- To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

COURSE OUTCOMES (COs)

CO1	Understand about properties and advancements of conducting materials.
CO2	Understand the principle and properties semiconducting materials.
CO3	Acquire Knowledge on Magnetic and dielectric Materials.
CO4	To Know about the creation of new materials with novel properties
CO5	To Understand the impact of modern materials in technical uses.
CO6	Learn new engineering materials and its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L								
	CO5		L	L									
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type

semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications.

TEXT BOOKS:

1. Jayaraman D Engineering Physics II. Global Publishing House, 2014.
2. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
3. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

REFERENCES:

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4 http://ocw.mit.edu/courses/find-by-topic
5 http://nptel.ac.in/course.php?disciplineId=122
6 https://en.wikipedia.org/wiki/Engineering_physics

BCH 201	**ENGINEERING CHEMISTRY-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING CHEMISTRY –I				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Students will understand the concepts and further industrial applications of surface chemistry
CO2	To impart knowledge about the Industrial importance of Phase rule and alloys

CO3	To make the students to be conversant with Analytical techniques of chemistry and their importance
CO4	To have an idea and knowledge about the Chemistry of Fuels and
CO5	Understanding of engineering materials
CO6	All about bonding and molecular structures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L		H		H				M	
	CO2		H			H		H					
	CO3	H		L		H		H				M	
	CO4			L		H		H					
	CO5			L		H		H					
	CO6			L		H		H		H		M	

3	Category	Humanities & Social	Basic Sciences	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project /Term Paper/ Semin
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I SURFACE CHEMISTRY 9

Introduction **:** Adsorption , absorption , desorption , adsorbent , adsorbate and sorption – (definition only) Differences between adsorption and absorption Adsorption of gases on solids – factors affecting adsorption of gases on solids – Adsorption isotherms –Frendlich adsorption isotherm and Langmuir adsorption isotherm Role of adsorbents in catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II PHASE RULE AND ALLOYS 9

Introduction **:**Statement of Phase Rule and explanation of terms involved – one component system – water system – Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) – eutectic temperature – eutectic composition – Pattinsons Process of desilverisation of Lead Alloys: Importance, ferrous alloys –nichrome and stainless steel – 18/8 stainless steel -heat treatment of steel – annealing – hardening – tempering normalizing – carburizing - nit riding . Non- ferrous alloys: Brass and Bronze

UNIT III ANALYTICAL TECHNIQUES 9

Introduction: Type of Spectroscopy - Atomic spectroscopy – molecular spectroscopy - Explanation IR spectroscopy – principles – instrumentation (block diagram only) – applications - finger print region UV-visible spectroscopy –– principle – instrumentation (block diagram only) – Beer-**Lambert's law**- – estimation of iron by colorimetry– Atomic absorption spectroscopy- principle - instrumentation (block diagram only) - estimation of Nickel by Atomic absorption spectroscopy Flame photometry– principles – instrumentation (block diagram only) - estimation of sodium ion by Flame photometry

UNIT IV FUELS **9**

Introduction **:** Calorific value – types of Calorific value - gross calorific value – net calorific value Analysis of Coal –- Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only) Flue gas analysis – importance - Orsat apparatus

UNIT V ENGINEERING MATERIALS **9**

Introduction: Refractory's – classification – acidic, basic and neutral refractory's – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Manufacture of Refractory's: alumina bricks and Magnesite bricks, Abrasives – natural and synthetic abrasives Natural type : Siliceous - quartz ; Non –siliceous – diamond Synthetic Abrasives : silicon carbide and boron carbide. Lubricants: Liquid lubricants - Properties – viscosity index, flash and fire points, cloud and pour points, oiliness) Solid lubricants – graphite and molybdenum sulphide

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub. Co.Ltd, New Delhi,(2008)
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Spectroscopy

BCS 202	INTERNET PROGRAMMING	L	T	P	C
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Dept of Information Technology				

OBJECTIVES

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science.

COURSE OUTCOMES (COs)

CO1	To enable the student to learn the major components of a computer system.
CO2	To know the correct way of solving problem.
CO3	To identify efficient way of solving problem.
CO4	To learn to use office automation tools.

CO5	To implement office automation tools
CO6	To learn and write program in "C".

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities	Basic Sc	Engg Sc	Professional	Core Elect	Non-Tech	Open	Project
				√					

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I BASIC INTERNETCONCEPTS 6

Internet principles-IPaddressing-Internet Service Provider (ISP)-URL-Basic web concepts-World WideWeb (WWW)-Intranet and Extranet-Internet Protocols: HTTP, TCP, UDP, FTP, Telnet-Domain Name System(DNS)-E mail-Next generation internet.

UNIT II WEBDESIGNBASICS 6

Introduction to HTML–Structureof HTMLDocument– Tags-Headings–Links–Images–Lists–Tables –Forms–Frames-Style sheets andits types.

UNITIII DYNAMIC HTML 6

Introduction to DynamicHTML-Object modeland collections-Event model-Filters and transition-Data binding-Data control-Activexcontrol.

UNIT IV CLIENT ANDSERVERSIDEPROGRAMMING 6

VBScript&JavaScript:Introduction-Operators–Data type-Control structures-Looping–Classes andObjects–Arrays-Functions-Events-Exampleprograms.

UNITV INTERNETAPPLICATIONS 6

Onlinedatabase-functionsofonlinedatabase-MeritsandDemerits-InternetInformationSystems (IIS)-EDIapplications inbusiness and its types-Internet commerce-Types and Applications

.

TEXT BOOKS:

1. Deitel, Deitel and Nieto, ''Internet and World Wide Web- How to program'', Pearson Education Publishers, 5th edition, 2008.
2. Elliotte Rusty Harold, ''Java Network Programming'', O'Reilly Publishers, 2010
3. Java Script: A Beginners Guide John Pollock 4thEdition, TMH Edition (2013)
4. VB Script Beginners Guide, Jyoti B. Giramkar, Create Space Independent Publishing (2014)

REFERENCES:

1... Krishnamoorthy & S.Prabhu, ''Internet and Java Programming'', New Age International Publishers, 2010.

2. Thomno A.Powell, ''The Complete Reference HTML and XHTML'', fourth edition, Tata McGraw Hill, 2001

3. E Commerce Kamlesh K.Bajaj, Debjani Nag, Tata McGraw Hill, Second edition, 2010

BFR 201	FRENCH	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

Language gives access and insights into another culture. It is a fundamental truth that cultures define themselves through languages.

COURSE OUTCOMES (COs)

CO1	Introduce the basics of the language to beginners
CO2	Understand a dialogue and dialogue presentation
CO3	To develop their knowledge as well as their communicative skills so as to be able to respond in simple everyday contexts.
CO4	Synchronies I includes documents which initiate the learners to another world, another culture and which acclimatize them to the authentic use of the French language through the exploitation of written and iconographic documents. The Indian context has been used.
CO5	Grammatical and lexical notions as well as activities required for communication are learnt by the students.
CO6	Interpreting skills and confidence in the language.
CO6	Interpreting skills and confidence in the language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humaniti	Basic Sc	Engg Sc	Prof es	Core El	Non - M	Ope	Proj ect /T er
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION 8

At the airport: Savoir– faire: exchanging greetings, self introduction, introducing another, welcoming someone, identifying someone - Grammar: verbs 'to be', 'to call oneself', subject pronouns, interrogation

UNIT II GRAMMAR 8

At the University: Savoir-faire: enquiring after one's welfare, taking leave, expressing appreciation - Grammar: definite & indefinite articles, gender of nouns, adjectives, present tense of regular 'er' verbs, 'to have', 'to learn', negation, irregular verbs

UNIT III CONVERSATION 8

At the café: Savoir –faire: speaking about one's likes, giving information, expressing admiration, asking information about someone - Grammar: Interrogative adjectives, irregular verbs, possessive and interrogative adjectives

UNIT IV PROPOSAL WRITING 7

At the beach: Savoir faire: proposing an outing, accepting/ refusing the proposal - Grammar: singular & plural, indefinite pronoun, demonstrative adjectives, negation, irregular verbs

UNIT V FORMAL LETTERS 7

A concert: Savoir –faire: inviting, accepting, expressing one's inability to accept an invitation

UNIT VI REGULAR & IRREGULAR VERBS 7

Grammar: Present tense of more irregular verbs, contracted articles, future tense, interrogative adverbs, **At Nalli's** Savoir- faire: asking the price of an article, protesting against the price, Grammar: possessive adjectives, Exclamative adjectives, imperative tense

REFERENCES:

1. Course Material: Synchronie I –Méthode de Français
2. Madanagobalane -Samita Publications, Chennai, 2007

BGM 20	**GERMAN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

At the end of this course, students shall be able to obtain good knowledge of the language, to r write and speak German, whereby the emphasis is laid on speech.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.

CO3	Will develop basic conversational skills.
CO4	Will understand German lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

Course structure:

A. German Language (speaking, reading, writing, grammar and test)
B. Life in Germany (shopping, restaurant, doctor, government, bank, post)
C. The German Way (introduction, doing business, conversation, meetings, dining)
D. Germany (Culture, Climate)

UNIT I PRONOUNCIATION 9

Welcome: Introduction to the Language, Spelling and Pronunciation (The alphabets and numbers) Greetings, ordering, requesting, saying thank you - Grammar **– the article "the", conjugation** of verbs

UNIT II SELF INTRODUCTION 9

Shopping - Grammar **–** adjectives, endings before nouns, practice. Self introduction

UNIT III TRAINING 9

Addresses, Occupations, Studies - Grammar **- 'to be', the definite/indefinite** articles, individual Training

UNIT IV ORAL 9

Leisure Time, Sports, Hobbies - Grammar **–** position of a verb in a main clause , oral practice

9

UNIT V NARRATION

At a Restaurant, Food and Drink - Grammar – the personal pronoun in the Nominative and Accusative, Narrating an event

RESOURCES:

1. Sprachkurs Deutsch 1 (Verlag Diesterweg), New Delhi Learning Centre

BJP 201	**JAPANESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Japanese language, Japanese culture and heritage
To impart knowledge Japanese lifestyle.
To give sufficient exposure to develop basic conversational skills.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Japanese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CULTURAL HERITAGE 9

Introduction-history and origin of Japanese language-Japan and its cultural heritage-Self introduction-counting numbers (1-100)-time-conversation with the use of audio devices, grammar– usage of particles wa, no, mo and ka

UNIT II USAGE 9

Greetings, seasons, days of the week and months of the year-numbers (up to 99,999)-grammar– usage of kore, sore, are, kono, sono, ano, koko and kochira, arimasu and imasu-i-ending and na-ending adjectives-use of audio and drills for practice

UNIT III ORAL 9

Asking the price–associated vocabulary-usage of particles ni, ga and ne- use of audio and drills for practice-Introduction to basic Kanji characters- use of audio and drills for practice

UNIT IV ART AND CULTURE 9

Family relationships- colours-Kanji (numbers) and festivals of Japan-religion-Japanese art and culture-ikebana, origami-introduction to hiragana- use of audio and drills for practice

UNIT V DRILLS AND PRACTICE 9

Vocobulary associated with directions-asking way-particles – e, de, mo, koko, soko, asoko, doko, nani, mae, ushiro, ue, shita- use of audio and drills for practice-introduction to katakana

TEXT BOOKS

1. Japanese Hiragana and Katakana for beginners, Timothy G. Stout, 2011
2. Genki I: An integrated course in elementary Japanese, Eri Banno and Yuko Ikeda, 2011

REFERENCE BOOKS

1. Japanese Reader collection Volume I, Yumi Boutwell and Clay Boutwell, Kotoba books, 2013
2. Living Language Japanese Complete Edition beginners through advanced course, Living Language, 2012

BKR 201	**KOREAN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Korean language, Korean culture and heritage
To impart knowledge on Korean lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.

CO4	Will understand Korean lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I PLANNING 9

Asking/giving reasons for studying Korean, making plans for the holiday, writing letters, describing past travel experiences and future travel plans, shopping in a grocery store, shopping in electronics store, storytelling Grammar: would like to (do), want to (do), construct future tense.

UNIT II MODIFIERS 9

Asking about feelings, asking about problems and giving advice, brief introductions - Grammar: Noun modifier, please try doing (something), irregular adjective/verb

UNIT III PLACING ORDERS 9

Asking about hobbies, asking about abilities (sports), job requirements, Ordering things for delivery, ordering a meal at a restaurant - Grammar: Sentence ending for the honorific form, please do something for me, have tried (something),

UNIT IV DESCRIPTIONS 9

Asking about evening plans, making plans with others, making preparations - Asking about rooms, describing your room to your classmates, describing your house. Grammar: to know/not know how to do something, must (do), have to (do), should,

UNIT V GRAMMAR 9

Describing your plans and giving reasons, cancelling appointments. Grammar: Shall we~? / Should we~?, with, and, irregular verbs/adjective, so, because, cannot, intend to, plan to, or hope to, (more) than, the most, tag question/is n't it? ,will (do)

COURSE MATERIAL:

Korean for Non-Native Speakers (Student Book 1B) Korean Language Education Center, Sogang University

BCN 201	**CHINESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Chinese language, Chinese culture and heritage

To impart knowledge on Chinese lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Chinese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT 1 RISE OF DIALECTS 9

History, Origins, Old and middle Chinese, Rise of northern dialects

UNIT II VARIETIES 9

Influences 3 Varieties of Chinese. 1.Classification 2.Standard Chinese and 3.Nomenclature

UNIT III CHARACTERS 9

Chinese characters, Homophones, Phonology

UNIT IV TRANSCRIPTIONS **9**

Tones, Phonetic transcriptions, Romanization, Other phonetic transcriptions

UNIT V GRAMMAR **9**

Grammar and morphology, Vocabulary, Loanwords, Modern borrowings and loanwords

REFERENCES:

1. Hannas, William C. (1997), Asia's Orthographic Dilemma, University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-1892-0" 978-0-8248- 1892-0.
2. Qiu, Xigui (2000), Chinese Writing, trans. Gilbert Louis Mattos and Jerry Norman, Society for the Study of Early China and Institute of East Asian Studies, University of California, Berkeley, ISBN HYPERLINK http://en.wikipedia.org/wiki/Special:BookSources/978-1-55729-071-7,978-1-55729-071-7.
3. Ramsey, S. Robert (1987), The Languages of China, Princeton University Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-691-01468-5" 978-0-691-01468-5.
4. Schuessler, Axel (2007), ABC Etymological Dictionary of Old Chinese, Honolulu: University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-2975-9"978-0-8248-2975-9.
5. R. L. G. " Language borrowing Why so little Chinese in English?" The Economist. June 6, 2013.

BBT 201	**PRINCIPLES OF GENETICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – Basic biology, concepts in genetics				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a fundamental knowledge on genetics, its laws, genes and chromosomes, inherita heredity, causes of genetic disorders and the methods of gene transfer

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals of genetics and the Mendelian laws
CO2	To understand about the structure and organization of chromosomes in prokary eukaryotes
CO3	To understand about the structure and organization of chromosomes in eukaryotes
CO4	To understand the concept of alleles in blood grouping and sex determination
CO5	To know the concept of linkage and crossing over of genes
CO6	To get a basic knowledge of the methods of gene transfer

UNIT I BASICS OF GENETICS **6**

Classical genetics, Mendelian Laws- Mendel's experiment-monohybrid cross-phenotype, genotype, Dihybrid inheritance, Interaction of genes, Fine structure of Genes

UNIT II CHROMOSOMES 6

Chromosome structure and organization in prokaryotes and eukaryotes, unusual chromosomes-chromosome banding, chromosome abnormalities- genetic disorders

UNIT III ALLELES 6

Classical concepts of Pleomorphism, Multiple alleles, ABO blood groups, Rh factor, sex linkage in Drosophila, linkage in human beings, mechanism of sex determination, XX-XY mechanisms of sex determination, sex determination in Drosophila, environmental factors and sex determination, sex differentiation.

UNIT IV CROSSING OVER 6

Coupling and Repulsion-Hypothesis, Test cross in maize and crossing over, theory of crossing over, molecular mechanism of crossing over, sex chromosomes and sex linked inherited disorders, colour blindness, hemophilia, Muscular dystrophy.

UNIT V GENE TRANSFER 6

Transformation, Tansduction, Conjugation, Plasmids and Episomes

TEXT BOOKS:

1. Principles of Genetics, Gardner, Simmons and Snustad, John Wiley and Sons (Asia), 2002
2. Genes VIII, Lewin, International Edition, Prentice Hall, 2004

REFERENCE BOOKS:

1. Instant Notes in Genetics, P.C. Winter, G.I. Hickey and H.L. Fletcher, Viva Books Private Limited, 2003
2. Weblink: nptel

BEE 201	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Engineering Mathematics, Engineering Physics-I & II				
	Course Designed by – Department of Electrical & Electronics Engineering				
OBJECTIVES: To understand the laws of electrical engineering.					
COURSE OUTCOMES (COs)					
CO1	Students will gain knowledge regarding the various laws and principles associated with electrical systems.				
CO2	Students will gain knowledge regarding electrical machines and apply them for practical problems.				
CO3	Students will gain knowledge regarding various types semiconductors.				
CO4	Student will gain knowledge digital electronics.				
CO5	Student will gain knowledge on electronic systems.				
CO6	Students will acquire knowledge in using the concepts in the field of electrical engg. projects and research.				

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L			
	CO2		H	M			L		L	L			
	CO3		H	M			L		L				
	CO4	M	H	M			L		L	L			
	CO5	M	H	M			L		L				
	CO6		H				L		L	H			
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective	Non-Major Elective (NE)		Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I ELECTRIC CIRCUITS 6

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem –Thevenin's and Norton's Theorem -Problems.

UNIT II ELECTRICAL MACHINES 6

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT III BASIC MEASUREMENT SYSTEMS 6

Introduction to Measurement Systems, Construction and Operating principles of PMMC, Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method – and Energy meter.

UNIT IV SEMICONDUCTOR DEVICES 6

Basic Concepts of semiconductor devices – PN Junction Diode Characteristics and its Applications – HWR, FWR –Zener Diode – BJT (CB, CE, CC) configuration & Characteristics.

UNIT V DIGITAL ELECTRONICS 6

Number system – Logic Gates – Boolean Algebra– De-**Morgan's Theorem –** Half Adder & Full Adder – Flip Flops.

TEXT BOOKS:

1. N.Mittal "Basic Electrical Engineering". Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.

3. Jacob Millman and Christos C-Halkias, “Electronic Devices and Circuits”, Tata McGraw Hill

REFERENCE BOOKS:

1. Edminister J.A. “Theory and Problems of Electric Circuits” Schaum’s Outline Series. McGrawHill Book Compay, 2nd Edition, 1983.
2. Hyatt W.H and Kemmerlay J.E. “Engineering Circuit Analysis”, McGraw Hill Internatinal Editions, 1993.
3. D. P. Kothari and I. J. Nagrath“ Electric Machines”Tata McGraw-Hill Education, 2004
4. Millman and Halkias, “Integrated Electronics”, Tata McGraw Hill Edition, 2004.

BCS2L1	INTERNET PRACTICES LABORATORY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Internet Programming				
	Course Designed by – Dept of Information Technology				

OBJECTIVES

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer sc

COURSE OUTCOMES (COs)

CO1	To enable the student to learn the major components of a computer system.
CO2	To know the correct and efficient way of solving problem.
CO3	To identify and implement the correct and efficient way of solving problem.
CO4	To learn to use office automation tools.
CO5	To infer from use office automation tools.
CO6	To learn and write program in “C”.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective	Non-Major Elective	Open Elective	Project/Term Paper/ Seminar/ Internship (PR)

				√					
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. **HTML (Hypertext Mark-up Language):**
   Basics of HTML.
   How to create HTML Document
   Steps for creating a simple HTML Program.
   a) Favorite Personality
   b) Resume Preparation
2. **ADVANCED HTML:** Advanced Topics of HTML
   a) Time Table
   b) Table Creation
3. **JAVASCRIPT:**
   Script Basics.
   Incorporating JavaScript into Web page.
   a) Star Triangle
   b) Temperature Converters
   Script Basics.
   Incorporating JavaScript into Web page.
   a) Star Triangle
   b) Temperature Converters
4. **VBSCRIPT:**

VBScript Basics.
Incorporating VBScript into HTML.
a) Changing Background Color
b) Simple Calculator

5. **WEB DESIGN:**

Inserting External Media in the Web Page.
a) Forms and Links
b) Frames with Links and Lists
To export a Dream weaver Document as XML File, checking entries, working in frames, windows control, the java script URL.

BCS 2L2	**COMPUTER PRACTICE LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	1
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Department of Computer Science &Engineering				
OBJECTIVES: To impart basic computer knowledge					
COURSE OUTCOMES (COs)					
CO1	Demonstrate major algorithms and data				
CO2	Implementation of array operations				

CO3	Implementation of binary tree.
CO4	Implementation of linked list
CO5	Students will able to do analyse data using spread sheet
CO6	Student will able to understand the basics of C programming.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H	H	L	H		H		L		H	H	H
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

A) WORD PROCESSING **6**

Document creation, Text manipulation with Scientific Notations. Table creation Table formatting and Conversion. Mail merge and Letter Preparation. Drawing-Flow Chart

B) SPREAD SHEET **9**

Chart-Line Xy Bar and Pie – Formula-Formula Editor-Spread sheet-Inclusion of Object, Picture and Graphics Protecting the document and sheet-Sorting and Import/Export features.

C) SIMPLE C PROGRAMMING* **15**

Data types, Expression Evaluation, Condition Statement. Arrays structures and Unions – Functions

D) SIMPLE C++PROGRAMMING **15**

-Classes and Objects

-Constructor and Destructor

***For Programming exercises Flow chart and Pseudo code are essential.**

	BASIC ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICES LABORATORY	**L**	**T**	**P**	**C**
BEE2L1	Total Contact Hours – 45	0	0	3	1

	Prerequisite – Basic Electrical and Electronics Engineering
	Course Designed by – Department of Electrical & Electronics Engineering

OBJECTIVES: To enhance the student with knowledge on electrical and electronic equipments.

COURSE OUTCOMES (COs)

CO1	Students will able to handle basic electrical equipments.
CO2	Students will able to do staircase wiring.
CO3	Students will able to understand domestic wiring procedures practically.
CO4	Student will able to assemble electronic systems.
CO5	Students will understand all the fundamental concepts involving electrical engineering
CO6	Students will understand all the fundamental concepts involving electronics engineering

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	
	CO5	M	H	M			L		L		M	H	
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

I LIST OF EXPERIMENTS FOR ELECTRICAL ENGINEERING LAB

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

II LIST OF EXPERIMENTS FOR ELECTRONICS ENGINEERING LAB

1. Study of electronic components and equipments.
   a. Resistor colour coding using digital multi-meter.
   b. Assembling electronic components on bread board.

2. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

BPC 1L1/2L1	**PHYSICS AND CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				

OBJECTIVES: To impart knowledge to the students in practical physics and chemistry

COURSE OUTCOMES (COs)

CO1	Students will understand the concept of hall effect
CO2	Students will understand the concept of semiconductors. .
CO3	Student will understand the working of spectrometer.
CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

I -LIST OF EXPERIMENTS – PHYSICS

14. Determination of Wavelength, and particle size using Laser
15. Determination of acceptance angle in an optical fiber.
16. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
17. Determination of wavelength of mercury spectrum – spectrometer grating

18. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
19. Determination of Young‟s modulus by Non uniform bending method
20. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
21. Determination of Young‟s modulus by uniform bending method
22. Determination of band gap of a semiconductor
23. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
24. Determination of Dispersive power of a prism - Spectrometer
25. Determination of thickness of a thin wire – Air wedge method
26. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS1L7/BSS2L7 YOGA FOREMPOWERMENT

L	T	P	C
0	1	2	1

OBJECTIVE:

Providing Value Education to improve the Students' character - understanding yogic life and physical health - maintaining youthfulness - Measure and method in five aspects of life

UNIT I PHYSICAL HEALTH 6

Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment.

Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.

Yogasanas 1: Pranamasana - Hastha Uttanasana - Pada Hasthasana - Aswa Sanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana.

Pranayama: Naddi suddi - Clearance Practice - Benefits.

Simplified Physical Exercise - Kayakalpa Practices - Meditation Practices.

UNIT II LIFE FORCE 6

Reasons for Diseases: Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)

Philosophy of Kaya kalpa: Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind.

Maintaining youthfulness: Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid - Measure and method in five aspects of life - Controlling undue Passion.

Kayakalpa practice: Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

UNIT III MENTAL HEALTH 6

Mental Frequencies: Beta, Apha, Theta and Delta wave-Agna Meditation explanation-benefits.

Shanti meditation: Shanthi Meditation explanation-benefits

Thuriya Meditation: Thuriya Meditation explanation-benefits

Benefits of Blessing: Self blessing(Auto suggestion) - Familyblessing-Blessing the others-World blessing-Divineprotection

UNIT IV VALUES 6

Human Values: Self control-Self confidence - Honesty Contentment - Humility-

Modesty Tolerance – Adjustment - Sacrifice-Forgiveness
Purity(Body,Dress,Environment)-Physicalpurity-Mentalpurity - Spiritual purity

Social Values :
Non violence-Service Patriotism-Equality
Respectforparentsandelders-careandprotection-Respectforteacher Punctuality-TimeManagement

UNIT V MORALITY (virtues) 6
Importance of Introspection: I-Mine (Ego, Possessiveness)
SixEvilTemperaments-Greed-Anger-Miserliness-Immoralsexualpassion-InferiorityandsuperiorityComplex-Vengeance
Maneuvering of Six Temperaments:Contentment-Tolerance-Charity-Chastity – Equality-Pardon (Forgiveness)
FiveessentialQualitiesacquiredthroughMeditation:Perspicacity – Magnanimity – Receptivity-Adaptability-Creativity(ImprovedMemoryPower)

Total periods: 30

REFERENCE BOOKS:

1. Yoga for modern age - ThathuvagnaniVethathiri Maharishi
2. Simplified Physical Exercises - ThathuvagnaniVethathiri Maharishi
3. Kayakalpam - Thathuvagnani VethathiriMaharishi
4. Thirukkural -Rev.Dr.G.U.pope
5. Mind-ThathuvagnaniVethathiriMaharishi
6. SoundHealththroughyoga-Dr.Chandrasekaran
7. Light on yoga -BKS.lyenger
8. □□□□□□□□□ – □□□□□□□□□□□□□□□□□□□□□□□□□□□□□

BBT304	**WASTE MANAGEMENT TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic of waste and its disposal				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES
To give a basic knowledge of waste handling and utilization

COURSE OUTCOMES (COs)

CO1	to understand the various types of waste
CO2	to know the various technologies to handle the waste material
CO3	To know the remedial measures for waste disposal
CO4	To get idea about industrial waste management
CO5	To know about bioremediation of waste
CO6	To understand about waste handling

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)				
					√								
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION 9

Introduction: Definition and Classification- Disposal methods: Land fill and Incineration – Recycling methods: biological reprocessing and Energy recovery-. Avoidance and Reduction Methods- Waste handling and Transport – Waste management Concepts

UNIT II AGRICULTURAL WASTE 9

Introduction- Waste Consistency- Waste Management Function: Production ,Collection, Storage, Treatment , Transfer, Utilization- Waste Management system Design – Waste Management System: Dairy Waste, Beef Waste, Swine Waste, Poultry Waste, Other animal – Municipal and Industrial Sludge- Food Processing – Agri-Chemical Waste Management- Handling.

UNIT III BIOMEDICAL WASTE 9

Introduction- Overview – Characterization of Medical Waste- Waste Generation Methodology – Sterilization- Chemical Disinfection – Thermal Inactivation- Irradiation- Microwave Treatment – Grinding and Shredding – Compaction- Current Practice – Standards .

UNIT IV INDUSTRIAL WASTE MANAGEMENT 9

Paper and Pulp Industry – Leather Industry – Cement Industry – Chemical Industry – fertilizer Industry – Pharmaceutical Industry – Textile industry – Iron and Steel industry – Mining Industry – Lignite industry – Petroleum Industry – Nuclear Industry.

UNIT V REMEDIAL MEASURES 9

Bioremediation – Phyto-remediation- Recycling of Plastic and Paper

TEXT BOOK:

1. Wang, Shannmas Hung, 2008, "Advanced hazardous industrial waste treatment" CRC Press.

REFERENCE BOOKS

1. Agricultural Waste Management Hand Book by USDA, III Ed,2005
2. Industrial Biotechnology Problems and Remedies by InduShekhar Thakur, VI Ed,2006

BBT306	PRINCIPLES OF CHEMICAL ENGINEERING	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engg Mathematics-I, Engg Mathematics -II, basics about unit operations				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES
To provide a basic knowledge of Process engineering

COURSE OUTCOMES (COs)

CO1	to understand the various unit operations involved in industry
CO2	to know the material balance for a process.
CO3	to know the energy balance for a process.
CO4	to get an idea about fluid mechanics.
CO5	to know about agitation and the types of agitators
CO6	to know about working principles of fermenter

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M			L	L	M
	CO2	H	M	M	H								
	CO3	H				H		M					M
	CO4	H	M		H	H							
	CO5	H	M	M		H		M					
	CO6	H			H			M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I OVERVIEW OF PROCESS INDUSTRY 12
Unit operations & Process - Conservation of mass & Energy -Stoichiometry- SI units & Conversion

UNIT II MATERIAL BALANCES 12

Overall and component material balances - Conversion -Yield - Selectivity - Material balances without chemical reactions and with chemical reactions

UNIT III ENERGY BALANCES 12

Energy - Forms of energy- Energy balances - Entropy - Latent heat -Hess's law- Standard heat of Reactions.

UNIT IV MOMENTUM TRANSPORT 12

Fluids-Types- Nature of flow-Momentum balance - Mechanical energy balance - Differential balances - Pressure losses in flow systems.

UNITVAGITATION AND TRANSPORTATION OF FLUIDS 12

Mixing and Agitation - Power consumption - Scale up - Pumps and gas moving machinery - Work of consumption.

TEXT BOOK

1. K.A.Gavhane, 2009, "Introduction to process calculations Stoichiometry" NiraliPrakasham Publications 22nd.

REFERENCE BOOKS

1. K.A. Gavhane, 2009, "Fundamentals of chemical engineering" NiraliPrakasham Publications 22nd.
2. McCabe and Smith,2002, "Unit operations in Chemical Enginering", Tata McHraw Hill Pblications, 6th Ed.
3. K.A. Gavhane, 2009, "Unit operations I Fluid flow & Mechanical operations" NiraliPrakasham Publications, 17th.
4. Bhat& Vora,2001, 'Stoichiometry", Tata McGraw Hill Ltd, III Ed
5. Weblink: nptel

BBT307	**GENERAL BIOCHEMISTRY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Chemistry and Biology				
	Course Designed by – Dept. of Industrial Biotechnology				

COURSE OUTCOMES (COs)	
CO1	to understand the fundamentals of biomolecules, their classification, structure
CO2	to apply the basic concept of carbohydrates, proteins ,lipids, nucleicacids and enzymes in metabolism.
CO3	to know the application of biomolecules in functioning of biological system
CO4	to get a basic knowledge of macromolecules in living organism and its energetic
CO5	To know basic concepts of enzymes

CO6	to understand the fundamentals function of biomolecules

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M				H						L
	CO2								H			H	
	CO3	H		H		H				H	H		H
	CO4	H	M				H	H					
	CO5	H										H	
	CO6	H		H					H		H		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CARBOHYDRATES 9

Significance and functions of carbohydrates structure and properties of monosaccharides: Glucose, Fructose, Galactose- Oligosaccharides: Sucrose, Lactose, Maltose, Raffinose- Polysaccharides: storage, structural, Homo, Hetero polysaccharides-Metabolism- Glycolysis, TCA cycle and Hexose Mono Phosphate pathway.

UNIT II LIPIDS 9

Structure and properties of Fatty acids – classification – Lipids – structure and properties of phospholipids- spingolipids, glucolipids and steroids-Biosynthesis and β oxidation of fatty acid.

UNIT III PROTEINS 9

Structure and properties of aminoacids – classification- peptides: chemistry and its properties- proteins: structures – properties – classification based on structure, function and nature. Biosynthesis of amino acid and catabolism-Urea cycle

UNIT IV NUCLEIC ACIDS 9

Structure and properties of purine and pyrimidine bases-Nucleosides- Nucleotides – Structure of DNA – various levels of organization of DNA – superhelical DNA – structure and properties of mRNA and rRNA-Biosynthesis and degradation of purine and pyrimidine

UNIT V ENZYMES 9

Classification and Nomenclature of enzymes- Properties of enzymes – active site -Factors affecting enzyme activity- Enzyme specificity- Mechanism of enzyme action- Enzyme kinetics related to Michaelis-Menten equation.

Text Book

1. 'Gaw A, 2008, "Clinical biochemistry" Elsevier Health Sciences, 4th.Ed.
2. J.L. Jain, 2008, "Fundamentals of biochemistry" S. Chand.8th Ed

Reference Books

1. J.L. Jain , , 2007 ,"Text Book Of Biochemistry' ,14th Ed
2. Zubey 2004 "Biochemistry" III Ed,
3. Voet&Voet 2006, "Biochemistry" V ed,.
4. Lehninger Nelson & Cox , , 2005 "Principles of Biochemistry",4th Ed
5. Weblink: nptel

BBT308	**GENERAL MICROBIOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic concepts in biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of microbes and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the source of microbes and their role in biotechnology
CO2	to get the knowledge of microbial diversity classification and morphology
CO3	to know the visualization of microbes by different microscopes
CO4	to know the cause, symptoms, diagnosis and treatment of diseases causing pathogens
CO5	to get a basic knowledge of the microbial nutrition and growth
CO6	To get knowledge about pathogens

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M			H	H	H	H		H
	CO2	H		M									
	CO3	H						H		H			H
	CO4	H		M	M			H					
	CO5	H				H	H						
	CO6	H		M	M					H			H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO MICROBIOLOGY 9

Definition-Scope and history of microbiology-prokaryotic and eukaryotic cell- different types of classification-Nomenclature-fermentation-pasteurization-role of microorganisms in pharmaceutical, food, agro and cosmetic industries-bioremedial applications-illustrations of genetically engineered strains

UNIT II GENERAL FEATURES OF MICROORGANISMS 9

Bacteria: diversity-classification-morphology-life cycle-Fungi: diversity-classification-morphology-life cycle-Algae: diversity-classification-morphology-life cycle-virus: diversity-classification-morphology-life cycle

UNIT III MICROSCOPY 9

Introduction- numerical aperture, resolving power-magnification- fixation, dyes and simple staining, differential staining- gram staining, acid-fast staining, Staining specific structures-negative staining, endospore staining, flagella staining-simple-compound-dark field-phase contrast-polarizing-fluorescent-laser optics-electron microscopy-scanning electron microscope-transmission electron microscope, specimen preparation-inverted microscope

UNIT IV MICROBIAL NUTRITION AND GROWTH 9

Common nutrient requirements-nutritional types of microorganisms, growth factors-uptake of nutrients by cells- culture media: synthetic or defined media-commonly used media-Types of media-selective-differential-enrichment media-aseptic techniques: disinfection-sterilization-cultivation of microbes: bacteria-fungi-viruses-pure culture: concept of pure culture-methods of pure culture of microorganisms–spread plate, streak plate and pour plate–microbial growth curve-factors affecting growth of microorganisms-measurement of growth

UNIT V MICROBIAL PATHOGENS AND DISEASES 9

Bacterial pathogens: *Staphylococcus aureus-Enterobacteriaceae*-Shigellosis-Fungal pathogens: superficial mycosis: Pityriasisversicolor-candidiasis-deep mycosis: Mycetoma-subcutaneous phycomycosis: Cryptococcosis-opportunistic systemic mycosis: aspergillosis, penicilliosis-mycotic poisons-Viral pathogens: Herpes, pox virus, AIDS virus, influenza virus

TEXT BOOKS

1. Michael J. Pelezar, J.R.E.C.S Chan, Noel R. Erieg, 2005, “Microbiology “ TATA McGraw Hill, 5thed
2. Anantha Narayan, C.K. JayaramPaniker, 2009, “Text Book of Microbiology” Orient Blackswan, 7thed

REFERENCE BOOKS

1. Presscott and Dunn, 2006, "Industrial Microbiology" CBS Publishers& Distributors.
2. Daniel V.Lim, "Microbiology", Kendall Hunt, 2002 ed
3. Weblink: nptel

BBT309	INSTRUMENTATION FOR BIOTECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – basic principles in instrumentation				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide a basic knowledge of the working principle of instruments and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of instruments and their different mode of applications
CO2	to know the principle, working concept and its applications
CO3	to find the various laboratory work based on instruments
CO4	to know the different types of instruments based on various parameters
CO5	to get a basic knowledge of equipments and their role in biological systems in relevant industries
CO6	To understand about working principles about instruments

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H				H					
	CO2	H	H	H	H					H		H	
	CO3	H						H					
	CO4	H						H			M		
	CO5	H						H					
	CO6	H			H			H					H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I RADIATION TECHNIQUES 9

Sources of radiation- absorptivity-Lambert Beers law, deviations, detectors, photometric accuracy, Rayleigh scattering, Fourier transform, calibration and standardization, atomisation, flame atomisation, turbidimetric and nephlometric titrations -scattering in gases.

UNIT II ELECTROCHEMICAL TECHNIQUES 9

Principles: redox potential-pH electrode-ion selective and gas sensing electrodes-Clarke oxygen electrode and its application-biosensors.

UNIT III SPECTROSCOPIC TECHNIQUES 9

Colorimetry-UV-visible spectrophotometry-ORD-CD-X-ray spectroscopy-IR spectroscopy-ESR spectroscopy-NMR spectroscopy-Mass spectroscopy

UNIT IV SEDIMENTATION TECHNIQUES 9

Centrifugation principles-centrifuges and its types-differential and density gradient centrifugation-analysis of subcellular fractions-assessment of purity and determination of relative molecular mass

UNITV RADIOISOTOPE TECHNIQUES 9

Nature of radioactivity-Detection and measurement of radioactivity-GM counter-Scintillation counting-photographic emulsions-radiotracer techniques-autoradiography

TEXT BOOK

1. Willard and Merrit, "Instrumental Methods of Analysis", VI Edition, CBS Publishers and Distributors.
2. Asokan, Practical Biochemistry, IV edition

REFERENCES

1. Ewing GW, "Instrumental Methods of Chemical Analysis", McGraw Hill Book Company, 1989.
2. Braun H., "Introduction to Chemical Analysis", McGraw Hill, 1987.
3. Keith Wilson and Walker, Practical Biochemistry, V edition, Cambridge editions.

BBT310	IMMUNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – basics of immune system				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biological defense mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of immune system

CO2	to apply the techniques for antigen and antibody reaction
CO3	to give the mechanism of immune response against antigens
CO4	to know the natural barrier against pathogens
CO5	to get a basic knowledge of the applications of immunology in transplantation
CO6	To understand about techniques in immunology

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						H		H			
	CO2	H		H				H		H			
	CO3	H		H				H		H			
	CO4	H		H	M			H		H			
	CO5			H		H	H	H	H				H
	CO6	H				H		H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I THE IMMUNE SYSTEM 9

Introduction, Immunity, antigens &their classification, complement and their biological functions, types of immune responses, anatomy of immune response.

UNIT II HUMORAL IMMUNITY 9

B-lymphocytes and their maturation, activation &differentiation, structure and function of immunoglobulin, immunoglobulin classes, antibody production, mono-clonal antibodies and diagnosis major histocompatibility complex

UNIT III CELLULLAR IMMUNOLOGY 9

T -Lymphocytes their classification, maturation, activation & differentiation, antigen presenting, cells (APC), macrophages, langerhans cells, their origin and function, mechanisms of phagocytosis, Cytokines and their role in immune response, immunosuppression, immune tolerence

UNIT IV ANTIGEN - ANTIBODY INTERACTION AND HYPERSENSITIVITY9

Principle and application: Precipitation- immuno diffusion &widal test, Agglutination reactions, radio immuno assay, ELISA, Complement fixation test, Immuno fluorescence technique, Immunoelectrophoresis-Hypersensitivity reactions

UNITV TRANSPLANTATION AND AUTO IMMUNITY 9

Graft rejection, evidence and mechanisms of graft rejection, prevention of graft rejection-immunosuppressive drugs, mechanisms of immunity to tumour antigens. Auto antibodies in humans, pathogenic mechanisms -autoimmune diseases- treatment of auto immune disorders

TEXT BOOKS:

1. Janis Kuby,2007, "Immunology" W.H. Freeman & Co. 6th ed.
2. Roitt I, 2001, "Essential Immunology". Blackwell Scientific Publications, Oxford,

REFERENCES:

1. Tizard, 1992, "Introduction to Immunology" Saunders collage publication, 3rded.
2. Abbas,2009, "Basic Immunology" W.B. Saunders Company, 2nded.

BBT3L3	BIO CHEMISTRY LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic concepts in chemistry and biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic knowledge of biochemical components and its functions and their Applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of biomolecules, their classification,structure and functions
CO2	to apply the basic concept of carbohydrates, proteins,lipids, nucleicacids and enzymes in metabolism
CO3	to know the application of biomolecules in functioning of biological system
CO4	to get a basic knowledge of macromolecules in living organism and its energetics
CO5	To know basic concepts of enzymes
CO6	To understand about compound identification

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H			H			H	H	
	CO2	H	H	H	H			H			H	H	
	CO3	H	H	H	H			H			H	H	
	CO4	H	H	H	H			H			H	H	
	CO5	H		H				H			H	H	
	CO6	H	H				M	M	M				

3	Category	Hum	Bas	Eng g	Profes	Core	Non-	Open	Proj ec t/ E
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Preparation of normal, molar and percent solutions.
2. Preparation of different buffer solution and measure pH.
3. Qualitative analysis of Unknown sugar- Monosaccharides,disaccharides and polysaccharides.
4. Estimation of sugar- Benedicts method.
5. Qualitative of unknown protein- Albumin,casein and gelatin.
6. Quantitative test for aminoacids- Ninhydrin method.
7. Quantitative test for protein – Biuret method.
8. Quantitative test for protein –Lowry method.
9. Quantitative test for protein – Bradford method
10. Spectrophotometric analysis of DNA.

BBT3L2	**INSTRUMENTAL METHODS OF ANALYSIS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic chemistry and physics				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic knowledge of the working principle of instruments and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals of instruments and their different mode of applications
CO2	to know the principle, working concept and its applications
CO3	to find the various laboratory work based on instruments
CO4	to know the different types of instruments based on various parameters
CO5	to get a basic knowledge of equipment and their role in biological systems in relevant industries
CO6	To understand about basic working principles of equipment

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H					H				M	

	CO2	H		H	L			H	L		L		H
	CO3	H	H			L		H		L		M	
	CO4	H	H				L	H				M	L
	CO5	H	H					M				H	
	CO6	H	M			M				M			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1.Working principle of colorimeter and spectrophotometer
2. Difference between the spectrophotometer and colorimeter.
3. Validating beer lamberts law using colorimeter-potassium permanganate
4. Validating beer lamberts law using colorimeter-copper sulphate
5. Validating beer lamberts law using colorimeter-potassium dichromate
6. Determination ofλ max.
7. Estimation of SO^{2-}_4 by nephlometry
8. Measurement of turbidity in water by nephlometry
9. Measurement of hydrogen ion in water samples
10. Preparation of buffer
11. Determination of moisture content
12. Precipitation of protein using ammonium sulphate.

BBT3L1	**CELL BIOLOGY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – basic cell biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge about cell biology

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of instruments and their different mode of applications
CO2	to get idea about slide preparation
CO3	to know about blood grouping
CO4	to get knowledge about mitosis
CO5	to get a basic knowledge of extraction of plant pigments
CO6	To understand about preservation technique

		Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low											
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H	H			H					
	CO2	H	H					H	M				
	CO3	H			H	H	H	H					
	CO4	H						H					
	CO5	H						H					
	CO6	H			H			H					
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term paper Seminar/ Internship (PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS

1. Study of Microscope
2. Spotters
3. Permanent Slide preparation
4. Killing and Fixing
5. Mitosis on onion root tip
6. Cryopreservation
7. Preparation of Blood smear
8. Separation of plasma and serum from blood sample
9. Total RBC and WBC Count
10. Osmosis
11. Extraction of pigments

BBT401	**BIOORGANIC CHEMISTRY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basics of biochemistry				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biochemical reactions, mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of biochemical reactions in living organism
CO2	to apply the concept of structural relationship between chemical and biochemical reactions
CO3	to create the drug formulation and its structural analogs in living systems comprehend genetics and the immune system
CO4	to know the role of metal ions in biological components and their importance in living systems

CO5	to get a basic knowledge of membrane transport and their permeability
CO6	To understand basic concepts of drug

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			H		H					
	CO2	H							H		H	H	H
	CO3	H		H	H	H	H	H				M	
	CO4	H						M					
	CO5	H						H					
	CO6	H		H						H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI INTRODUCTION TO BIOORGANIC CHEMISTRY 9

Basic considerations, Proximity effect, Molecular adaptation, Molecular recognition, supramolecular chemistry, Chemistry of living cells, Analogy between biochemical transformations and bioorganic reactions.

UNIT II BIOORGANIC CHEMISTRY OF AMINO ACIDS AND PEPTIDES 9

Chemistry of Peptide bond synthesis- Asymmetric synthesis of amino acids - different models, Transition state analogous, chemical mutations, site specific mutagenesis, Molecular recognition and drug design, Catalytic antibodies.

UNIT III ENZYME CHEMISTRY 9

Introduction to enzymes, Types of enzymes- Immobilized enzyme- Semi synthetic enzymes- Mechanism of enzyme action- Allosteric regulatory enzymes.

UNIT IVMETAL IONS IN BIOLOGICAL SYSTEMS 9

Metal ions in proteins -Role on Zinc in carboxy peptidase- Iron and oxygen transport in Haemoglobin- Metal ion act as co-enzymes & Co factors in a biological reaction & Respiratory chain

UNIT V MEMBRANE CHEMISTRY 9

Structure- Active & Passive transport- ATP driven pumps – Ligand gated channels – Voltage gated channels.

TEXT BOOK

1. Dugas. H, Bio-Organic Chemistry - A chemical approach to enzyme action, Springer Verlag,

2002, revised edition.

REFERENECE BOOKS

1. Faber. K, Biotransformations in Organic Chemistry- A text book, 4th Edition, Springer
2. Zubay .G. Bio chemistry, Max well Macmillan Publications, 2003 edition.
3. Weblink: nptel

BBT403	**INTRODUCTION TO INDUSTRIAL BIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic cell biology, genetics and biology				
	Course Designed by – Dept. of Industrial Biotechnology				

COURSE OUTCOMES (COs)	
CO1	to understand the objective and scope of biotechnology
CO2	to know the concept of cell culture techniques
CO3	to comprehend DNA and its role in functioning of a cell
CO4	to know the microbial production
CO5	to get an idea about the applications of biotechnology
CO6	To get knowledge about vaccination

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						H	H				H
	CO2	H				H		H				H	
	CO3	H	H	H				H					
	CO4	H		H				H		H		H	M
	CO5	H								H	H	M	H
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Introduction to Industrial Biotechnology - Objectives and Scope: Characteristics and comparison of bioprocessing with chemical processing – Strain improvement.

UNIT II CELL CULTURE 9

Basics of Cell Culture, Cell culture techniques in microorganisms. Preservation and improvement of industrial microorganisms

UNIT III BIOPROCESS 9

Process Technology, Development of inocula for industrial fermentation and some primary metabolites e.g. ethanol, acetone - butanol and citric acid

UNIT IV INDUTRIAL BYPRODUCTS 9

Microbial Production- Microbial production of industrial enzymes - glucose isomerase, proteases, Streptokinases Production of Vit B_{12} and secondary metabolites- penicillin, Streptomycin

UNITV APPLICATIONS OF BIOTECHNOLOGY 9

Application of Biotechnology in Human Welfare- Human health care -insulin, interferon, monoclonal antibodies etc- Development of vaccines for immunity - Bacterial and viral vaccines, Crop improvement- Disease, pest, herbicide resistance

TEXT BOOK:

S.N. Joganand, 2003, "Environmental Biotechnology"Himalaya publishing House, IV ed.

REFERENCE BOOKS:

1. Saha BC,2003, “Fermentation biotechnology” Americal Chemical Society.
2. Vyas SP,2002, “Methods in biotechnology and bioengineering” CBS Publishers & Distributors.
3. Acharya R, 1999, “The emergence and growth of biotechnology” E.Elgar.
4. Jain PC, 2004, “Microbiology and biotechnology for sustainable development” CBS Publishers & Distributors.
5. Stanbury Whittaker, 2002, "Principles of fermentation technology" - II Edn.
6. Weblink: nptel

BBT404	**PRINCIPLES OF CHEMICAL THERMODYNAMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Basic concepts in chemical engineering				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge of thermodynamics

COURSE OUTCOMES (COs)

CO1	to understand the basic concepts in thermodynamics
CO2	to know the properties of fluid
CO3	to know to get an idea about application of thermodynamics in various field
CO4	to get knowledge about reaction equilibrium
CO5	to know about applications of thermodynamics law

CO6	To understand about properties of pure liquids

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H				H	M				M
	CO2	H				L		H			H		
	CO3	H			L			H	H	H	H	H	
	CO4						L						L
	CO5	H	H		H			H					
	CO6	H				L		H	L		H		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)

4	Approval	37th Meeting of Academic Council, May 2015

UNITI BASIC CONCEPTS IN THERMODYNAMICS 12

Scope and limitations- Definitions and Fundamental concepts - Calculation of force, pressure and energy - Phase rule -Zeroth law- Heat reservoirs & Heat engine -First law- First law for non-flow process- enthalpy- First law for flow process.

UNIT II PVT BEHAVIOUR AND FIRST LAWOF THERMODYNAMICS 12

PVT behavior of pure liquids - Equations of state- Constant volume process , constant pressure process and constant temperature process- Vander Waals equation- Virial equation.

Second law- Mathematical statement of second law- Kelvin and Clausius statement- Clausius inequality

UNIT III THERMODYNAMIC PROPERTIES OF PURE LIQUIDS 12

Classification of properties- Helmholtz free energy - Gibb's free energy-Fundamental property relations- Maxwell equations - Clapeyron equation -Relationship between Cp and Cv- Fugacity and fugacity coefficient- Effect of temperature and pressure on fugacity- Activity and Activity coefficient-Effect of temperature and pressure on Activity.

UNIT IV CHEMICAL REACTION EQUILIBRIUM 12

Reaction stoichiometry -Equilibrium constant and standard free energy change - Effect of temperature on equilibrium constant- Evaluation of equilibrium constant - Effect of pressure on equilibrium - Other factors affecting equilibrium conversion.

UNITV APPLICATIONS OF THE LAWS OF THERMODNAMICS 12

Energy equation - Ejectors - Throttling process - Compressors - Adiabatic and Isothermal compression - Refrigeration - Choice of refrigerant -Absorption refrigeration- COP- Carnot cycle- Heat pumps.

TEXT BOOK

1. K.V.Narayanan, 2004, "Chemical Engineering Thermo Dynamics" Prentice Hall of India Pvt Ltd.

REFERENCCE BOOKS

1. K.A.Gavhane, 2009, "Chemical Engineering Thermodynamics" NiraliPrakasham Publications, 20th.
2. T.M.Letcher, 2004, "Chemical thermodynamics for industry" R.S.C Publication 3rd.
3. Weblink: nptel

BBT405	UNIT OPERATIONS	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engg Mathematics-I& III, Principles of Chemical Engineering				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To give a knowledge of heat and mass transfer

COURSE OUTCOMES (COs)

CO1	to understand the basic concepts in heat transfer
CO2	to know basic concepts of evaporation
CO3	to know about mass transfer operations
CO4	to know about leaching and extraction
CO5	to know about various drying
CO6	To understand about the size reduction equipment

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				H		H		L	L		L
	CO2	H	H					H					
	CO3	H	H					H		M			M
	CO4		H	H	H						H	M	
	CO5	H			H			H					
	CO6	H		H				H				M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT IHEAT TRANSFER **12**

Modes of heat transfer- Heat transfer through compound wall- Heat flow through cylinder- Definition of Boiling, condensation and its types.

UNIT IIHEAT EXCHANGERS **12**

Heat exchanger- Theory of Shell and Tube heat exchanger and double pipe heat exchanger- Derivation of Overall heat transfer coefficient - LMTD.

Evaporator- Types: falling film- Climbing film. Forced circulation and Agitated film evaporator- Methods of feeding

UNIT IIIMASS TRANSFER **12**

Outline of Mass transfer operations- Diffusion in Gases, Liquids & Solids. Distillation- Theory of Simple, Flash, Steam and Azeotropic distillation-McCabeThiele method

UNIT IVLEACHING **12**

Leaching- Theory of Moving bed leaching and Dispersed solid leaching. Liquid extraction- Mixer settler- Spray and packed extraction tower-Agitated extraction tower.

UNITVDRYING **12**

Drying- Drying equipment: Tray, Screen-conveyor, Rotary and Spray dryer-Selection of drying equipment- Time of drying.

Size reduction -Laws- Work index-Size reduction equipment: Jaw crusher. Smooth roll crusher- Tumbling mill - Fluid energy mill - Knife cutters-open and Closed circuit operation

TEXT BOOKS

1. Gavahnee, 2009,"Heat & Mass Transfer" NiraliPrakasham Publications, 20th Ed

REFERENCE BOOKS

1. K.A. Gavhane, 2009, "Unit operations II Heat & Mass Transfer" NiraliPrakashamPyblications, 23rd Ed
2. G.S. Sawhney, 2008,"Heat & Mass Transfer" I.K. International Publishing House
3. McCabe W. L & Smith J. C., "Unit operations in chemical Engineering". V.Ed..McGrawHillInt Ed.,
4. Robert e.Treybal,2000, "Mass Transfer Operations", McGraw Hill International III edition.
5. Christie J. Geankoplis,2000 " Transport Processes and Unit Operations", Prentice Hall India PvtLtd, III Edtion,
6. Weblink: nptel

BBT406	INTRODUCTION TOMOLECULAR BIOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic concepts in Biology, Microbiology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of molecular level of DNA and their applications from the

perspective of engineers	
COURSE OUTCOMES (COs)	
CO1	to understand the fundamentals of central dogma of biological systems
CO2	to know the concept of cell replication,transcription and translation
CO3	to comprehend DNA and its role in functioning of a cell
CO4	to know the functioning of regulatory factors and its application in maintaining cell activity
CO5	to get a basic knowledge of the DNA and RNA
CO6	to get a basic knowledge of the proteins

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H				H				H	H
	CO2	H			H		H						
	CO3	H	M			H		H	H		M		
	CO4	H	M									H	
	CO5	H					H			H			
	CO6	H	M			H						H	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I DNA STRUCTURE 9

DNA as the vehicle of inheritance-structure of DNA-forms of DNA-nucleic acid biosynthesis-experimental evidence: Griffith, McLeod, McCarty and Avery, Hershey–Chase experiments-Definition of gene-organization of genes and non coding DNA in prokaryotes- Eukaryotes–unique, moderately repetitive and highly repetitive DNA sequence-satellite DNA- Cot value-DNA binding proteins

UNIT II DNA REPLICATION 9

DNA replication in prokaryotes and eukaryotes- modes of replication-semi continuous and semi discontinuous replication- Okazaki fragments- RNA primers – enzymes of replication – DNA polymerases I, II, III, -DNA modifying enzymes: topoisomerases-helicases- binding proteins and ligases- replication in E.coli–replisomes-events at OriC (initiation), events on the replication fork (elongation) and termination- Fidelity of replication-Sigma or rolling circle mode of replication in Φ x 174-Inhibitors of replication.

UNIT III DNA REPAIR 9

Repair of DNA–types of damages- repair by direct reversal of damage- excision repair- recombination repair- SOS repair-Mutation: definition-type of mutations (spontaneous and induced) point mutation-Gene mutation and chromosomal aberrations- Cause of mutations- chemical and physical agent

UNIT IV TRANSCRIPTION 9

Transcription in prokaryotes and eukaryotes: RNA polymerases–enzyme structure- role of sigma factor- promoter-closed and open promoter complexes-Initiation-elongation and termination of RNA synthesis-Post transcriptional modification in prokaryotes and eukaryotes-transcription factors

UNIT V GENETIC CODE 9

Genetic code–Basic features of genetic code-Deciphering of genetic code-Wobble hypothesis-Protein biosynthesis-activation of amino acids- initiation-elongation and termination of translation in prokaryotes and eukaryotes-Post translational modifications-Inhibitors of translation.-Regulation of gene expression in prokaryotes and eukaryotes- operon concept

TEXT BOOKS

1. Biochemistry by Jeremy M. Berg, John L. Tymoczko and LubertStryer, 2006
2. Lehninger, Principles of Biochemistry, David L. Nelson and Michael M. Cox, 2008
3. James D. Watson, Tania A. Baker, Stephen P. Bell, and Alexander Gann, Molecular Biology of the Gene (6th ed), 2007

REFERENCE BOOKS

1. R.L. Adams, J.T. Knowler, and D.P. Leader, The Biochemistry of the Nucleic Acids, 1992
2. Stephen Neidle, Principles of Nucleic Acid Structure, 2007
3. Robert Weaver, Molecular Biology, 2007
4. Weblink: nptel

BCE406	**ENVIRONMENTAL STUDIES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – Physical Sciences				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To study the nature and facts about environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context

CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance, Need for public awareness.

Natural Resources : Renewable And Non – Renewable Resources

Natural resources and associated problems

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.

c) Mineral resources : Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes caused by agriculture and overgrazing , effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 8

Concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-
Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III BIODIVERSITY AND ITS CONSERVATION 7

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega-diversity nation, Hot-spots of biodiversity -Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution 7

Definition, Causes, effects and control measures of ;- Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management : floods earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8

From Unsustainable to Sustainable development, Urban problems related to energy, nuclear accident and holocaust, case studies, wasteland reclamation, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection Act, Forest Conservation Act, Issues involved in enforcement of environmental Legislation, public awareness –
Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel –oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes – Noise produced by fire crackers – Noise pollution – Noise level standards for fire crackers – Intensity of sound – Impact on hearing – Safety measures.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations, population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXTBOOKS:

1. Gilbert M.Masters, “Introduction to Environmental Engineering and Science”, Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
3. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, 1989.

4. Benny Joseph, "Environmental Studies"., TATA McGraw Hill, 2010

REFERENCES

1. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, EnviroMedia 2009
2. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
4. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno Science Publications 2013
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB),2001.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
8. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
9. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publish Co. Pvt. Ltd. 345p.
12. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut.
13. http://eng.mft.info/uploadedfiles/gfiles/c8e31c9e52d84c3.pdf

BBT4L1	Microbiology Lab	0	0	3	2
	Total Contact Hours - 45				
	Prerequisite- Microbiology, Molecular biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES-

To provide a basic understanding of microbes and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the source of microbes and their role in biotechnology
CO2	to get the knowledge of microbial diversity classification and morphology
CO3	to know the visualization of microbes by different microscopes
CO4	to know the cause, symptoms, diagnosis and treatment of diseases causing pathogens
CO5	to get a basic knowledge of the microbial nutrition and growth
CO6	To understand about various identification methods of microorganisms

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1											H	
	CO2	H						H					
	CO3	H	H										
	CO4									L			
	CO5						L						L
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Laboratory rules and regulations
2. Isolation of Bacteria Soil
3. Motility of Bacteria
4. Staining techniques
5. Streak Plate techniques
6. Antibiotic sensitivity test
7. Isolation of Fungi
8. Water analysis by MPN
9. Milk Analysis
10. Biochemical Analysis

BBT4L2	**BIOORGANIC CHEMISTRY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Biochemistry, Bioorganic chemistry				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biochemical reactions, mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of biochemical reactions in living organism
CO2	to apply the concept of structural relationship between chemical and biochemical reactions
CO3	to create the drug formulation and its structural analogs in living systemscomprehend genetics and the immune system
CO4	to know the role of metal ions in biological components and their importance in living systems
CO5	to get a basic knowledge of membrane transport and their permeability
CO6	To understand about extraction of various compounds

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H	H	H		H	H				H
	CO2		H	H			M					M	
	CO3	H		M	M	H					M		
	CO4		L	L				L	L	L			L
	CO5			H	H		M			H		M	M
	CO6	M	M	M					M		M	M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Preparation of casein from milk.
2. Separation of starch from potato.
3. Extraction of chlorophyll in plant tissue.
4. Extraction of lactose from milk.
5. Estimation of glucose from grapes.
6. Extraction of fructose from honey.
7. Extraction of lycopene from tomato.
8. Acetylation of D-glucose.
9. Preparation of methyl salicylate from aspirin.
10. Preparation of aspirin from salicylic acid.

BBT4L3	**MOLECULAR BIOLOGY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic concepts in biotechnology, microbiology and molecular biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of molecular level of DNA and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of central dogma of biological systems
CO2	to know the concept of cell replication,transcription and translation
CO3	to comprehend DNA and its role in functioning of a cell
CO4	to know the functioning of regulatory factors and its application in maintaining cell activity
CO5	to get a basic knowledge of the DNA and RNA
CO6	to get a basic knowledge of the proteins

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				H			H	M		M	
	CO2			H	M		M						L
	CO3	H				H							H
	CO4	H		M	H		H		H	M			
	CO5			H			H				H		H
	CO6	H		H		H			H			M	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term paper Seminar/ Internship (PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS

1. Extraction of plant genomic DNA.
2. Extraction of Bacterial genomic DNA
3. Extraction of Animal DNA
4. Agarose gel electrophoresis.
5. Restriction Digestion of DNA.
6. Ligation of E-CoR1 digest of λDNA
7. Isolation of plasmid DNA by alkaline lysis
8. Effect of UV radiation on bacterial survival (induced mutagenesis.
9. Transformation.
10. Poly acrylamide –SDS slab gel electrophoresis of proteins

BBT4S1	**TECHNICAL SEMINAR I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – General Biochemistry, General Microbiology, Cell Biology				
	Course Designed by– Dept. of Industrial Biotechnology				

OBJECTIVES

To enable students to create the habit of exploring new avenues of biotechnology and to improve their presentation skills

COURSE OUTCOMES (COs)

- It is a one credit course offered in the IV Semester
- Each student will be allocated topics for presentation
- There are 2 hours allocated per week for the students give their presentation. This will be considered for the award of internal marks.
- The final topic will be presented on the day of the external examination in the presence of the internal examiner. The student will be judged based on the presentation and how he or she defends the selected topic.

BMA501	**BIOSTATISTICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engg Mathematics-I &II				
	Course Designed by – Dept. of Mathematics				

OBJECTIVES

To provide a basic knowledge of probability and statistics

COURSE OUTCOMES (COs)

CO1	to understand the basic concepts various theorem in probability
CO2	to know basic concepts random variables
CO3	to know about sampling concepts
CO4	to know about design of experiments using various test.
CO5	to know about various testing methods
CO6	To know about various process for statistics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M			H	H	L	L	H
	CO2	H	M	M				H					
	CO3	H			H	H	H	H			L	L	M
	CO4	H	M			H			H		L	H	M
	CO5	H	M	M	H	H		M					
	CO6	H			H		M	M		H	M	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI RANDOM VARIABLES 12

Probability and Random Variables - Probability concepts, Baye's Theorem, Random Variables, Discrete and continuous Function of random variables- Moment generating function of binomial, Poisson, Geometric. Uniform, Exponential Distributions, Normal Distribution (Problems)

UNIT II DISTRIBUTION AND EXPECTATION 12

Two Dimensional Random Variables - Marginal and conditional Distributions, Expectation and conditional Expectations, Transformation of Two dimensional Random Variables, Central Limit Theorem (Statement and Problems)

UNIT III SAMPLING 12

Sampling Concepts - Methods of sampling. Simple random sampling, Stratified random sampling, Systematic sampling, Point and Interval estimators. Properties of Estimators, Sample size determination, testing of hypothesis, Small samples (t test). Large samples (Z test), Confidence limits

UNIT IV RANDOM PROCESSES 12

Random Processes - Classification stationary and Markov Process, Poisson Processes, Markovian chains, Markovian Quenching models, infinite and finite with single server

UNITV DESIGN OF EXPERIMENTS 12

Design of Experiment and Non Parametric Test - Completely randomised design, Randomised block design, Latin Square design- Sign Test, KolmogrovSmirovTest, Mann Whitney U test, KniskalWallisTest

Text Book

1. Kapur J. N and Saxena H. C, "Mathematical Statistics", S. Chand and Co., New Delhi

Reference Books

1. Veerarajan T, "Probability Statistics and Random Process" Tata McGrawHill, New Delhi
2. S.C. Gupta and V.K. Kapoor, "Applied Statistics", S. Chand and Sons, New Delhi
3. W. W. Daniel, "Biostatistics- A foundation for analysis of health sciences", John Wiley and Sons, New Delhi
4. P.N. Arora and S. Arora, "Statistics for Management", S. Chand and Sons, New Delhi

BBT501	**GENETIC ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Molecular biology, Cell biology, Microbiology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of recombinant mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of genetic engineering
CO2	to apply the concept of recombinant DNA IN plant, animal and microbial systems and growth in real life situations

CO3	to get the knowledge of molecular scissors and its role in creating transgenic products
CO4	Toknow the techniques related to screen the recombinant products
CO5	to get a basic knowledge of the applications of transgenes in agriculture, health care and biological products in relevant industries
CO6	to know about gene transfer methods

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	H	H	L	H
	CO2	H	M	M	H	H	M	M	H		L		
	CO3	H	M		H					H	M	L	H
	CO4	H	M			H	H	M	M		M	M	M
	CO5	H	M	M		H		M		M		L	H
	CO6	H			H	H			L				M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I BASICS OF GENETIC ENGINEERING 9

Introduction to Genetic engineering; Role of genes within cells- method of creating recombinant DNA molecules.-Role of vectors plasmid, cosmid, BAC, YAC etc.-Restriction enzymes and mapping of DNA-Role of Transposons in genetic engineering-Safety guidelines of creating recombinant DNA research.

UNIT II CONSTRUCTION OF cDNA LIBRARIES 9

Characterization of recombinant clones by Southern, Northern, Western and PCR analysis. Construction of genomic and cDNA libraries, methods of nucleic acid sequencing, factors involved in expression of cloned genes.

UNIT III APPLICATION OF rDNA TECHNOLOGY IN PLANTS 9

Method of gene transfer to plants- agrobacterium mediated / chemical mediated, Biolistics. Transgenic plants- Ri and Ti plasmids, Screening of recombinants, Biopharmaceuticals, Single cell proteins.

UNIT IV APPLICATION OF rDNA TECHNOLOGY IN ANIMALS 9

Animal cloning, Ethical aspects of animal cloning,-Transgenic animals- sheep, goat, cattle, fish etc-Methods of gene transfer to animals-embryo transfer.

UNITV APPLICATIONS OF rDNA TECHNOLOGY ININDUSTRY 9

Health care: Vaccines, hormones, antibiotics & pharmaceuticals- Industrial enzymes and agriculture.

TEXT BOOK

1. Brown TA, 2000, "Gene cloning-and introduction" VNR (U.K) Co Ltd.

REFERENCE BOOKS

1. Setlow JK,2004, "Genetic engineering: principles and methods" Springer.
2. Fridal R,2006, "Genetic engineering" Lerner publications.
3. LeVine H,2006, "Genetic engineering-A reference handbook" ABC-CLIO.
4. Levine AD,2009, "Cloning" The Rosen publishing group, 1st.
5. Weblink: nptel

BBT502	**PRINCIPLES OF BIOPROCESS TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engg Mathematics-I &II, Principles of Chemical Engineering.				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge of Biological processes.

COURSE OUTCOMES (COs)

CO1	to understand the development of bioprocess techniques.
CO2	to know about the instrumentation and control for bioprocess operations
CO3	to get idea about media formulations
CO4	to know about stoichiometry of bioprocess.
CO5	to know about various bioreactors
CO6	to know about the importance of sterilization.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H		H	H	H	H	M	L	M
	CO2	H	M	M	H							L	M
	CO3	H				H			H	L			
	CO4	H	M				M	M				L	
	CO5	H	M	M		H				M	L		
	CO6	H				H		L	M		L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO BIOPROCESSES 9

Historical development of bioprocess technology, an overview of traditional and modern applications of biotechnological processes, Biotechnology & Bioprocess engineering- outline of Unit Operations involved in Upstream and Downstream processing, generalized process flow sheets.

UNIT IIOPERATION AND CONTROL OF BIOREACTOR 9

Overview of reactor- -General requirements of fermentation processes, Basic design and construction of fermentor and ancillaries. Main parameters to be monitored and controlled in fermentation processes- solid-substrate fermentation and its applications

UNIT III GROWTH MEDIA AND STERILIZATION 9

Medium requirements for fermentation, Carbon, Nitrogen, Minerals, Vitamins, and other complex nutrients, Oxygen requirements, medium formulation - Simple and complex media- Batch and continuous heat sterilization of liquid media, filter sterilization of liquid media.

UNIT IV STOICHIOMETRY OF MICROBIAL GROWTH 9

Stoichiometry of Cell growth and product formation- elemental balances- degrees of reduction of substrate and biomass-available electron balances-yield coefficients of biomass and product formation

UNITV BIOREACTOR DESIGN 9

Reactor engineering in perspective- Cost determining factor in design- Bioreactor configuration- Practical consideration for bioreactor construction- inoculation and sampling from fermentor- materials of construction- Steps involved in fermentor design.

Text Book

1. Shuler and Kargi, 2005 "Bioprocess Engineering",Prentice Hall

Reference books

1. Bailey and Ollis, 2000, "Biochemical Engineering Fundamentals", McGraw Hill 3rded.
2. Stanbury PF,1984, “Principles of fermentation technology” SS Hall, 2nd.
3. Mansi El Mansi.2003 “Fermentation Microbiology & Biotechnology”.IVEd.
4. P.T. Kalaichelvan and I. Arul Pandi. 2007 “Bioprocess technology” MJP Pub, 1sted.

BBT503	CHEMICAL REACTION ENGINEERING	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engg Mathematics-I &II, Unit operations				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge of Reaction engineering

COURSE OUTCOMES (COs)

CO1	to understand basic concepts in homogenous reactions
CO2	to know about various order reaction
CO3	to know about the plug flow and mixed flow reactor
CO4	to know about multiple reactors
CO5	to know about design of bioreactors
CO6	to know about rate of a reaction

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	H	H	M	M
	CO2	H		M	M	H	M					M	
	CO3	H	M			H			M	M	M		H
	CO4	H			M	M	M		M			L	M
	CO5	H	M	M	M	L		L	L	L	M	M	L
	CO6	H	L	M				L					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI KINETICS OF HOMOGENEOUS REACTIONS 12

Single and multiple reaction- Elementary and Non elementary reaction-Order &Molecularity-rate constant - Kinetics models for non-elementary reaction- searching mechanism for Irreversible and Enzyme catalyzed reaction- Theories of chemical reaction.

UNIT II INTERPRETATION OF BATCH REACTOR DATA 12

Methods: Integral and Differential – Constant Volume Batch reactor – Analysis of total pressure data in constant volume system- Rate Equation: Irreversible Unimolecular I and II order and irreversible bimolecular II order – half-life period – variable volume batch reactor.

UNIT III DESIGN OF SINGLE IDEAL REACTORS 12

Constant Density & Changing Density Batch and Flow system – Design of ideal batch reactor – Space time and Space velocity – Design of MFR & PFR

UNIT IV MULTIPLE REACTION AND NON IDEAL FLOW REACTOR 12

Comparison of MFR with PFR I order & II order – Reactor in series: CSTR in series –Unequal size CSTR in series, Equal size CSTR in series – PFR in series.

UNITV BIOREACTOR 12

Biochemical reaction: Bioprocess &Bio reaction- Cell multiplication kinetics- types of bioreactors- Some industrial application of bioprocess: Aerobic and anaerobic bioprocess.

TEXT BOOK:

1. K.A.Gavhane, 2009, "Chemical Reaction Engineering I" NiraliPrakasham Publications, 19th.

REFERENCE BOOKS:

1. K.A.Gavhane, 2009, "Chemical Reaction Engineering II" 21sted.
2. Octave Levenspiel, 2006, "Chemical Reaction Engineering" Wiley-India, 3rd Edition
3. Weblink: nptel

BBT505	**PLANT BIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – General biology, Cell biology, Microbiology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge about plant tissue culture and its applications

COURSE OUTCOMES (COs)

CO1	to understand basic concepts in organization of plant genome
CO2	to know about the genetic engineering concepts involved in plant
CO3	to know about plant tissue culture
CO4	Toknow about bioremediation.
CO5	to understand the various applications of plant tissue culture
CO6	to know about gene transfer methods

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	M	L	L	H
	CO2	H	M	M	H	H	H	M	H	H	M	H	H
	CO3	H			H	H	H	M	M	M	L	L	M
	CO4	H	M	H	H	H	M	M	L	M	L	M	H
	CO5	H	M	M	H	H	M	M	M	M	H	L	M
	CO6	H			H	H		M			L	L	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PLANT MOLECULAR BIOLOGY 9

Plant genome organization – mitochondrial genome – cytoplasmic male sterility – chloroplast genome – post transcriptional modifications – transcription factors – gene silencing – regulation of gene expression – transposable elements

UNIT II PLANT GENETIC ENGINEERING 9

Plant viral vectors – Ri& Ti plasmid vectors – promoters used in plant vectors – methods of gene transfer- Agrobacterium mediated gene transfer –biolistics – latest methods of gene transfer in plants – Transposon tagging – selection of transformants/recombinants – RFLP, RAPD – plant pathogen interactions.

UNIT III PLANT TISSUE CULTURE 9

Basic terminologies – requirements of a plant tissue culture laboratory – Types of culture – selection of explants – sterilization techniques – Types of media – direct and indirect regeneration – micropropagation – haploid culture – protoplast culture – somatic hybridization and cybridization – embryo rescue – artificial seeds.

UNIT IV BIOCONTROL, BIOREMEDIATION AND BIOFERTILIZERS 9

Biochemistry and molecular biology of nitrogen fixation – transfer of nif genes – biocontrol of insect pests – genetic engineering of biocontrol agents – microbial pesticides – biofertilizers; types and applications – effluent treatment and using plant materials – phyto remediation.

UNIT V APPLICATIONS 9

Transgenic plants for insect, disease, stress & herbicide resistance – edible vaccines and antibodies – methods of crop improvement through genetic engineering - DNA finger printing – production of secondary plant metabolites through suspension cultures.

TEXT BOOKS

1. Adrian Slater, 2006, "Plant biotechnology", 3rd Ed,
2. Fr. S. Ignacimuthu, 2000 Plant biotechnology IV ed.

REFERENCE BOOKS

1. C. B. Nirmala, G. Rajalakshmi, Chandra Karthick. 2009," Plant Biotechnology"
2. Veereshem C, 2006, "Medicinal plant biotechnology" CBS Publishers & Distributors.
3. Weblink: nptel

BBT5L1	GENETIC ENGINEERING LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Molecular biology,rDNATechnology,Microbiology.				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of recombinant mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of genetic engineering
CO2	to apply the concept of recombinant DNA IN plant, animal and microbial systems and growth in real life situations
CO3	to get the knowledge of molecular scissors and its role in creating transgenic products
CO4	to know the techniques related to screen the recombinant products.
CO5	to get a basic knowledge of the applications of transgenes in agriculture, health care and biological products in relevant industries
CO6	To get knowledge about PCR

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H		H	M	H	H	L	L	M
	CO2	H	M				L		H	M	L		
	CO3	H	M	H	H	H	H	M	H	H	L		
	CO4	H			H	H	H	M	M	M		L	M
	CO5	H	M	M	H					L	L	L	
	CO6	H			H	H	H	M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Extraction of DNA
2. Agarose gel electrophoresis
3. Restriction digestion of DNA
4. Ligation of digested DNA
5. Preparation of competent cell
6. Transformation
7. Southern hybridization
8. AFLP
9. GFP cloning
10. Polymerase Chain reaction

BBT5L2	CHEMICAL ENGINEERING LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – principles of chemical engg,chemical reaction engg,mechanicaloperations, Mass&Heat Transfer				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES:To provide a knowledge about heat, mass transfer and reaction kinetics

COURSE OUTCOMES (COs)

CO1	to get knowledge about reactor kinetics
CO2	to know about drying equipment
CO3	to get idea about heat transfer
CO4	to know about mass transfer operations
CO5	to understand about mechanical operations
CO6	To know about the basic Technical analysis methods

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						H	L		H		L
	CO2			L		M				L		L	
	CO3	H	L		M		H	H			H		L
	CO4								M	L			
	CO5	H		M							H		
	CO6	H	L					H				L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Batch Reactor I
2. Batch Reactor II
3. Drying studies in Tray dryer
4. Simple Leaching
5. Adsorption
6. Heat transfer through Natural convection
7. Heat transfer through Forced convection
8. Heat transfer through composite wall
9. Sieve Shaker Analysis
10. Magnetic Separator
11. Analysis of chloride content in Cement
12. Analysis of chlorine content in Bleaching Powder

BBT5L3	PLANT AND ANIMAL BIOTECHNOLOGY LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Plant biotechnology, Animal biotechnology, Genetic engineering				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide a basic understanding of plant and animal cell culture techniques

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of plant biotechnology
CO2	to know about sterilization techniques
CO3	to know about plant tissue culture
CO4	to know about animal cell culture
CO5	to get a basic knowledge of the applications using plant biotechnology
CO6	to get a basic knowledge of the applications using animal biotechnology

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M	H	H	L	M			
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H	M	H	L	M	L		M
	CO4	H	M		H	H		M			L	L	
	CO5	H	M	M	H	H	H	H		M	L	L	M
	CO6	H			H	H		M	M			L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Sterilization techniques.
2. Plant tissue culture techniques.
3. Preparation of culture medium
4. Callus induction in *Daucuscarota.*
5. Nodal bud culture.
6. Micropropagation of rose.
7. Rooting and hardening of regenerated shoots.
8. Isolation and purification of protoplast from *Aloe vera*leaf mesophyll cells.
9. Determination of protoplast viability using Evan's blue staining.
10. Protoplast fusion using PEG.
11. Preparation of synthetic seeds.
12. Isolation of Rhizobium from ground nut nodules.
13. Preparation of Rhizobialbiofertilizer.

14. Aseptic techniques for animal cell culture.
15. Establishment of a primary culture.
16. Resuscitation of frozen cell lines.
17. Subculture of adherent cell lines.

BBT602	ANIMAL BIOTECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Molecular biology, Genetic engineering, Microbiology, Immunology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biological mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of animal cells and culture
CO2	to apply the techniques for animal cell culture and its types
CO3	to comprehend genetics system
CO4	to know the large scale of cell cultures in a bioreactor
CO5	To know about the immune system
CO6	to get a basic knowledge of the applications of animal cell in biological systems and in relevant industries

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		H			L	L	
	CO2	H	M	M	H	H		M		M	L		M
	CO3	H			H	H	M	H	H			L	M
	CO4	H	M		H			M			L		
	CO5	H	M	M	H	H		M	M	M	L		M
	CO6	H			H	H		M				L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION **9**

History of animal cell and organ culture-requirements for animal cell and organ culture-characteristics of animal growth in culture-substrates for cell culture and its treatment-culture media-natural and synthetic media- sterilization of glassware, equipment and culture media.

UNIT II ANIMAL CELL CULTURE 9

Equipment required for animal cell culture-isolation of animal material- disaggregation of tissue by physical and enzymatic methods- establishment of cell culture-evolution of cell lines-primary and secondary cell culture-types of cell lines-factors affecting subculture in vitro.

UNIT III SUSPENSION CULTURE 9

Cultivation of animal cells in bioreactor-Suspension cultures-methods of scaling up of cell culture-roller bottle-spinner culture-immobilized cell culture-insect cell culture-somatic and organ cell culture- organ culture on plasma clots, agar and liquid medium-whole embryo culture-production of commercially valuable products obtained from animal and insect cell culture-hybridoma technology.

UNIT IV MANIPULATION OF REPRODUCTION 9

Manipulation of reproduction in animals-artificial insemination-semen collection and storage-ovulation control-embryo transfer-multiple ovulation and embryo transfer-embryo splitting and sexing-in vitro fertilization-nuclear transplantation-problems related to test tube babies-infertility in humans.

UNIT V TRANGENICS 9

Techniques of gene transfer in animals-transgenic animals- transgenic sheep and fish-knockout mice-animal bioreactor and molecular farming-diagnosis, elimination and breeding strategies of genetic diseases-PCR based markers-xenotransplantation-mapping of human genome-bioethics in animal genetic engineering.

TEXT BOOK

1. R.C. Dubey, 2005, "A textbook of Biotechnology", 3rd ed.

REFERENCE BOOK

1. Stewart Sell, 2004, "Stem Cells Hand Book" Humana Press.
2. John R.W. Masters, 2000, "Animal Cell culture a practical approach" Oxford University Press, 3rd ed.
3. YoshitoIkada, 2006, "Tissue engineering fundamentals and applications" Academic Press, 3rd ed.
4. John P. Fisher et al, 2007, "Tissue engineering" CRC Press.
5. Nigel Jenkins,2007, "Animal Cell Biotechnology" Hamana press, 2nd ed.
6. P. Ramadass. 2008 "Animal Biotechnology", MJP Pub.
7. Weblink: nptel

BBT605	ENZYME ENGINEERING AND TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biochemistry, Unit operation, Chemical reaction engg.				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES To provide a knowledge about enzymes and its kinetics	
COURSE OUTCOMES (COs)	
CO1	to understand the applications of enzymes in various fields
CO2	to know about enzyme inhibition
CO3	to know about kinetics of enzyme
CO4	to know about immobilization and its applications
CO5	to get knowledge about transport in cell
CO6	to get ideas about various bioreactors and its uses

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	L	M	L	L	M
	CO2	H	M	M	H	H						L	M
	CO3	H	M		H	H		M	H	H	L		
	CO4	H	L		H			M			L	L	M
	CO5	H	M	M	H	H					L		M
	CO6	H			H	H	L	M	M	L		L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)

4	Approval	37th Meeting of Academic Council, May 2015

UNITI INTRODUCTION AND INDUSTRIAL APPLICATIONS 9

Definition and scope of biochemical processes - application of biochemical process in Pharma, food and other industries - comparison of chemical and biochemical processes - development and scope of biochemical engineering.

UNITII ENZYME KINETICS 9

Nature and function of Enzymes - Co - Enzymes and cofactor - classification of Enzyme - Practical application of Enzyme in biochemical processes of industrial importance - mechanism of enzymatic reaction –Michaelis-Menten Kinetics - Enzyme inhibition – kinetics of competitive and non-competitive inhibition-factors affecting the reaction rates - Immobilization Of Enzymes - Characteristics and applications.

UNIT-III MICROBIAL KINECTICS AND IMMOBILIZATION 9

Typical growth characteristics of microbial cells: Phase of growth curve, factors affecting growth- Monod Model - Immobilization of cells and characteristics - applications.

UNIT-IV TRANSPORT IN MICROBIAL SYSTEMS 9

Transport mechanism- gas liquid mass transfer in cellular system- design parameters affecting O_2 transfer- Measurement of K_La- factors affecting K_La- - Correlation of mass transfer co-efficient- Agitation and Aeration in fermentor- heat transfer- Power consumption using π theorem- sterilization: batch & Continuous.

UNIT-V BIOREACTORS 9

Classification- Stirred tank reactor, Bubble column- Air lift rector- Packed bed- fluidized bed- Trickle bed reactor- Industrially important reactor: Photo bio reactor, membrane bio reactor. Comparison of industrially important bioreactor

TEXT BOOKS

1. Manjula, 2006, "Bio and Enzyme Engineering", III Ed.

REFERENCE BOOK

1. J.B.Bailey and D.F. Ollis, 2005, "Biochemical Engineering Fundamentals" McGraw Hill, New York.
2. Dr.Mansi El Mans, 2006 "Fermentation microbiology and biotechnology" IV Ed,
3. Weblink: nptel

BBT607	**ENVIRONMENTAL BIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biochemistry, Microbiology, Environmental Studies				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide basic knowledge about environmental issues related to bioprocess and its remedial measures

COURSE OUTCOMES (COs)

CO1	to understand the microbiological concepts in air
CO2	to know about various bioremediation techniques
CO3	to know about biosafety
CO4	to know about microbiology of water
CO5	to get idea about microbiology of soil
CO6	to know about IPR

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M	H	H		L	L	L	M
	CO2	H	M	M	H	H	H	M	H				M
	CO3	H	M		H		H	H			L	L	
	CO4	H	M		H	H	H	M			L		M
	CO5	H	M	M	H	H	H	M	M	M	L	L	
	CO6	H			H	H	H	M				L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I MICROBIOLOGY OF AIR AND WATER 9

Microbial Contamination of air-Enumeration of bacteria in air-Air Sampling devices-Air Sanitation and purification methods-Determination of Water quality-Bacteriological examination of water-indicator organisms-Water borne pathogens

UNIT II MICROBIOLOGY OF SOIL 9

Microbial flora of soil, Growth, Ecological adaptation, Interaction among soil microorganisms-Microorganisms involved in nitrogen fixation, Positive and negative role of microbes.

UNIT III DETOXIFICATION 9

Detoxification of Hazardous chemicals-Biocatalyst for pesticide Detoxification- Bioremediation: Bioremediation of Persistent chemicals-Improving catabolic processes, Biosorption of Heavy metals-Bioremediation of oil spills, Bio deterioration of paper, Textile, sugar distilleries, diary industries.

UNIT IV BIOWASTE UTILIZATION 9

Biotechnology for biowaste conversion in to bioresources-Single cell protein, Mushroom, Algal growth for fisheries, and Aqua culture- Industrial waste recycling -Waste fueled furnaces.

UNIT V BIOSAFETY AND IPR 9

Intellectual Property, Rights in bioremediation, Biosafety-Microbiology. Medical Laboratory-Medical waste- Bioharzardous waste-Sharps-Pathological waste-Rules and Regulations-Biosafety protocol

TEXT BOOK

1. Bruce. E.Rittaman and Perry. L. Mc Carty, 2004, "Environmental Biotechnology-Principles and applications" McGraw Hill.
2. N. Ahmed, F.M. Quershi and D. Y.Khan, 2001, "Industrial Environmental Biotechnology" Horizon press.

REFERENCE BOOKS

1. W.D. Grand, P.E. Long Blakies, "Environmental Microbiology", Glasgow London.
2. T. Meenambal, 2009, "Environmental Science and Engineering".
3. Weblink: nptel

BSS601	VALUE EDUCATION AND PROFESSIONAL ETHICS	L	T	P	C

	Total Contact Hours - 45	3	0	0	3
	Prerequisite – English & Professional Courses				
	Course Designed by – Dept. of Management Studies				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
- To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)

CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing
CO4	To learn more of Engineer as Responsible Experimenter.
CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To learn more of Responsibilities and Rights as Professional and facing Global Challenges

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe- Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.

UNIT III MIND CULTURE & TENDING PERSONAL HEALTH 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelizing the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV: ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS'SRESPONSIBILITIES FOR SAFETY 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Challenger, case study-Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies

UNIT V: ENGINEERS'S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership

TEXT BOOKS

1. Value Education for Health, Happiness and Harmony, the World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata Mcgraw Hill, Newyork 2005 (Units IV & V)

REFERENCE

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004 (Units IV-V)

BBT6L1	BIOPROCESS ENGINEERING LAB 1	L	T	P	C
	Total Contact Hours - 45	0	0	3	2

	Prerequisite – Bioprocess Engg., Unit Operation
	Course Designed by – Dept. of Industrial Biotechnology

OBJECTIVES: To provide basic knowledge about bioprocessing

COURSE OUTCOMES (COs)

CO1	to get knowledge on biomass
CO2	to know about enzyme kinetics
CO3	to understand about immobilization of enzyme
CO4	to get idea about mass transfer
CO5	to know about death kinetics
CO6	to know about product optimization

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H	H	M		M		H	L		M
	CO2	H	M	M	H	H			M			L	
	CO3	H	M	M	H			M			L	L	M
	CO4	H	M	H	H	H			H	M		L	M
	CO5	H	M	M		H	L	M			L	L	
	CO6	H		H	H	H		M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS

1. Culturing of different types of microorganism
2. Estimation of biomass production.
3. Enzyme kinetics.
4. Effect of temperature on enzyme activity.
5. Effect of pH on enzyme activity.
6. Effect of substrate concentration on growth of *E.coli.*
7. Immobilization of enzyme.
8. Estimation of k_La by sulphite oxidation method.
9. Thermal death kinetics of yeast.
10. Thermal death kinetics of bacteria.

BBT6L2	ENVIRONMENTAL BIOTECHNOLOGY LAB	L	T	P	C

	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Biochemistry, Microbiology, Environmental Biotechnology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide knowledge about environmental science and technology

COURSE OUTCOMES (COs)

CO1	to know about analysis of water
CO2	to understand about microbial examination of effluent
CO3	to get basic idea about adsorption of dye
CO4	to know about microbial remediation
CO5	to get basic idea about bioremediation
CO6	to know about analysis of soil

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M	M		M	H		L	
	CO2	H	M	M	H	H		M			L	L	
	CO3	H	M		H		M	M					M
	CO4	H	M		H	H			L	M		L	M
	CO5	H	M	M	H	H	M	M			L		M
	CO6	H			H	H				L	L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Estimation of pH
2. Analysis of Alkalinity
3. Estimation of Hardness
4. Analysis of Chloride
5. Analysis of Total Dissolved Solids
6. Estimation of Fluoride
7. Analysis of Iron
8. Analysis of Nitrite
9. Analysis of Nitrate
10. Analysis of Phosphate
11. Analysis of Residual Chlorine
12. Microbiological Examination using Leather Effluents
13. Adsorption of Dye using Charcoal
14. Microbial Degradation of Dye
15. Reduction of Sulphate by biological method
16. Bioremediation of Hexavalent chromium reduction

BBT6L3	IMMUNOTECHNOLOGY LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Immunology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biological defense mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of immune system
CO2	to apply the techniques for antigen and antibody reaction
CO3	to give the mechanism of immune response against antigens
CO4	to know the natural barrier against pathogens
CO5	to get a basic knowledge of the applications of immunology in transplantation
CO6	to know about immune electrophoretic techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	M	M		L
	CO2	H	M	M		H		H				L	
	CO3	H			H			H	M	H			M
	CO4	H	M					M				L	
	CO5	H	M	M	H	H	H	H	L		L		M
	CO6	H			H	H		M		H	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg [illegible] (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. SDS- Slab gel electrophoresis of immunoglobulins
2. Western blotting
3. Immunoelectrophoresis
4. Countercurrent Electrophoresis
5. Rocket Immunoelectrophoresis
6. Single radial immunodiffusion
7. Double immunodiffusion
8. Dot- ELISA
9. DEAE cellulose chromatography for IgG.
10. Affinity chromatography for antiserum purification.

BBT6P1	MINI PROJECT	L	T	P	C
	Total Contact Hours -60	0	0	4	2
	Prerequisite – Biochemistry, Microbiology, Bioprocess, Plant and Animal Biotechnology				
	Course Designed by– Dept. of Industrial Biotechnology				

OBJECTIVES: To enable students to do independent research

COURSE OUTCOMES (COs)

- It is a two credit course offered in the VI Semester
- Each student will be allocated a guide and a research topic at the end of the V semester. This will help them to collect sufficient literature during their vacation. A guide will have a maximum of four students
- There are 4 hours allocated per week for the students to do research. This will be considered for the award of internal marks.
- There will be three reviews to assess the progress of their research
- The final review will be on the day of the external examination in the presence of the an external and internal examiner. The student will be judged based on the presentation and how he or she defends the selected topic.

BBT701	RESEARCH METHODOLOGY AND INSTRUMENTATION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biochemistry, Instrumental method of analysis, Downstream processing				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide basic knowledge about various instrumentation techniques and data documentation

COURSE OUTCOMES (COs)

CO1	to understand the biochemical analysis
CO2	to know about spectroscopic and microscopic techniques
CO3	to know about the separation techniques
CO4	to get ideas about ethical issues related to research
CO5	to know about data documentation
CO6	To prepare research articles

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		H	H	H	M	M	M
	CO2	H	M	M	H	H		H			L	L	
	CO3	H	M	H	H	H		M	H		M		M
	CO4	H	M	H	H	H	H	H		M		M	H

	CO5	H	M	M	H	H		M	H		L	L	M
	CO6	H	H	H	H	H		H		M	L		
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term paper Seminar/ Internship (PR)	
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I BASIC PRINCIPLES FOR BIOCHEMICAL ANALYSIS 9

Introduction – preparation of organ and tissue samples for analysis – cell disruption methods – physiological solutions: buffers and growth media for plants, animals and microbes – Medium standardization - cell sorting, isolation and enumeration techniques – cryopreservation – elucidating metabolic pathways by tracer studies.

UNIT II SPECTROSCOPIC AND MICROSCOPY TECHNIQUES 9

Introduction – UV – visible spectroscopy – NMR spectroscopy – IR and Raman spectroscopy – atomic spectroscopy - Introduction to microscopy – Election microscopy –ultramicrotome- phase contrast microscopy – Fluorescent and confocal microscopy.

UNIT III SEPARATION TECHNIQUES 9

Introduction to chromatography and electrophoresis – gel filtration – ion exchange – affinity – GC – HPLC - partition chromatography – electrophoresis of proteins and nucleic acids – immune precipitation techniques – ELISA.

UNIT IV ETHICAL ISSUES IN BIOTECHNOLOGY 9

Legal and socio economic impacts of biotech research – bio safety regulation – r-DNA guidelines- issues involved in experimenting with animals – Experimental protocol approvals – contaminant levels and environmental effects- impact of GM organisms and GM foods – IPR and patents.

UNIT V DATA ANALYSIS AND DOCUMENTATION 9

Sampling concepts for statistical analysis – Mean, median, standard deviation, standard error – ANNOVA – Guidelines for thesis writing: literature collection methods – writing of abstract, introduction and review of literature – results, discussion and summary – guidelines to publish articles in journals.

TEXT BOOKS

1. Keith Wilson and John Walker,2004, Practical biochemistry, Principles and techniques – Cambridge publication
2. N. Gurumani, 2006, Research methodology for biological sciences, MJP publishers.

REFERENCE BOOKS

1. P. Ramadass, 2009, Research and writing: Across the disciplines, MJP publishers.

BBT703	DOWNSTREAM PROCESSING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Unit Operation, Bioprocess engineering				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide basic knowledge about various separation techniques in bioprocesses

COURSE OUTCOMES (COs)

CO1	to understand the unit operations involved in downstream
CO2	to know about various separation processes
CO3	to know about the product recovery and purification techniques
CO4	to get basic idea about fractionation
CO5	to know about product polishing technique
CO6	to know the various industrial product purification

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M				L	M
	CO2	H	M	M	H	H			H	M	L	L	
	CO3	H	M		H	H		H				L	M
	CO4	H	M		H			M	L		L	L	M
	CO5	H	M	M	H	H		H		M	L	L	
	CO6	H			H	H	L	M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ROLE OF DOWNSTREAM PROCESSING IN BIOTECHNOLOGY 9

Role and Importance of downstream processing in biotechnological processes- Problems and requirements of bioproduct purification-Economics of downstream processing in Biotechnology, cost - cutting strategies, characteristics of biological mixtures, process design criteria for various classes of bioproducts (high volume, low value products and lowvolume, high value products), physico- chemical basis of bioseparation processes

UNIT II PRIMARY SEPARATION AND RECOVERY PROCESSES 9

Cell distribution methods for intracellular products, removal of insolubles, biomass (and particulate debris) separation techniques, flocculation and sedimentation, centrifugation and filtration methods

UNIT III ENRICHMENT OPERATIONS 9

Membrane separations (micro and ultrafiltration theory, and configuration of membrane separation equipment) applications, precipitation methods - extractive separations, aqueous two phase extraction, supercritical extraction- *insitu* product removal, integrated bioprocessing.

UNIT IV PRODUCT RESOLUTION/FRACTIONATION 9

Adsorptive chromatographic separation processes, electrophoretic techniques.

UNIT V PRODUCT POLISHING 9

Gel Permeation Chromatography, dialysis, Crystallization

TEXT BOOK

1. SivaShankar , 2004, "BioSeparation" III Ed,

REFERENCES

1. Wankat P.C, 2003, "Rare Controlled Separations", Elsevier,.
2. Better PA and Cussier E, 2002,"Bioseparations", Volley,
3. Weblink: nptel

BBT705	**BIOPROCESS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Chemical reaction engg., Unit operation, Animal biotechnology, Plant biotechnology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES:

To provide a knowledge about various bioprocesses and the designing of reactor

COURSE OUTCOMES (COs)

CO1	to know basic concepts in bioprocess engineering
CO2	to know different types of plant and animal cell bioreactors
CO3	to understand basic concepts in transport phenomena in bioprocessing
CO4	to get knowledge about bioreactor design
CO5	to know about modern biotechnological processes
CO6	to know about modeling and simulation of bioprocess technology

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		H	H		L	L	
	CO2	H	M	M	H	H		M		M	L	L	
	CO3	H	M		H	H		M				L	M

	CO4	H	M		H		L				M	L	M
	CO5	H	M	M	H	H		M	M		L		
	CO6	H			H	H	M	M		L	L	L	M
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)				
					√								
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I DESIGN AND ANALYSIS OF BIOPROCESSES 9

On-line data analysis for measurement of important physico-chemical and biochemical parameters; Methods of on-line and off-line biomass estimation; microbial calorimetre; Flow injection analysis for measurement of substrates- Product and other metabolites: State and parameter estimation techniques for biochemical processes-Biosensor

UNIT II RANSPORT PHENOMENA IN BIOPROCESS SYSTEM 9

Role of diffusion in bioprocess- Film theory- Oxygen uptake in cell culture, factors affecting cellular Oxygen demand, Oxygen transfer from gas bubble to cell, Measuring DO concentration, measurement of KLa .

UNIT III BIOREACTOR 9

Basic design consideration for a bioreactor- Batch Bioreactor- Fluidized bed reactor- Air lift bioreactor- Trickle bed bioreactor- Hollow fibre reactor- and wave bioreactor (Disposable bioreactor)

UNIT IV MODERN BIOTECHNOLOGICAL PROCESSES 9

Recombinant cell culture processes, guidelines for choosing host-vector systems, plasmid stability in recombinant cell culture, limits to over expression, Modelling of recombinant bacterial cultures; Bioreactor strategies for maximizing product formation; Bioprocess design considerations for plant and animal cell cultures.

UNITV MODELLING AND SIMULATION OF BIOPROCESSES 9

Study of Structured models for analysis of various bioprocess; Computer based data acquisition, Monitoring and control- Lab view software, MATLAB-SIMULINK

TEXT BOOK

1. Shuler and Kargi, 2004, "Bioprocess Engineering Fundamentals", McGraw Hill 2nd Ed.

REFERENCES

1. Sameer A. Zodgkar,2008, “Bioprocess” ICFAI University Press, 1st.
2. P.T. Kalaichelvan and I. Arul Pandi. 2007 “Bioprocess technology”. MJP Pub.
3. FunshangYabgJuming Tang, 2002, “Advances in Bioprocess Engineering” World scientific publishing company 2nd.

4. Syed Tanveer Ahmed Inamdar, 2007, "Biochemical Engg principles & concepts" Prentice Hall of India,2nd Edition.
5. Weblink: nptel

BBT7L1	BIOPROCESS ENGINEERING LAB II	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Microbiology, Bioprocess Engineering, Biochemistry				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide knowledge about production of bioproducts

COURSE OUTCOMES (COs)

CO1	to know about media formulation
CO2	to know about media sterilization
CO3	to understand about Solid State Fermentation
CO4	to get basic idea about production of natural wine and biofuel
CO5	to get basic idea about production of soap
CO6	to get basic idea about production of fertilizer

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M		M				M		L	M
	CO2	H	M	M	H	H		M			L	L	
	CO3	H	M		H			M	M	L		L	M
	CO4	H	M			H	M				L		M
	CO5	H	M	M	H	H		M		L	L	L	
	CO6	H			H	H	M	M	L		L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Plate assay
2. Media optimization by Plackett-Burmann method
3. Solid state fermentation.
4. Production of wine
5. Estimation of alcohol concentration in wine.
6. Estimation of acid concentration in wine.
7. Production of soap and analyze its properties.

8. Production of biodiesel and analyze its properties.
9. Activity of Various Natural Substances on the Growth of *Malassezia furfur*
10. Production of biofertilizer.

BBT7L2	**DOWNSTREAM PROCESSING LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Downstream Processing, Microbiology, Unit Operation				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide knowledge about purification of bioproducts

COURSE OUTCOMES (COs)

CO1	to know about precipitation technique
CO2	to understand about flocculation and settling
CO3	to get basic idea about chromatographic techniques
CO4	to get basic idea cell disruption
CO5	to know about extraction
CO6	to know about crystallization

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M					H			L	M
	CO2	H	M	M	H	H		M		M	L		
	CO3	H	M		H	H		M			L		M
	CO4	H	M						M	L	L	L	
	CO5	H	M	M	H	H		M			L		M
	CO6	H			H	H		M				L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Isoelectric precipitation
2. Settling characteristics
3. Flocculation (Jar Test)
4. Solids Recovery by Centrifugation
5. Paper chromatography
6. Thin Layer Chromatography
7. Ion –Exchange Chromatography
8. Affinity Chromatography
9. Gel Filtration

10. Desalting of Protein Sample by Gelfiltration
11. Sonication
12. Crystallization
13. Aqueous Two Phase Extraction Of Proteins
14. Enzyme Purification by Salt precipitation Method.

BBT7P1	TERM PAPER	L	T	P	C
	Total Contact Hours -60	**0**	**0**	**4**	**2**
	Prerequisite – Biochemistry, Microbiology, Bioprocess, Plant and Animal Biotechnology				
	Course Designed by– Dept. of Industrial Biotechnology				

OBJECTIVES

To enable students to do independent research

COURSE OUTCOMES (COs)

- It is a two credit course offered in the VII Semester
- Each student should register for the course
- Each student will be allocated a guide and a research topic at the end of the VI semester. This will help them to collect sufficient literature during their vacation. A guide will have a maximum of four students
- There are 4 hours allocated per week for the students to do research. This will be considered for the award of internal marks.
- There will be three reviews to assess the progress of their research
- The final review will be on the day of the external examination in the presence of an external and internal examiner. The student will be judged based on the presentation and how he or she defends the selected topic. The student also should publish a paper in a journal or in a conference proceeding

BBT8P1	PROJECT WORK	L	T	P	C
	Total Contact Hours -18 per week	0	0	18	9
	Prerequisite – Biochemistry, Microbiology, Bioprocess, Plant and Animal Biotechnology, Downstream process				
	Course Designed by– Dept. of Industrial Biotechnology				

OBJECTIVES: To enable students to do independent research

COURSE OUTCOMES (COs)

- It is a nine credit course offered in the VIII Semester
- Each student will be allocated a guide and a research topic at the end of the VII semester. This will help them to collect sufficient literature during their vacation. A guide will have a maximum of four students
- There are 18 hours allocated per week for the students to do research. This will be considered for the award of internal marks.
- There will be three reviews to assess the progress of their research
- The final review will be on the day of the external examination in the presence of an external and internal examiner. The student will be judged based on the presentation and how he or she defends the selected topic.

BBTE01	FOOD PROCESS TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioprocess technology, Heat and mass transfer				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide basic technologies involved in food processing

COURSE OUTCOMES (COs)

CO1	To know about preservation techniques
CO2	to understand basic concepts in sterilization of food products
CO3	to know about various dryers
CO4	to know about the mixing equipment for various products
CO5	to know about various preservation techniques for food products
CO6	to understand the microbiological aspects in food process

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		L	L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M	L	M	L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M	M	H	L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PHYSICAL TREATMETN OF FOOD 9

Thermal, electrical and rheological properties- Heat processing- Methods of applying heat to food - sterilization - Thermo bacteriology- dehydration and drying - free moisture - equilibrium moisture content- water activity- classification of dryers- tray, and freeze dryers, osmotic dehydration - foam mat drying- extrusion coking.

UNIT II BLENDING METHODS 9

Mixing of solids, Pastes and liquids - Characteristics of mixtures-Blending -emulsification- equipments - liquid, pastes, and plastic masses - dry powders - criteria of mixer effectiveness- mixing index

UNIT III PRESERVATION OF FOOD 9

Concentration - freeze concentration - freezing and storage of frozen products - low temperature preservation - irradiation of food products - microwave heating - dielectric heating of foods.

UNIT IV DAIRY FOODS 9

Physics and chemical properties of milk and their effect on design - heaters - coolers -heat exchange equipments - storage tanks - can washers - pasteurization - principles and methods - equipments - LTLT - HTST - UHT pasteurization - CIP unit -Homogenization - Theory and working of homogenizers - bottle fillers and cappers -cream separation - principles - types of separator - classifiers - butter churns - cheese plant equipments - ice cream freezers - drying equipments - drum drier and spray drier -membrane concentration equipments.

UNIT V FOOD MICROBIOLOGY 9

Food microbiology: food spoilage, food borne diseases, infections, intoxifications, utilization of microorganisms in food industries, Nutraceuticals. Quality control, Case studies on biotechnology in the evaluation of food quality.

TEXT BOOKS

1. Lehninger and Beverlov, 2002, "Food Process Engineering". Reidal Publishing Co. Holland
2. Yin H.Hui, 2006, "Handbook of food science, technology and engineering" Wiley, New York, 2nd ed

REFERENCE BOOKS

1. Tucker & Woods, 1995, "Enzymes in food processing" Springer, 5th ed.
2. Hamm &Hammilton, 2000, "Edible oil processing" Academic Press 5th ed
3. Fellows, 2009, "Food processing technology" 21th ed
4. Heldman, 2007,"Hand book of food engineering" CRC Press 2nd ed
5. P.G. Smith, 2003, "Food Process Engineering" Academic Plenum Pub, New York 1st ed
6. Srilakshmi,2005, "Food Science" MJP Publiashers, 3rd ed
7. Weblink: nptel

BBTE02	CANCER BIOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Molecular biology, Genetic engineering				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biological mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of cancer cells and its constituents
CO2	to find the environmental factors related to cancer
CO3	to know the concept of carcinogenesis and carcinogenic agents
CO4	to know the cause, symptoms, diagnosis and treatment of cancer
CO5	to give a basic knowledge of the different types of cancer
CO6	To understand about basics of cancer therapy

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	H	M	M	H	M		M		H	L	L	M
	CO2	H	M	M	H	H		M	H				L
	CO3	H	M		H	H		M	M	M	L	L	
	CO4	H	M		H	H	L	M				L	H
	CO5	H	M	M	H	H		M	L	L	L		
	CO6	H			H	H	L	M				L	
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)				
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION 9

Fundamentals of Cancer Biology- Cell Cycle- regulation of cell cycle, modulation in cell cycle in cancer, Changes in signaling molecules- Effects on receptors, signal switches, Classification of stages of cancer- metasis, Metastatic cascade, common features of cancer cells, Tumor suppressor genes, Cancer genetics.

UNIT II CARCINOGENESIS 9

Principles of Carcinogenesis- Carcinogens- Targets of carcinogens, Chemical carcinogenesis, Physical carcinogenesis- X-ray radiation and radiation carcinogenesis, Viruses and Cancer, Diet and cancer

UNIT III MOLECULAR BIOLOGY OF CANCER 9

Molecular biology of cancer- Oncogenes, Identification of oncogenes, Retroviruses and oncogenes, growth factors and Growth factor receptors as oncogenes.

UNIT IV TYPES OF CANCER 9

Different sites and forms of cancer, Lung, Liver, Breast, Cervical, Blood, Prostrate, Ovarian cancers- Epidemology, causes, mutations, and features

UNIT V CANCER THERAPY 9

Cancer therapy- Cancer Immunology, Different forms of cancer therapy- Chemotherapy, radiation, Detection of cancers, advances in cancer detection and therapy, Gene therapy.

TEXT BOOKS:

1. Lewis J.Kleismith,2006, "Principles of Cancer Biology" Pearson Benjamin Cummings.
2. Raymond W. Ruddon,2007, "Cancer Biology" Oxford University Press, 4th.

REFERENCE BOOKS:

1. G.M. Cooper,2008, "Oncogenes" Jones &barlett Publisher, 1st.
2. 'Molecular Cell Biology' Darnell, Lodish& Baltimore, IV Ed,2004
3. An Introduction to cellular and Molecular Oncology- Oxford University Press, 2003
4. Genes VII and VIII – Benjamin Lewin, 2004
5. Weblink: nptel

BBTE03	BIOREACTOR DESIGN	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Fermentation Techniques, Chemical reaction engineering, Bioprocess engineering				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide knowledge about the designing of reactor

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals transport phenomena
CO2	To know about various types of reactors
CO3	To know about instrumentation and control of reactors
CO4	To learn the process of modulation and simulation of fermentation process
CO5	To understand plant and animal cell reactors
CO6	To get the knowledge of bioreactors and its Industrial

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		M	L	L	
	CO2	H	M	M	H	H		M	H				M
	CO3	H	M			H					L	L	
	CO4	H	M		H	H		M	H		L		M
	CO5	H	M	M	H	H		M		H	L	L	M
	CO6	H			H	H	L	M				L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BIOREACTOR DESIGN 9

Batch reactors; Continuous Stirred Tank Bioreactors (Chemostat); Enzyme Catalysis in Chemostat; Age Distribution Models; Fed Batch Reactors; Recycle Systems, Design of airlift bioreactors

UNIT II TRANSPORT PHENOMENA & GROWTH MODELS 9

Rheology; Gas-Liquid Mass Transfer- Measurement of transfer coefficients; Design of bubble columns; Three-phase flow, mixing, oxygen transfer: isobaric method, non-isobaric model, oxygen transfer in a three-phase flow-Phases of batch growth cycle; Monod Model; Models of Product Formation and Inhibition; Introduction to structured models

UNIT III BIOREACTOR INSTRUMENTATION AND CONTROL 9

Introduction, bioreactor sensor characteristics, temperature measurement and control, principles of dissolved oxygen measurement and control, principles of pH/redox measurement and control, detection and prevention of foam, determination of biomass, ion specific electrodes, biosensors.

UNIT IV FERMENTATION CONTROL 9

Introduction to control: control loop, analogue and digital control, control algorithm-PID control, time-proportional control. Physical control of fermentation

MODELING AND SIMULATION OF FERMENTATION PROCESSES

Modeling, digital simulation, digital simulation programming languages, ISIM(interactive simulation language)

UNIT V PLANT AND ANIMAL CELL BIOREACTORS 9

Introduction, plant cells: plant cell bioreactors, characteristics of plant cell suspensions, plant cell bioreactor requirements, plant cell bioreactor design, plant cell bioreactor operation, alternative cultures for plant cells. Animal cells: Animal cell bioreactors, animal cell bioreactor operation, animal cell bioreactor design

TEXT BOOKS

1. Scragg A.H.,2002, "Bioreactors in Biotechnology", Edited by, Ellis Horwood Limited, England
2. Bailey and Ollis, 2000, "Biochemical Engineering Fundamentals", McGraw Hill 3rd ed.

REFERENCE BOOKS

1. Stanbury PF,1984, "Principles of fermentation technology" SS Hall, 2nd.
2. Mansi El Mansi.2003 "Fermentation Microbiology & Biotechnology".IVEd.
3. Weblink: nptel

BBTE04	DIARY TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioprocess, Food process engineering				
	Course Designed by – Dept of Industrial Biotechnology				
OBJECTIVES To explore the different techniques involved in diary science					
COURSE OUTCOMES (COs)					

CO1	To study the process involved in the marketing of milk
CO2	To learn about the processing of butter and skim milk powder
CO3	To understand the steps involved in cheese making
CO4	To learn to prepare milk sweets
CO5	To explore the quality control methods involved
CO6	To understand about preservation techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M		H	L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M	H		L	L	M
	CO4	H	M		H	H		M		M	L	L	M
	CO5	H	M	M	H	H		M	M		L	L	M
	CO6	H			H	H		M		L	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Market milk – market milk industry in India – Collection, Transportation of milk- milk reception – Clarification- Chilling – Homogenization – Sterilization- Pasteurization – UHT processing of fluid milk – aseptic packaging – Special milk – Clean Milk Production – Grading of Milk.

UNIT II DAIRY PRODUCTS 9

Fat rich Dairy products – Cream, preparation, types, defects – Butter preparation, types, defects – Butter Spreads- Preparation of Ghee , defects in ghee- AGMARG standards- Frozen dairy products – Manufacture of Ice Cream: Ingredients and their role, types and defects, Judging and grading of Cream, Butter and Ice Cream. Concentrated and dried milk Products- Condensed milk – Evaporated milk – BIS standards –defects- Manufacture of milk powder- whole milk, skim milk powder- spray drying – whey powder- whey protein concentrates- biodiesel from whey.

UNIT III CHEESE AND FERMENTED PRODUCTS 9

Cheese and fermented products- Classification- preparation of cheddar, cottage, mozzarella and processed cheese- cheese spreads- ripening – accelerated ripening- action of rennet – microbial rennet – milk coagulating enzymes – defects in cheese, causes and control measures- fermented milk products – Manufacture of Dahi- yogurt- shrikhand- therapeutic effects of fermented milk products- functional foods- probiotics - prebiotic -symbiotic.

UNIT IV INDIGENOUS MILK PRODUCTS 9

Indigenous milk products and by products – Channa – Chana based products – preparation of Khoa and Khoa based products – peda- Gulabjamun – Rasagolla – preparation of paneer – kulfi – utilization of skim milk – butter milk – whey.

UNIT V QUALITY CONTROL AND QUALITY ASSURANCE 9

Introduction- Cleaning and Sanitation – Sterilization agent- Can Washing- Manual & Mechanical washing – Washing treatments – Cleaning in Place Programmes (CIP) – Packaging of milk & Milk Products – Function- Packaging Material – Filling system – Aseptic Packaging

TEXT BOOK:

1. Sukumar de, 2000, "Outlines of Dairy Technology" Oxford Univ press
2. Bhattacharya A and Rajan R P, 2002 "An over view on Yogurt, beverage and food world".

REFERENCE BOOKS:

1. Andrews,2004, "Biochemistry of Milk Products" Black rabbit books, 2nd ed.
2. Ananthakrishnan C P., and Padmanabhan " The technology of milk processing" Shrilakshmi publications

BBTE05	**MEDICAL BIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Immunology, physiology, animal biotechnology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of biological systems and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of genetics and their relationship to hereditary disorders
CO2	to apply the concept of plant, animal and microbial systems in discovery of medicine
CO3	to comprehend genetics and the immune system
CO4	to know the cause, symptoms, diagnosis and treatment of common diseases
CO5	to know the cause, symptoms, diagnosis and treatment of common diseases
CO6	to apply the concept of plant, animal and microbial systems in discovery of medicine

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M		L	L	L	M
	CO4	H	M		H	H		M	L		L	L	M
	CO5	H	M	M	H	H	L	M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I HUMAN GENETICS 9

Genes and Chromosome- structure, function and inheritance- Repetitive DNA in human genome- Alu, LINE and SINE repeats- Congenital abnormalities, Clinical aspects of autosomal and sex chromosomal disorders. Gene therapy and its types

UNIT II HUMAN PHYSIOLOGY 9

Structure, types and functions of tissues and muscles-Biological functions and abnormalities of digestive system, circulatory system, excretory system and central nervous system

UNIT III HORMONES 9

Hormones- structure, classification, biosynthesis and circulation in blood- Synthesis transport and biological functions of pituitary hormones, thyroid hormones and pancreatic hormones

UNIT IV CLINICAL BIOCHEMISTRY 9

Blood sugar level in diabetes mellitus- Blood pressure and cholesterol level in heart attack- Clinical significance of diagnostic enzymology- Evaluation of renal, pancreatic, liver and intestinal function

UNIT V GERM LINE ENGINEERING 9

Characteristics and diagnostic applications ofstem cell culture, organ culture, embryo culture – Artificial blood- Genetic counseling-Artificial insemination, IVF and embryo transfer in humans- Egg and sperm Preservation banks

TEXT BOOKS

1. Lehninger Nelson &Cox., 2009 “Principles of Biochemistry”,5th edition
2. Chatterjee and Raneshinde2009 “Clinical Biochemistry”7th edition.

REFERENCES

1. Guyton,2010 “Medical physiology”, 12th edition
2. Devlin, 2005 “Biochemistry with clinical correlation”, 10th edition
3. Weblink: nptel

BBTE06	BIOPROCESS ECONOMICS AND PLANT DESIGN	L	T	P	C
	Total Contact Hours -45	3	0	0	3

	Prerequisite – Basic Biotechnology, Chemical Reaction Engineering, Bioreactors
	Course Designed by – Dept of Industrial Biotechnology
OBJECTIVES: To provide knowledge about process economics and plant design	
COURSE OUTCOMES (COs)	
CO1	To understand basic principles of process design
CO2	To know about marketing of products
CO3	To know about capital and fixed cost
CO4	To study the cost involved in human resources
CO5	To understand about the administration of a plant
CO6	To understand about the economics of a plant design

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	F	G	h	i	j	K	l
2	CO1	H	M	M	H	M		M			L		
	CO2	H	M	M	H	H		M		M		L	M
	CO3	H	M		H	H		M	M		L		
	CO4	H	M		H	H	L	M			L	L	M
	CO5	H	M	M	H	H		M				L	M
	CO6	H			H	H		M	L	M	L		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PROCESS DESIGN DEVELOPMENT 9

Technical feasibility survey, process development, flow diagrams, equipment design and specifications

UNIT II GENERAL DESIGN CONSIDERATION 9

Marketability of the product, availability of technology, raw materials, equipment, human resources, land and utilities, site characteristics, waste disposal, government, regulations and other legal restrictions, community factors and other factors affecting investment and production cost.

UNIT III COST ESTIMATION 9

Capital investment-fixed capital investments including land, building, equipment and utilities, installation cost(including equipment, instrumentation, piping, electrical installation and other utilities), working capital investment.

UNIT IV COST ESTIMATION 9

Manufacturing costs-Direct Production cost(including raw materials, human resources, maintenance and repair, operating supplies, power and other utilities, royalties etc) fixed charges (including depreciation, taxes insurance, rental cost etc).,

UNIT V LIABILITIES 9

Plant overheads-Administration, safety and auxiliary services, payroll overheads, ware house and storage facilities etc. Profitability Analysis-return on original investment, interest rate of return, accounting for uncertainty and variations and future developments- Optimization techniques-Linear and Dynamic programming, Optimization strategies

TEXT BOOK:

1. Peters and Timmerhaus, "Plant design and Economics for Chemical Engineers ",McGraw Hill 4th Edition, 2002.

REFERENCES:

1. Rudd and Watson, "Strategy of Process Engineering ", Wiley, 2003.

BBTE07	**FOOD SAFETY AND QUALITY CONTROL**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Food process engineering, Microbiology, Bioprocess Engineering, Biochemistry				
	Course Designed by – Dept. of Industrial Biotechnology				
OBJECTIVES: To know about the safety regulations of food industries					
COURSE OUTCOMES (COs)					
CO1	To study the history of food safety regulations				
CO2	to know about food adulteration				
CO3	to understand about food management practices				
CO4	to get basic idea about food hygiene				
CO5	to get basic idea about microbial quality control				
CO6	to get basic idea about food safety standards				

UNIT I FOOD SAFETY REGULATIONS 9

History of food regulations in India- Legislations- Prevention of Food Adulteration act 1954, Food product order (1955), Solvent Extracted Oil, De-oiled Meal and Edible Flour (Control) Order, 1967, Meat Food Products Order (1973),Edible Oils Packaging, 1998, Edible Oils Packaging, 1998, Vegetable Oil Products Order, 1998, Milk & Milk Product Amendment Regulations – 2009.

UNIT II FOOD SAFETY MANAGEMENT 9

Introduction to concepts of food quality, food safety, food quality assurance and food quality management; objectives, importance and functions of quality control, Current challenges to food safety Food adulteration, nature of adulterants, methods of evaluation of food adulterants and toxic constituents.

UNIT III FOOD QUALITY MANAGEMENT 9

Principles of food quality assurance, total quality management (TQM)–good manufacturing/management practices, good hygienic practices, good lab practices, general awareness and role of management practices in quality control Food safety management, applications of HACCP in food safety, concept of food traceability for food safety,

UNIT IV MICROBIAL CONTAMINATION 9

Microbial quality control: determination of microorganisms in foods by cultural, microscopic, physical, chemical methods. Statistical quality control in food industry Food safety and Standards Act 2006: salient provision and prospects

UNIT V FOOD SAFETY STANDARDS 9

Role of national and international regulatory agencies, Bureau of Indian Standards (BIS), AGMARK, Food Safety and Standards Authority of India (FSSAI), Introduction to WTO agreements: SPS and TBT agreements, Codex alimentarious commission, USFDA, International organization for standards (ISO) and its standards for food quality and safety (ISO 9000 series, ISO 22000, ISO 15161, ISO 14000)

TEXT BOOKS:

1. V. K. Kaushik (1999),Nutrition And Food Safety, Neha Publishers
2. Early. R. (1995): Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London.

REFERENCE BOOKS:

1. Andre, Gordan (2015), Food Safety and Quality Systems in Developing Countries, Elsevier
2. YasmineMotarjemi(2013), Food Safety Management, 1st Edition, Elsevier

BBTE08	**STEM CELLS AND TISSUE ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Animal Biotechnology, G3enetic Engineering, Molecular Biology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide a basic understanding of stem cells and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of stem cells and its types
CO2	to apply the techniques for preservation of stem cells
CO3	to give the information about embryonic stem cell research
CO4	to know the role of stem cells in medicine
CO5	to get a basic knowledge of the applications of stem cells in gene therapy
CO6	to know about formation of new organs from stem cells

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	L		L		M
	CO2	H	M	M	H	H		M		H	L	L	M
	CO3	H	M		H	H		M				L	M
	CO4	H	M		H	H			H		L	L	
	CO5	H	M	M	H	H		M		M		L	M
	CO6	H			H	H		M			L		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I ORIGIN AND CHARACTERISTICS OF HUMAN STEM CELLS 9

Origin and characteristics of human stem cell, plasticity of human somatic stem cells research, Novel stem cell based therapies, Scientific and technical obstacles to overcome before realizing the potential clinical uses of novel human stem cell based therapy, Cord blood,-Stem cell marker.

UNIT II HUMAN EMBRYONIC STEM CELL RESEARCH 9

Possible sources for human embryonic stem cell, growing human ESC in laboratory, Current advantages and limitations of hESC and human somatic cells-Examining the need for new hES cell lines, Developments regarding establishment of human stem cell banks and registries.

UNIT III ISOLATION AND IDENTIFICATION OF STEM CELLS 9

Preparation of complete human neuroculture, Culturing and subculturing human neurospheres, Differentiation of cells from human, neurospheres into neurons, astrocytes and oligodendrocytes; Immunolabelling procedures

UNIT IV GENE THERAPY 9

Possibilities to overcome immuno-rejection responses in stem cell therapy, Haematopoietic stem cell transplantation - A new therapy for autoimmune disease, Prenatal diagnosis of genetic abnormalities using fetal CD34+ stem cells, Stem cells in treatment for major diseases and reparative medicine, ESC a promising tool for cell replacement therapy, germ line therapy.

UNIT V TISSUE ENGINEERING 9

Basic principles and consideration - Cell type and source, Metabolic requirements of cells, Reconstruction of connective tissues, Reconstruction of epithelial or endothelial surfaces - cells embedded in extracellular matrix material, Culture on a single surface and sandwich configuration, Bioreactor design on tissue engineering - Hollow fiber systems, Microcarrier based systems-Tissue engineering of the liver.

TEXT BOOK:

1. R.C.Dubey, 2004, "Text book of Biotechnology" 3rd Ed.

REFERENCE BOOK:

1. SudhaGangal , 2002, "Principles and Practice of Animal tissue culture", IV Ed
2. P. Ramadass , 2008, " Animal Biotechnology" MJP pub.
3. Weblink: nptel

BBTE09	BIOSENSOR TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biochemistry, Basic biotechnology, Bioprocess Engineering				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide basic knowledge about the biosensors

COURSE OUTCOMES (COs)

CO1	to understand basic principles of biosensor
CO2	to know about various types of biosensor
CO3	to know about applications of biosensors in various fields
CO4	to get some knowledge about transducers in biosensors
CO5	to learn about the applications of transducers in biosensors
CO6	To get knowledge about

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M			L	L	
	CO2	H	M	M	H				H	H		L	M
	CO3	H	M		H	H		M		H	L		M
	CO4	H	M			H		M			L	L	
	CO5	H	M	M	H	H		M	H	M	L		
	CO6	H			H	H						L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Biosensor – principle, construction, components, Advantages and limitations; ISFET, ENFET, ISE

UNIT II TYPES 9

Various biological materials used for biosensor construction - Microbial biosensors, Enzyme biosensor, Tissue based biosensor, Affinity biosensor

UNITIII TRANSDUCERS IN BIOSENSOR-I 9

Potentiometric, Amperometric biosensors - Principle, constructions, and applications- Generations of biosensor Technology

UNIT IV TRANSDUCERS IN BIOSENSOR-II 9

Calorimetric, Optical, Piezo – electric biosensors - Principle, constructions, and applications

UNIT V APPLICATIONS 9

Online/Offline monitoring in bioprocess; Applications in clinical chemistry, medicine, health care, veterinary, agriculture, food and environmental monitoring.

TEXT BOOK

1. Alice Cunningham, 2000, "Introduction to BioanalyticalSensors",John Wiley& Sons,.
2. Jiri Janata, 2002, "Principles of Chemical Sensors" Plenum Press.

REFERENCE BOOKS

1. F. Schellr, F. Schubert, J. Fedrowitz, BirkhauserVerlag ,1995 "Frontiers in Biosensors"
2. F. Ligler, C. Rowe Taitt, 2002 "Optical Biosensors. Present & Future" Elsevier,
3. Brian Eggins, 2002 "Chemical Sensors and Biosensors" John Wiley & Sons,
4. Graham Ramsay,1998, 'Commercial Biosensors'-, John Wiley& Sons.
5. Weblink: nptel

BBTE10	**PROTEOGENOMICS AND BIOINFORMATICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioorganic chemistry, Basic Biotechnology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of genomics and proteomics using software and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the classification of biological databases and its role in research
CO2	to apply the concept of genomics of different organism, gene expression and mapping situations
CO3	to know the tools for gene identification and prediction
CO4	to know the structural elucidation and prediction of proteins
CO5	to get a basic knowledge of techniques related to proteomics
CO6	To know about bioinformatics tools

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	H	M	M	H	M		M		L	L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M	M		L	L	M
	CO4	H	M		H	H		M		M	L	L	M
	CO5	H	M	M	H	H		M	L		L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BIO INFORMATICS 9

Introduction to bioinformatics – Databases, Classification – Biological Databases, and application – Data mining and Applications – Sequence Database search – FASTA – BLAST.

UNIT II GENOMICS 9

Genome – Organization of Eukaryotic genome – Mitochondrion and chloroplast genome Mapping strategies – Genetic mapping and physical mapping – Genome mapping – Human genome project – Gene expression – Microarrays

UNIT III SEQUENCE TECHNOLOGIES 9

Alignment of multiple sequences – Methods and applications – Phylogenetic analysis – Tools for sequence alignment. Gene identification Methods and applications – Tools for gene prediction – Methods and applications

UNIT IV PROTEOMICS 9

Lifecycle of protein – Classification and structure visualization techniques – Protein databases – Prediction of primary and secondary structure – Prediction of 2D and 3D structure

UNIT V TOOLS OF PROTEOMICS 9

Protein extraction – Separation and digestion techniques – Mass spectrometry –MALDITOF – Peptide mass finger printing – Peptide sequence analysis – SALSA and TMS

TEXT BOOK

1. S.C. Rastogi, 2007, "Bioinformatics methods and applications ", Prentice – Hall of India Publication

REFERENCE BOOK

1. Lesk AM, 2007, "Introduction to Genomics", Oxford University Press, IV Ed.
2. Brownstein M.J, 2003, "Functional genomics methods and protocols", Humana Press, III ed.
3. Weblink: nptel

BBTE11	ALTERNATE ENERGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Microbiology, Bioprocess Engineering, Chemical engineering				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To make students familiar with importance of alternative fuels

COURSE OUTCOMES (COs)

CO1	Learn limitations of fossil fuels and need for alternative fuels
CO2	Learn sources of various alternative flues
CO3	Learn storage, distribution and safety aspects of alternative fuels
CO4	To have an understanding of engine requirements and combustion characteristics fuels
CO5	To teach engine requirements and adaptability of engines to alternative fuels
CO6	To teach combustion and emission characteristics of various gaseous and liquid alternative fuels

UNIT I FOSSIL FUELS 9

Fossil fuels and their availability - Potential alternative liquid and gaseous fuels - Merits and demerits of various alternative fuels - Engine requirements

UNIT II PRODUCTION OF FUELS 9

Methods of production - Properties - Blends of gasoline and alcohol - Performance in SI engines – Adaptability - Combustion and emission characteristics - Performance in CI engines -Emission characteristics - Properties of alcohol esters

UNIT III NATURAL GAS 9

Production and properties of CNG, LPG, biogas and producer gas - Performance and emission in SI/CI engines - Storage, distribution and safety aspects

UNIT IV HYDROGEN FUELS 9

Sources of Hydrogen - Properties - Production of hydrogen - Transportation, storage and safety aspects - Performance and emission characteristics – Adaptability - Fuel cell - Hybrid vehicles

UNIT V BIOFUEL 9

Various vegetables oils - Properties - Esterification - Performance and emission characteristics - Bio-diesel: Feed stock, characteristics, preparation (lab and commercial), storage, applications, environmental impacts, economics, policy

TEXT BOOK

1. Osamu Hirao and Richard Pefley (1988), Present and Future Automotive Fuels, WileyInterscience Publication, New York.

REFERENCE BOOKS

1. R.L. Bechtold (1997), Alternative Fuels Guidebook, SAE
2. Nick Wagoner and Sheryl Wagoner (2006), Alternate Fuels: An Overview, ThomsonDelmar Learning.

3. Reda Mohamed Bata (1994), Alternate Fuels: A Decade of Success and Promise(Progress in Technology), SAE International

BBTE12	DEVELOPMENTAL BIOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Molecular biology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide basic knowledge about biology of human system

To provide knowledge about the designing of reactor

COURSE OUTCOMES (COs)

CO1	to understand the history and scope of developmental biology
CO2	to know about fertilization
CO3	to know basic concepts on cleavage
CO4	to know about regeneration
CO5	to study the various processes involved in regeneration
CO6	To study about human physiology

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	H	M	M	H	M	H				L		M
	CO2	H	M	M	H	H		M		M	L	L	
	CO3	H	M		H	H	H		H			L	M
	CO4	H	M		H	H		M		M	L		M
	CO5	H	M	M	H	H	M	M	H			L	M
	CO6	H			H	H			H	M	L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Developmental biology: its scope, history and special fields-Germ cells: origin of germ cells, its migration and fate-Spermatogenesis: cells in seminiferous tubes, spermiotelosis, nuclear control of spermiotelosis, ultramicroscopic structure of mammalian sperm, types of sperm.

UNIT II OOGENESIS 9

Oogenesis: growth of oocyte, maturation of ovum, formation of yolk, accessory cells, egg cortex and its importance, egg membrane-Fertilization: significance of sperm-egg interaction, acrosome reaction, sperm penetration, behaviour of pronuclei, syngamy, polyspermy, activation of egg-Parthenogenesis: natural and artificial.

UNIT III CLEAVAGE 9

Cleavage: definition, early history and concept, geometry of cleavage, types of cleavage, cleavage patterns and factors governing them, laws of cleavage, theories of cytokinesis-Gastrulation: morphogenetic movements, selective affinity and adhesiveness of cells, mechanism of the change of shape of cell during morphogenesis-Embryonic induction: Spemann's primary organizer, nature of induction mechanism of action of inducing substances.

UNIT IV EMBRYO DEVELOPMENT 9

Organization of the early embryo: polarity, symmetry, regulative development and physiological gradients, mosaic development- Differentiation: equivalence of nuclei, cytoplasmic control of nuclear activity, genetic control of differentiation, isozymes, mass effects-Metamorphosis: insect metamorphosis, amphibian metamorphosis, metamorphosis and evolution.

UNIT V REGENERATION OF TISSUES AND ORGANS 9

Regeneration: regeneration in amphibians and planarian, stimulation and suppression of regeneration, histological processes concerned in regeneration, gradient concept, neural and endocrine influences- Developmental aspects of immunology- Teratology: factors inducing abnormal development of tissues and organs.

TEXT BOOK

1. B. Balinsky 2004, “An introduction to embryology”, 5th ed.

REFERENCES

1. J. Brachet, 2003, “Introduction to molecular embryology”.
2. N.J. Berrill, 2005, “Developmental biology”.
3. Gene activity in early development, (2005), H. Davidson.
4. Weblink: nptel

BBTE13	BIOPHARMACEUTICAL TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biochemistry, Bioorganic chemistry, Basic biotechnology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES:

To provide a basic understanding of pharmaceutics and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of drugs and its absorption
CO2	to know the manufacturing process of drugs and its bioavailability
CO3	to comprehend drugs and its binding mechanism

CO4	to know the drug metabolism and biotransformation
CO5	to get a basic knowledge of the applications of prodrugs in biological systems
CO6	To understand about the drug formulation

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	H	L	L	
	CO2	H	M	M	H	H					H	L	M
	CO3	H	M		H	H		M	M	M	M		M
	CO4	H	M			H		M				L	
	CO5	H	M	M	H	H		M	L	L			M
	CO6	H			H	H		M			L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Introduction to bio pharmaceutics – Various route of drug administration- drug absorption, factors influencing drug absorption from the gastrointestinal tract.

UNIT II FORMULATION OF DRUGS 9

Manufacturing Principles - Compressed tablets - wet granulation - Dry granulation or slugging - Direct compression - Tablet presses formulation - Coating - Pills - Capsules - Parental solutions - injections

UNIT III PHARMACODYNAMICS 9

Binding of drugs to blood components - tissue binding of drugs - factors affecting protein drug binding - significance of protein/tissue binding of drugs - kinetics of protein-drug binding

UNIT IV BIOTRANSFORMATION 9

Biotransformation - drug metabolizing enzymes - phase I reactions - phase II reactions - first pass effect - factors affecting biotransformation of drugs - bio activation and tissue toxicity.

UNITV PRODRUGS 9

Bio precursor prodrugs - carrier prodrugs - application of prodrug design: - enhancement of bioavailability - site specific drug delivery - limitations of prodrug design.

TEXT BOOK

1. Brahmankar, D.M. "Biopharmaceutical and pharmacokinetics: A Treatise", VallabhPrakashan, 1995.

REFERENCE BOOK

1. Remington's Pharmaceutical Sciences, Mack Publishing and Co.,
2. Weblink: nptel

BBTE14	BIOFUEL TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Bioprocess				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES:

To provide a basic understanding of fuel and biofuel concepts and its production techniques

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of biofuel
CO2	to know the various source for biofuel
CO3	to apply the technique in large scale
CO4	to study about lipid derived biofuel
CO5	to give a basic knowledge of the applications biofuel
CO6	to get idea about various sources of biodiesel

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H		M		H		L	M	M
	CO2	H	M	M	H	H		M		H			
	CO3	H	M		H	H		M	M		M	L	M
	CO4	H	M		H		M	M		H			
	CO5	H	M	M	H	H			M			M	H
	CO6	H			H	H	L	M		H	L		H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Introduction – Potential of biomass – biofuel policies: Policy in EU – Biofuel standardization – International Trade of biofuel-Biofuel Life Cycle – Energy balance -& Efficiency of biofuel –

Biofuel emission: Greenhouse gas emission – Vehicle emission standards – other environmental Impacts of Biofuel – economy of biofuel – Consideration of Co-Products.

UNIT II BIOETHANOL 9

BioEthanol – Feed stock production: sugar Crops, Starch crops , Cellulosic feed stock – Bioethanol Production : Sugar to ethanol Process, Starch to ethanol process, Cellulose to Ethanol Process – Distillation & Dehydration process – Properties – Application –standardization – Energy balance – Bioethanol Emission : Greenhouse gas emission, toxic exhaust emission – Other environmental impacts: water issues, land use & biodiversity, human Health.

UNIT III LIPID BIOFUELS 9

Lipid derived Biofuel – Feed stock production -: Oil seed crops, Micro algae , Animal fats, waste oils – Fuel production : Oil Extraction , Oil Refining, Transesterification – Properties & Use : Properties of Pure Plant Oil (PPO) , Properties of Biodiesel – Application – Energy balance – Emissions of lipid biofuel – Other Environmental Impacts – Economy.

UNITIV BtL FUELS 9

BtL Fuel: Feed Stock production – BtL production – Gasification, Gas Cleaning – Synthesis process-Biohydrogen: Processing – Use – The Future of Biofuel.

UNIT V BIOMETHANE 9

Biomethane – Feed stock Production- BioMethane Production : Digestion Process- Digester types- biogas Purification – Properties & Use – Application – Standardization – BioMethane Emission – Other Environmental Effects – Economy.

TEXT BOOK

1. Dominik Rutz& Rainer Janssen, 2007, "Hand Book on BioFuel Technology", II ED.

REFERENCE BOOKS

1. SoetaertErlckI. Vandamme, 2009, "Biofuels" John Wiley & Sons, 1st.ed.
2. Hand Book on " BioFuel Technology" by Dominik Rutz& Rainer Janssen, 2007
3. "Bioprocess technology" – P.T. Kalaichelvan and I. Arul Pandi. 2007. MJP Pub.
4. CayeDrapcho, John Nghiem, Terry Warker, 2007, "Biofuel Engg& Process Technology" Mc-Graw Hill, 1sted.

BGE006	**BIOMEDICAL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Fermentation Techniques, Chemical reaction engineering, Bioprocess engineering				
	Course Designed by – Dept of Biomedical Engineering				
OBJECTIVES: To understand the working principle of various equipment					
COURSE OUTCOMES (COs)					
CO1	To understand the differences in the application of different microscopic methods				
CO2	Enables the student to develop their skills in the medical devices				

CO3	It also gives knowledge on rehabilitation biomechanics
CO4	It deals with bio signal analyzer
CO5	It imparts determination of ultrasound in diagnosis
CO6	To analyze the results of different spectrophotometer and identify the chemical nature of the samples

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M	L		L	L	M
	CO3	H	M		H	H		M		L	L	L	M
	CO4	H	M		H	H		M	M		L	L	M
	CO5	H	M	M	H	H		M		M	L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Anatomy of human-various bones-functions-muscles-types-function- Medical devices- Medical imaging- Implants- Bionics- The improvement of diagnosis and therapy; biomedical information storage and retrieval

UNIT II MUSCLE STRUCTURE AND ITS FUNCTIONS 9

Muscle structure and its attachment with skeleton-rate of contraction and force generation-Activation contraction-locomotion-stability-forces on ground-forces on muscles-energy requirement-mechanisms of walking, running and trotting-sports.

UNIT III BIOMECHANICS 9

Mechanical analysis of performance-rehabilitation biomechanics-mechanics of prosthetics and orthotics biomechanics of human injury and orthopaedics fixation-mechanics of bones and joint-dynamics of man machine interaction

UNIT IV BIOSYSTEM MODELING 9

Electrical impedance cephalography-biotelemetry-biosignalanalyzer-biosystem modelling

UNIT V ULTRASOUND IN DIAGNOSIS 9

Ultrasound in diagnosis-limb prosthetics and orthotics-sensory aids for the blinds-assisting the heart and kidney- ECG-EEB-Physiological equipment

TEXT BOOKS

1. AtillaHincal A., Suheylakas, H, BiomedicalScience&Technology, Plenum Press NewYork.
2. Albert D.Helfrick and William D. Cooper. Modern Electronic Instrumentation and Measurement Techniques", Prentice Hall of India, 2007

REFERENCES BOOKS

1. Ernest o Doebelinand Dhanesh N Manik, Measurement systems, Application and design,5th edition,McGraw-Hill, 2007.
2. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw-Hill, New Delhi, 2003
3. Standard Handbook of Biomedical Engineering & Design – Myer Kutz, McGraw-Hill Publisher, 2003.

BBTE15	METABOLIC ENGINEERING	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Biochemistry, Metabolic conceptsand bioenergetics				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To have a detailed knowledge about the metabolic pathway of carbohydrates, proteins and fat and to engineer them based on industrial requirement

COURSE OUTCOMES (COs)

CO1	To learn the basic process of metabolism
CO2	To study the energetic of metabolism
CO3	To learn about metabolic stoichiometry
CO4	To explore the kinetics of metabolism
CO5	To study the various signal transduction pathways
CO6	To learn the concepts of metabolism and its kinetics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		H	L	L	M
	CO2	H	M	M	H	H		M	L		L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M		M	L	L	M
	CO6	H			H	H		M	H		L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)

							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I METABOLISM 9

Metabolism- glycolsis, gluconeogenesis-glycogen-HMP shunt-TCA cycle-fatty acid metabolism-urea cycle and metabolism of purine and pyrimidine

UNIT II ENERGETICS 9

Energetics of metabolism, Energy coupling (ATP and NADH), Stoichiometry of cell growth and product formation, Elemental Balances, Degree of reduction, fundamental concepts, yield coefficients, oxygen consumption and heat evolution in aerobic cultures.

UNIT III STOICHIOMETRY 9

Metabolic stoichiometry, Energy of batch and continuous process, Stoichiometry of cell growth and product formation, available electron balances, yield coefficients of biomass and product formation, Maintenance coefficients, Energetic analysis of microbial growth and product formation, Heat evolution in anaerobic culture

UNIT IV THERMODYNAMICS 9

Thermodynamic efficiency of growth, Thermodynamics and kinetics of cell metabolism, metabolic path ways, modeling of EM pathway, Thermal Energetic studies, Activation Energies of reaction and heat of reaction, formation and combustion of biochemical reactions.

UNIT V SIGNAL TRANSDUCTION 9

Signal transduction- Receptors and Methods of action- Signal amplification and different models, G proteins- Phosphatidyl Inositol – cAMP – Calcium ions – Protein kinase- defects in signaling pathways.

TEXT BOOKS

1. Biochemical Engineering Fundamentals- Bailey and Olis, 2013

REFERENCE BOOKS

1. Roles JA Kinetics and Energetics in Biotechnology –Elsevier 1983
2. Chemical Reaction Engineering- Octave Levenspiel
3. Chemical process Principles vol III Bioprocess Engineering – Coulson and Richardson Wiley International 1986.
4. Weblink: nptel

BBA005	**ENERGY ENGINEERING AND MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Principles of chemical engineering, Thermodynamics, Environmental studies, basic concepts in energy				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

To enlighten the student in the field of energy engineering concern with energy efficiency, energy service and facility management

COURSE OUTCOMES (COs)

CO1	Understand different energy resources and their uses
CO2	Understand different energy conservation techniques
CO3	Understand the impact energy on environment
CO4	Know about management of energy
CO5	Calculate economics of energy
CO6	Understand different types of energy

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	H	M	M	H	M		M			M	M	M
	CO2	H	M	M	H			M					M
	CO3	H	M			H		M			L	M	
	CO4	H	M		H	H		M					M
	CO5	H	M	M	H	H		M			L	M	
	CO6	H						M					M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION TO ENERGY AND ENVIRONMENT 9

Definition – Fossil fuel reserves – Energy consumption – Greenhouse effect, global warming – Renewable energy resources – Environmental aspects, utilization – energy prizes – Energy policies.

UNIT II ENERGY CONSERVATION 9

Need – different types of energy conservation schemes – industrial energy use – energy surveying and auditing – energy index – cost of energy – cost index-energy conservation in engineering and process industry in thermal systems, in buildings and non-conventional energy resources schemes.

UNIT III ENERGY GENERATION BY TECHNOLOGY 9

Fuels and consumption – Boilers – Furnaces – Waste heat recovery systems – Heat pumps and refrigerators – Storage systems – Insulated pipe work systems – heat exchangers

UNIT IV ENERGY MANAGEMENT 9

Energy management principles – energy resource management – energy management information systems – Instrumentation and measurement – Computerized energy management

UNIT V ENGINEERING ECONOMICS 9

Costing techniques – Optimization cost – Optimal target investment schedules – Finance appraisal – Profitability – Project management.

TEXT BOOK:

1. W.R. Murphy and G. Mckay, Energy Management, Butterworths, London, 1982.

REFERENCE BOOK:

1. Callaghan P.W. Design and Management for Energy Conservation, Pergamon Press, Oxford,1993.

BBTE16	**NANOBIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Molecular biology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide basic knowledge about nanoscience involved in biotechnology

COURSE OUTCOMES (COs)

CO1	to understand the various nano devices
CO2	to know about nano molecules
CO3	to learn the applications of nanotechnology in proteins, lipids and nucleic acids
CO4	to know about the applications of nanotechnology in microbiology
CO5	to know about nano technology involved in drug delivery system
CO6	To understand about nanoparticles

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	M	M	M	H	M		H				L	M
	CO2	H	M	M	H	H		M			L		L
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H					L	L	M
	CO5	H	M	M	H	H		M				L	L
	CO6	H			H	H		M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Introduction to nanobiotechnology – nanodevices& techniques – micro &nanosystems – synthesis & characterization of nanoscale molecules – nanoarchitecture – fabrication technologies – self-assembly systems

UNIT II NANODEVICES 9

Inorganic nanoscale systems – properties of fullerene carbon nano tubes – quantum dots & wires – gold nanoparticles – nanopores.

UNIT III NANOMOLECULES 9

Nanomolecules in proteins, lipids RNA & DNA – peptide coupled nanoparticles – proteins nanodevices – cell nanotechnology – cell motility – nanomotors& cellular navigation – chemotaxis – transmembranesignaling – nanoscale artificial platform.

UNIT IV MICROBIAL NANOTECHNOLOGY 9

Nanotechnology and microorganisms – PHA – magnetosomes – cyanophycin inclusions – alginates – bacteriophages – bacterial spores – S – layer proteins – bacteriorhodopsin.

UNIT V NANOMEDICINE 9

Nanotechnology in drug delivery – nanoscale devices for drug delivery – micelles – protein targeting – protein interaction with other molecule – microarray – genomic chips – nanobiosensors – nanobiochips – Nanotechnology for cancer diagnosis & treatment.

TEXT BOOK

1. K.K. Jain , 2006, "Nanotechnology in molecular diagnostics – current techniques & applications", Horizon Bioscience publishers

REFERENCE BOOKS

1. Microbial bionanotechnology:Biological Self-Assembly Systems and Biopolymer-Based Nanostructuresed: Bernd Rehm, Taylor and Francis, 2006
2. Applications of nanoparticles in biology & medicine O.V. Salata, Journal of nanobiotechnology (2004),
3. Weblink: nptel

BCE057	INDUSTRIAL WASTE TREATMENT AND DISPOSAL	L	T	P	C

	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Environmental biotechnology, Waste management				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

To provide knowledge on sources and characteristics of industrial wastewater,techniques and approaches for minimizing the generation and application of physio chemical and biological treatment methods for recovery, reuse and disposal

COURSE OUTCOMES (COs)

CO1	Have a fundamental knowledge of the effluent discharge standards and waste minimization technology
CO2	Have a well-founded knowledge of characteristics of industrial wastewaterand treatment methods
CO3	Acquire knowledge about conventional methods of treatment for industrial waste
CO4	Understand various biological treatment methods
CO5	Have a fundamental knowledge of combined treatment of industrial and municipal wastes
CO6	Have knowledge about various types of effluent released from industries

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	M	M	M	H	M	H	M	L		L	L	M
	CO2	H	M	M	H	H	H	M		H	L	L	M
	CO3	H	M		H	H	M	M	H		L	L	M
	CO4	H	M		H		H	M	M	M	L	L	M
	CO5	H	M	M	H	H	M	M			L	L	M
	CO6	H			H	H	H	M		L	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Effects of industrial wastes on streams, land and air, waste water treatment plants, water quality criteria – effluent standards : Process modification, method and material changes, housekeeping etc., to reduce water discharges and strength of the waste and established recovery methods for bye products within the plant operations.

UNIT II CHARACTERISTICS OF WASTE 9

Characteristics of major industrial waste water (liquid wastes) Chemical Industries: Petrochemicals & refineries, pharmaceuticals. Apparel Industries: Textile, synthetic fibres, leather, paper-Agro Industries: Fertilizer Food Industries: Heat – packing pickles, canning poultry and eggs, distillers, sugar. Metallurgical Industries: Thermal power station, nuclear power plants.

UNIT III WASTE TREATMENT 9

Conventional methods of treatment and disposal of industrial wastes-Equalization and neutralization, separation of solids – sedimentation and filtrations

UNIT IV BIOLOGICAL TREATMENT 9

Removal of organic contents: Biological treatment methods, aerobic and anaerobic, digestion, tickling filters, stabilization ponds, activated sludge process – oxidation ditch.

UNIT V PHYSICOCHEMICAL TREATMENT 9

Physico Chemical Treatment Method – Neutralization, coagulation, flocculation, adsorption and precipitation. Combined treatment of industrial and municipal wastes.

TEXT BOOKS:

1. EckenfalderW.W,"Industrial Water Pollution Control", McGraw Hill, New York, 1989

REFERENCES:

1. Arceivala S.J &ShyamAsolekarR,"Waste Water Treatment and Pollution Control Tata McGraw Hill, 1998.
2. Nelson Leonard Nemerow," Theories and practice of industrial waste treatment", Addison Wesley Pub. Co., 1963
3. World Bank Group "Pollution prevention and Treatment Hand Book" World Bank and UNEP Washington DC, 1998

BBTE17	ENGINEERING OPTIMIZATION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Engg Mathematics-I, Input and output ,Engineering concepts				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide knowledge about the process optimization

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals of process optimization
CO2	To know about various optimization methods
CO3	To know about statistical approach
CO4	To understand the linear programming methods
CO5	To know the yield and economic importance
CO6	To understand about neural network

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	D	E	F	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		H	L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M	M	M	L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M	L	M	L	L	M
	CO6	H			H	H		M			L	L	M
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)		Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)		
								√					
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION 9

Introduction to Optimization, Necessity and need for process optimization- Necessary and Sufficient Conditions for Extremum-Maxima and minima- Local maxima, local minima, global maxima, global minima

UNIT II ONE DIMENSIONAL OPTIMIZATION 9

Optimization of Unconstrained Functions: One-Dimension. Newton Ralpson Method- Bisection Method- Interval Halving Method

UNIT III MULTI-DIMENSIONAL OPTIMIZATION 9

Optimization of Unconstrained Functions: Multi-DimensionalOptimization by Generalized Reduced-Gradient method (deterministic process optimization) -Statistical Modeling (empirical process optimization, experimental design and analysis) -Taguchi Method (process optimization) -Random Search Method -Fuzzy Logic (process optimization, control systems) -Linear Programming (process optimization)

UNIT IV STATISTICAL OPTIMIZATION 9

Linear Programming - Simplex Method-The Nonlinear Problem with Constraints-Statistical Approaches

UNIT V PROCESS OPTIMIZATION 9

Neural Networks (process optimization, control systems) - Genetic Algorithms (process optimization) - Optimization of Systems with Discrete Variables (process design)

TEXT BOOK

1. Singiresu S. Rao, 2005, “Engineering Optimization Theory and Practice”, Third Edition.

REFERENCE BOOKS

1. Ananthakrishnan TN,2006, "Animal biodiversity" Scientific publishers(India).
2. Good enough U,1998, "Human biology; personal, environmental and social concerns" Saunders collage publication.

BBA008	**TOTAL QUALITY MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional ethics& Professional Courses				
	Course Designed by – Dept of Management studies				

OBJECTIVES:
To study about the management methods involved in quality assessment of a product

COURSE OUTCOMES (COs)

CO1	to study the basic definition of quality
CO2	to study the importance of customer satisfaction
CO3	to study the statistical methods of quality control
CO4	to explore the methods of benchmarking
CO5	to classify the products into quality standards
CO6	To know about quality principle

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		L	L	L	M
	CO2	H	M	M	H	H		M	L		L	L	M
	CO3	H	M		H	H	L	M		M	L	L	M
	CO4	H	M		H	H		M	M		L	L	M
	CO5	H	M	M	H	H		M		L	L	L	M
	CO6	H			H	H	L	M	L		L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Definition of Quality, Dimensions of quality, Quality planning, Quality costs- Analysis – Techniques for quality costs, Basic concepts of total Quality Management, Historical Review, Principles of TQM, Leadership- Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation

UNIT II TQM PRINCIPLES 9

Customer satisfaction-Customer Perception of Quality, Customer complaints, Service Quality, Customer Retention and, Employee Involvement- Motivation, Empowerment, Teams, Recognition Reward, Performance Appraisal, Benefits, Continuous process improvement- Jurantrlogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership- Partnering, sourcing, Supplier selection, Supplier rating, relationship development, Performance measure- Basic concepts, Strategy, Performance measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals- Measures of central Tendency and Dispersion, Population and sample, Normal curve, Control charts for variables and attributes, Process capability, Concept of six sigma, New seven management tools.

UNIT IV TQM TOOLS 9

Benchmarking- Reasons to Benchmark, Benchmarking process, Quality function Deployment (QFD)- House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM)- Concept, Improvement Needs, FMEA- Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and other Quality Systems, ISO 9000:2000 Quality system- Elements, Implementation of Quality systems, Documentation, Quality Auditing,
QS 9000, ISO 14000- Concept, Requirements and Benefits.

TEXT BOOK

1. R.Ramakrishnan, 2004, "A Text Book of Total Quality Management" V Ed.

REFERENCE BOOKS:

1. Ronald A. Armstrong , 2006, "Total Quality management", Chapman and Hall,
2. Suresh Lulta, 2002"Total Quality management" Vol. I and ll, ShahTrust, Mumbai

BBA009	**INTELLECTUAL PROPERTY RIGHTS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Value Education and Professional Ethics & Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

Strong intellectual property rights (IPR) protection is crucial to fostering trade, and achieving the goals and benefits of global integration. Countries with high standards of IPR protection tend to attract more investment, stimulate more innovation, thereby

developing more rapidly. Countries with inadequate protection are often vulnerable to infringements of intellectual property rights that hinder trade flow and economic development.

Hence, the objective is to introduce IPR to the UG Engineering and Technology students.

COURSE OUTCOMES (COs)

CO1	Understand the principles, function and basic legal rules of IP Law.
CO2	Recognize the relevant criteria for generating and protecting intellectual works.
CO3	Recognize the intellectual property likely to be produced in the academic and professional environment.
CO4	Demonstrate appreciation and critical awareness of pertinent IP issues in the academic and professional lives.
CO5	Understand the relevance and impact of IP Law on academic/scientific works/studies.
CO6	Understand the different forms of infringement of intellectual property rights.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					H					H	
	CO2		H		M					H			
	CO3	M							M		H		
	CO4			M	H							H	
	CO5							M					
	CO6	H			H					M			L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I PROPERTIES AND TYPES 9

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i). Movable Property ii. Immovable Property and iii. Intellectual Property.

UNIT II PATENTS AND RIGHTS 9

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures..

UNIT III INTERNATIONAL TRADE 9

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV WTO 9

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V CASE STUDIES 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TEXT BOOKS:

1. Subbaram N.R. "Handbook of Indian Patent Law and Practice ", S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.

REFERENCES:

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.
4. www.ipmatters.net/features/000707_gibbs. html.
5. http://www.metastudio.org/Science%20and%20Ethics/file/readDoc/535a76367d9d331598f49e2d/34_Hb_on_IPR.pdf

BCE059	ENVIRONMENTAL HEALTH ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Waste Management				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

To give an insight into the various diseases that affect human beings and introduces the importance of sanitation processes

COURSE OUTCOMES (COs)

CO1	To learn about the various environmental pollution and the impacts of land use and overuse of natural resources
CO2	To learn the various water acts and the sources of water pollution
CO3	To learn the various Air acts and the sources and the effects of Air and noise pollution
CO4	Insight into the solid waste management and various disposal techniques
CO5	Insight into food sanitation and the effects of food borne diseases
CO6	To acquaint the student with various methods and techniques of disposing and management of waste

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M	H	M	H		L	L	M
	CO2	H	M	M	H	H	H		H	H	L	L	M
	CO3	H			H	H	H	M	H	M	L	L	M
	CO4	H	M		H	H	H		H	M	L	L	
	CO5	H	M	M	H	H	H	M	H	L	L	L	M
	CO6	H			H	H	H		H	M	L	L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term paper Seminar/ Internship (PR)
											√		
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION 9

Impact of Development and Water Pollution – Ecology and ecosystems Impact of development, land use and natural resource management, Cause and effects of environmental pollution

UNIT II SOURCES OF POLLTION 9

Natural Processes: Pollution due to industrial, agriculture and municipal wastes – Limitation of disposal of dilution. BOD considerations in streams- Water Pollution control legislation.

UNIT III AIR POLLUTION 9

Air and Noise Pollution and Control- Pollutants and their sources- Effect of pollution of human wealth, vegetation- Air pollution control legislation -noise pollution- sources and effects – Control measures.

UNIT IV SOLID WASTE MANAGEMENT 9

Solid Wastes Management and Water Control Sources - Characteristics Quantities – Collection methods and disposal techniques - Sanitary -landfill -Incineration and pyrolysis – composting - water borne diseases – of mosquitoes, flies, rodents.Rational control and naturalistic methods of control, uses and limitations of pesticides, engineering measures of water control.

UNIT V FOOD SANITATION 9

Food & Milk Sanitation : Relation of food to disease – principles of food sanitation – Sanitation of Kitchen in restaurants and other catering establishments – Quality changes in milk – Milk as carrier of infection – Pasteurization of milk – HTST and LTLT processes. Cattle shed sanitation.

TEXT BOOKS

1. Ehlws V.M. and E.W. Steel. Municipal and Rural Sanitation – McGraw Hill Co. Inc, New York, 1954

REFERENCES

1. Park J.E. and Park K.,"Text Book of Preventing and Social Medicine",M/s. Banarsidos, Bhanot, Jabalpur, 1980.
2. Stern A.C. *ed,* "Air Pollution Vol. I, II & III", Academic Press, New York, 1968
3. Cuniff P.E,"Environmental Noise Pollution", John Wiley & Sons, New York. 1977.

BBTE18	**INDUSTRIAL SAFETY ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioprocess, Enzyme Engineering & Technology, Basic Biotechnology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge about Safety engineering

COURSE OUTCOMES (COs)

CO1	to understand basic concepts in hazard analysis
CO2	to know about safety and its management
CO3	to know about accidents and its preventive measures
CO4	to understand various personal protective equipment and first aid
CO5	to know about personal protective equipment
CO6	To know about fire and safety

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	M		L		M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M		M	L	L	M
	CO4	H	M		H	H		M	L		L	L	
	CO5	H	M	M	H	H		M		L	L		M
	CO6	H			H	H		M			L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INDUSTRIAL HAZARDS 9

Safety in Process Plants – Hazard Analysis – Types of Hazard – hazard Identification techniques Hazard Evaluation – Important Factories Act.

UNIT II CHEMICAL HAZARD 9

Hazards in work place: safety in the use of chemicals at work – Chemical hazard - Air-Borne Contaminants – particulate matter – Hazard and safety methods – hazards and Safety measures in Refineries , Paper and Pulp Industries- Safety Conditions in tanneries –Hazards of Pesticide – Sugar industry.

UNIT III SAFETY MANAGEMENT AND FIRE SAFETY 9

Introduction- Safety policy- Safety in electrical installation: Electrical shock and prevention-safety precautions for residential and commercial installation - Case study-Four stages of Fire-types of Fire Detectors – Fire safety in Industry – chemistry of fire- Types of Combustion- Fire Triangle- Fire extinguishing Technique – Engineering consideration for safety consideration

UNIT IV INDUSTRIAL ACCIDENTS 9

Industrial accidents – Classification – prevention – accident cost – Steps of investigation – Analysis of Accidents – Remedial Measures – Methods of Prevention – Safety Slogans – Case study

UNIT V PROTECTIVE EQUIPMENTS 9

Personal protective Equipment and personal Protection – Aim – Need – Types: Non Respiratory Protective equipment- Respiratory typeFirst aid – principles and methods – First aid training – Scope of first aid – Golden rules– First aid treatment : for wounds and Hemorrage , Shock , respiration :Schafer's Method, Shock. Fractures, Burns and Scalds, Unconsciousness, Heat exhaustion and Stroke– First aid Kit box A and B.

TEXT BOOK:

1. Nicholas, 2008, "Practical Guidance to Industrial Safety" 3rd ed
2. M.H.Fulekar, 2007, "Industrial Hygiene & chemical Safety" 2nd ed

REFERENCE BOOKS:

1. Rudd,2005, "Strategy of process engineering" Willey
2. Wang, Shannmas Hung, 2008, "Advanced hazardous industrial waste treatment" CRC Press.

BBTE19	**BIOENTREPRENEURSHIP DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Industrial Biotechnology				
OBJECTIVES: To provide basic knowledge about Entrepreneurship					
COURSE OUTCOMES (COs)					
CO1	to understand the fundamentals of Entrepreneurship				
CO2	to know about time management				

CO3	to explore the avenues for financing a business venture
CO4	to know about various company laws
CO5	to understand Entrepreneurship in biotechnology
CO6	To get knowledge about decision making

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	H		M	H	M	M	M				L	
	CO2	H	M	M	H	H		M		M	L	L	M
	CO3	H	M	M	H	H	L		H		L		M
	CO4	H	M			H		M			L	L	M
	CO5	H	M	M	H	H		M		M	L	L	M
	CO6	H			H	H	M	M	M		L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I ENTREPRENEURSHIP FUNDAMENALS 9

Entrepreneur – Entrepreneurship – Enterprise – Writing good business plan – operations and management.

UNITII DECISION MAKING AND TIME MANAGEMENT 9

Entrepreneur psychology – personal decision making style – Decision making process – setting personal and Business goals – Setting time priorities – Business person working at home.

UNIT III FINANCE AND ECONOMIC FEASIBILITY 9

Financing the business– Raising venture capital – Financing sources – Pricing the product (or) Service – operating expenses Economic Analysis – Basic financial Analysis worksheets

UNIT IV COMPANY LAWS AND REGULATIONS 9

Forming company – Types of companies – Types of market – Proprietary information: Intellectual property, copy right, ownerships, Trademark, Patent – International Trade

UNIT V ENTREPRENEURSHIP IN BIOTECHNOLOGY 9

Various business opportunities in Biotechnology – Development of Biotech companies in India – Case studies on Biotech companies and its growth

TEXT BOOK

1. Exploring Entrepreneurship: D. Allan Barefield and George F. Smith, Ettmae Westbrook,

Tennesse State University, 2006

REFERENCE BOOK

1. Entrepreneurship fundamentals by ZobiasKollmann International journal of Technology management,2007

CURRICULUM AND SYLLABUS (R2015)

CHOICE BASED CREDIT SYSTEM

B.TECH – AGRICULTURAL BIOTECHNOLOGY

I – VIII SEMESTERS

SEMESTER I							
SL NO	**SUB.CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1.	BEN101	HS	English – I	3	1	0	3
2.	BMA101	BS	Mathematics - I	3	1	0	3
3.	BPH101	BS	Engineering Physics - I	3	0	0	3
4.	BCH101	BS	Engineering Chemistry - I	3	0	0	3
5.	BBT101	ES	Cell Biology	2	1	0	3
6.	BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
7.	BSS101	HS	Personality Development	1	1	0	2
8.	BCE101	ES	Basic Civil Engineering	2	0	0	2
9.	BME103	ES	Basic Mechanical Engineering	2	0	0	2
PRACTICAL							
10.	BCM1L1	ES	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	3	1
11.	BCS2L2	ES	Computer Practices Lab	0	0	3	1
12	BPC1L1	BS	Physics and Chemistry Laboratory#	0	0	3/3	0
13	BSS1L4/ BSS1L5/ BSS1L6	HS	NCC/ NSS/ NSO (to be conducted during weekends)				1
Total Instruction Periods per week=35						**Total No. of Credits = 27**	
# Laboratory Classes on alternate weeks for Physics and Chemistry. The Lab examinations will be held only in the second semester (including the first semester experiments also)							

SEMESTER II							
SL. NO	**SUB. CODE**	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY							
1.	BEN201	HS	English – II	3	1	0	3
2.	BMA201	BS	Mathematics - II	3	1	0	3
3.	BPH201	BS	Engineering Physics - II	3	0	0	3
4.	BCH201	BS	Engineering Chemistry – II	3	0	0	3
5.	BCS201	ES	Internet Programming	2	0	0	2
6.	BFR201*	HS	Foreign / Indian Language	3	0	0	3
7.	BBT201	ES	Principles of Genetics	2	0	0	2
8.	BEE201	ES	Basic Electrical and Electronics Engineering	2	0	0	2
PRACTICAL							
9.	BCS2L1	ES	Internet Practices Lab	0	0	3	1
10.	BEE2L1	ES	Basic Electrical and Electronics Engineering Practices Laboratory	0	0	3	1
11.	BPC2L1	BS	Physics and Chemistry Laboratory#	0	0	3/3	1
12	BSS1L7	HS	Yoga	0	0	2	1
Total Instruction Periods per week=34				**Total No. of Credits = 25**			

*Any one of the following courses: BFR201 – French, BGM201-German, BJP201 – Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 – Tamil**.**

Laboratory Classes on alternate weeks for Physics and Chemistry. The Lab examinations will be held only in the second semester (including the first semester experiments also)

SEMESTER III						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BAC301	PC	Production of Agricultural crops	3	0	0	3
BAC302	PC	Agricultural Botany	3	1	0	4
BAC303	PC	Plant Biochemistry	3	0	0	3
BAC304	PC	Agricultural Microbiology	3	0	0	3
BBT305	PC	Instrumentation for Biotechnology	3	0	0	3
BAC305	PC	Principles Plant Breeding	3	0	0	3
PRACTICAL						
BAC3L1	PC	Plant Biochemistry Lab	0	0	3	2
BBT3L2	PC	Instrumental Methods of Analysis Lab	0	0	3	2
BBT3L3	PC	Cell Biology Lab	0	0	3	2
TOTAL HOURS : 28			**CREDITS : 25**			

SEMESTER IV						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BAC401	PC	Plant Molecular Biology	3	0	0	3
BAC402	PC	Crop Physiology	3	0	0	3
BAC403	PC	Enzymology	3	1	0	4
BAC404	PC	Process engineering in Biotechnology	3	1	0	4
BAC405	PC	Production of horticultural crops	3	0	0	3
BCE406	HS	Environmental studies	3	0	0	3
PRACTICAL						
BAC4L1	PC	Agricultural Microbiology Lab	0	0	3	2
BAC4L2	PC	Process engineering Lab	0	0	3	2
BAC4L3	PC	Plant Molecular Biology Lab	0	0	3	2
BAC4S1	PR	Technical Seminar	0	0	2	1
TOTAL HOURS : 31			**CREDITS: 27**			

SEMESTER V

SUB. CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY						
BMA505	BS	Probability and Statistics	3	1	0	4
BAC501	PC	Plant Genetic Engineering	3	0	0	3
BAC502	PC	Plant Pathology and disease management	3	0	0	3
BAC503	PC	Introduction to Silviculture	4	0	0	4
BAC505	PC	Plant Cell and Tissue culture	3	0	0	3
	CE	Core Elective -I	3	0	0	3
PRACTICAL						
BAC5L1	PC	Plant Genetic Engineering Lab	0	0	3	2
BAC5L2	PC	Plant Cell and Tissue culture Lab	0	0	3	2
BAC5L3	PC	Plant Pathology Lab	0	0	3	2
BAC5C1	PR	Comprehension - I	0	0	0	1
TOTAL HOURS : 29CREDITS : 27						

SEMESTER VI						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BAC601	PC	Fermentation Technology	3	0	0	3
BAC602	PC	Biofertilizers and Biopesticides	3	0	0	3
BAC603	PC	Entomology and Pest Management	3	0	0	3
BSS601	HS	Value Education and Professional ethics	3	0	0	3
	CE	Core Elective-II	3	0	0	3
	NE	Non Major Elective I	3	0	0	3
PRACTICAL						
BAC6L1	PC	Fermentation Technology Lab	0	0	3	2
BAC6L2	PC	Biofertilizers and Biopesticides Lab	0	0	3	2
BAC6L3	PC	Crop Production Lab I- Agricultural crops	0	0	3	2
BAC6P1	PR	Mini Project	0	0	4	2
TOTAL HOURS:31		**CREDITS: 26**				

SEMESTER VII						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
BBT701	PC	Research Methodology and Instrumentation	3	0	0	3
BAC701	PC	Biotechnology of biotic and abiotic stress tolerance	3	0	0	3
BAC702	PC	Food Biotechnology	3	0	0	3
	CE	Core Elective III	3	0	0	3
	NE	Non Major Elective II	3	0	0	3
	OE	Open Elective I	3	0	0	3
PRACTICAL						
BAC7L1	PC	Food biotechnology Lab	0	0	3	2
BAC 7L2	PC	Crop Production Lab- Horticultural crops	0	0	3	2
BAC7P1	PR	Term Paper	0	0	4	2
BAC7V1	PR	In-plant Training Note: Students to get trained in an industry for a period of two weeks at the end of VI semester)	0	0	0	1
TOTAL HOURS:28			**CREDITS: 25**			

SEMESTER VIII						
SUB. CODE	**CATEGORY**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
	OE	Open Elective –II	3	0	0	3
	NE	Non Major Elective III	3	0	0	3
PRACTICAL						
BAC8C1	PR	Comprehension – II	0	0	0	1
BAC8P1	PR	Project work	0	0	18	9
TOTAL HOURS:24			**CREDITS: 16**			

OVERALL CREDITS = 198

LIST OF ELECTIVES

CORE ELECTIVE(CE) I					
BAC001	Immunotechnology	3	0	0	3
BAC002	Industrial microbiology	3	0	0	3
BAC003	Biodiversity conservation	3	0	0	3
CORE ELECTIVE(CE) II					
BAC004	Principles of Seed Technology	3	0	0	3
BAC005	Introduction to Agribusiness management	3	0	0	3
BAC006	Bioremediation Technology	3	0	0	3
CORE ELECTIVE(CE) III					
BAC007	Fundamentals of Soil Science	3	0	0	3
BAC008	Post-Harvest and Food Engineering	3	0	0	3
BAC009	Farming System & Sustainable Agriculture	3	0	0	3
NON MAJOR ELECTIVE(NE) I					
BBT010	Proteogenomics and Bioinformatics	3	0	0	3
BBT001	Food process technology	3	0	0	3
BAC010	Diary process Technology	3	0	0	3
NON MAJOR ELECTIVE(NE) II					
BBT007	Food safety and quality control	3	0	0	3
BAC011	Soil and Applied Microbiology	3	0	0	3
BAC012	Principles of organic Farming	3	0	0	3
NONMAJOR ELECTIVE(NE) III					
BAC013	Greenhouse Technology	3	0	0	3
BAC014	Livestock and Poultry Management	3	0	0	3
BBT016	Nanobiotechnology	3	0	0	3
OPEN ELECTIVE(OE) I					
BAC015	Introductory Nematology	3	0	0	3
BAC016	Manures, Fertilizers and Soil Fertility	3	0	0	3
BBA008	Total Quality Management	3	0	0	3
	NSS Paper I	2	0	2	3
OPEN ELECTIVE(OE) II					
BBA009	Intellectual Property Rights	3	0	0	3
BAC017	Marketing and export of biotechnological products	3	0	0	3
BBT018	Industrial Safety Engineering	3	0	0	3
BBT019	Bio entrepreneurship Development	3	0	0	3
	NSS Paper II	2	0	2	3
	Massive Open Online Course	3	0	0	3

SU

MM

ARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	6	7	-	3	-	3	-	-	19	9.60
2	Basic Sciences (BS)	9	10	-	-	4	-	-	-	23	11.62
3	Engineering Sciences (ES)	12	8	-	-	-	-	-	-	20	10.10
4	Professional Core (PC)	-	-	25	23	19	15	13	-	95	47.98
5	Core Electives (CE)	-	-	-	-	3	3	3	-	9	4.55
6	Non major Electives (NE)	-	-	-	-	-	3	3	3	9	4.55
7	Open Electives (OE)	-	-	-	-	-	-	3	3	6	3.03
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	-	1	1	2	3	10	17	8.59
	Total Credit	27	25	25	27	27	26	25	16	198	100
	Total Contact Hour	35	34	28	31	29	31	28	24	240	

BEN101	ENGLISH - I	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Dept of English				

OBJECTIVES

To make the students learn the basic modes of communication for fluency and attainment of confidence in speech, reading and writing.

COURSE OUTCOMES (COs)

CO1	Understand the importance of being responsible, logical, and thorough.
CO2	Respond to the situations where short reports and instructions are required.
CO3	Explain "how things work", and what to suggest when "things don't work
CO4	Develop our confidence and authority in the practical use of language.
CO5	Understand the importance of being responsible, logical, and thorough.
CO6	Able to Face interviews and competitive examinations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H	H	H	H	H	M	L	L	H	H	H	H
	CO2							L					
	CO3	H						H		H			H
	CO4	H	M				M	L	H	H			H
	CO5							L					
	CO6	H		H	H	H	H	L		H	H	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective	Open Elective (OE)	Project/ Term Paper/ Seminar/
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI STRUCTURES 12

Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT II TRANSCODING 12

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT III REPORTING 12

Degrees of comparison – Positive, Comparative, Superlative - questions- SI units -Lab reports - Physics chemistry, workshop and survey report for introducing new product in the market.

UNIT IV FORMAL DOCUMENTATION 12

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT V METHODOLOGY 12

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives, prepositional relatives.

TEXT BOOK

1. Department Of Humanities and Social Sciences Division, Anna University, Oxford University Press, 2013.

REFERENCES:

1. S.P.Danavel, English and Communication for Students of Science and Engineering, Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007.
3. Murali Krishna and Sunitha Moishra, Communication Skills for Engineers. Pearson, New Delhi, 2011.

BMA101	**MATHEMATICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – + 2 Level Mathematics				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To make the students learn Mathematics in order to formulate and solve problems effectively in their respective fields of engineering.

COURSE OUTCOMES (COs)

CO1	Study the fundamentals of mathematics
CO2	Students learn multiple integral techniques
CO3	Students gain knowledge in application of variables
CO4	Find area and volume based on a function with one or more variables.
CO5	Apply matrix operations to solve relevant reallife problems in engineering.
CO6	Formulate a mathematical model for three dimensional objects and solve

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	D	e	f	g	h	i	j	k	l

2	CO1	H											
	CO2			M		H							
	CO3		H				M						
	CO4								L				
	CO5							H			L		
	CO6											L	
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar/ Internship (PR)
				√									
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT 1 MATRICES 12

Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes- Envelopes- Applications of Evolutes and Envelopes.

UNIT 1V FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives- Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobians- Taylor's expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates-Area as double integral- Volume as triple integral.

TEXT BOOK:

1. Ravish R.Singh and Mukkul Bhatt, "Engineering Mathematics-I" First Reprint, Tata McGraw Hill Pub Co., New Delhi. 2011.
2. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi. 2007.

REFERENCES:

1. Ramana.B.V. "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons, New York, 2003.
4. Murray R.Spiegel, "Advanced Calculus", Schaum's Outline Series, First Edn, McGraw Hill Intl Book Co.,New Delhi, 1981.

BPH101	**ENGINEERING PHYSICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES:
To enhance the fundamental knowledge in Physics and its applications relevant to various stream Engineering and Technology

COURSE OUTCOMES (COs)

CO1	Understand the Principles and Laws of Physics
CO2	To understand the impact of Crystal Physics
CO3	Learn the Properties of Elasticity and Heat transfer.
CO4	Acquire Knowledge on Quantum Physics.
CO5	Understand the concepts on Laser & Ultrasonic's and its Applications
CO6	Understand the Principle of Laser and its Applications in Engineering and Medicine.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	A	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M			H		
	CO2		L	H		M				M		L	H
	CO3												
	CO4	H		M	L						L		M
	CO5		L	L								L	L
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)-

Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity-Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion –Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO2, Semiconductor lasers (homo junction & hetero junction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TEXT BOOKS:

1. Jayaraman D Engineering Physics I. Global Publishing House, 2014.
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai Publishers, 2009.
4. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
4. http://ocw.mit.edu/courses/find-by-topic
5. http://nptel.ac.in/course.php?disciplineId=122
6. https://en.wikipedia.org/wiki/Engineering_physics

BCH101	ENGINEERING CHEMISTRY - I	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level Chemistry				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Understand the principles of water characterization and treatment for portable and industrial purposes.
CO2	To impart knowledge on the essential aspects of Principles of polymer chemistry and engineering applications of polymers
CO3	Having a sound knowledge in the Field of the Conventional and non-Conventional energy
CO4	To impart knowledge on the essential aspects of electrochemical cells, emf and applications of EMF measurements
CO5	To make the students understand the Principles of corrosion and corrosion control .
CO6	To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	L
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I WATER TECHNOLOGY 9

Introduction-Characteristics : Hardness of water – types - temporary and permanent hardness - estimation by EDTA method Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –Domestic water treatment – disinfection methods (Chlorination, Ozonation , UV treatment) Boiler feed water – requirements – disadvantages of using hard water in boilers

Internal conditioning (Calgon Conditioning method) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

UNIT II POLYMERS 9

Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization– Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III ELECTRO CHEMISTRY 9

Introduction CELLS: types of Electrochemical cells , Electrolytic cells – Reversible and irreversible cells EMF – measurement of EMF– Single electrode potential – Nernst equation Reference electrodes : Standard Hydrogen electrode -Calomel electrode Ion selective electrode :Glass electrode and measurement of pH using Glass electrode Electrochemical series – significance Titrations :Potentiometer titrations (redox - Fe^{2+}vs dichromate titrations) Conduct metric titrations (acid-base – HCI vs, NaOH titrations)

UNIT IV CORROSION AND CORROSION CONTROL 9

Introduction: Chemical corrosion Definition - Chemical Corrosion - Electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion control – sacrificial anode and impressed cathodic current methods – Protective coatings :Paints– constituents of the paint and their functions Metallic coatings – electroplating of Gold and electro less plating of Nickel.

UNIT V NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Introduction : Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor Solar energy conversion – solar cells – wind energy Fuel cells – hydrogen – oxygen fuel cell Batteries :Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries :Lead–acid storage battery –working –uses Nickel–cadmium battery - working – uses Solid – state battery : Lithium battery

TEXT BOOKS:

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara “A text book of engineering chemistry” S.Chand& Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).

REFERENCES :

1. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Electrochemistry

BBT101	CELL BIOLOGY	L	T	P	C
	Total Contact Hours - 45	2	1	0	3
	Prerequisite – Higher Secondary level biology, basic concepts in cell signaling				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of cell, its structure, function, types and about its culture

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals of the structure of cells
CO2	To study the types and functions of cell organelles
CO3	To comprehend the methods involved in the cellular transport
CO4	To know the cause, and methods of cell signaling
CO5	To give a basic knowledge of cell culture and its applications
CO6	To understand about signal transduction

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2				M								
	CO3	M											
	CO4							H				M	
	CO5	H											
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I: CELL STRUCTURE 9

Cells-definition, Eukaryotic cell and prokaryotic cell – differences and key organelles, Relationship and evolution of Eukaryotic cell and prokaryotic cell, plant cells and animal cells–differences and general structure- Cellular environment, tissues, various types of cell, Extra cellular matrix, cytoskeletal proteins, Cell cycle-Mitosis and meiosis

UNIT II: CELL ORGANELLES 9

Cell Organelles and function – Nucleus, Cytoplasm, Endoplasmic reticulum, Golgi complex, lysosomes, cell membranes, chloroplast, mitochondria – structure, importance and function

UNIT III: CELLULAR TRANSPORT 9

Transport across cell membranes – importance, classification – Active and passive, passive transport – movement of water, small lipid across membrane. Active – Na+ K+ ATPase Pump, Lysosomal and Vacuolar pumps. Cotransport – Symport, antiport – examples, Endocytosis and Exocytosis transport across prokaryotic membrance, entry of viruses and toxins

UNIT IV: CELL SIGNALING AND SIGNAL TRANSDUCTION 9

Cell signaling – process importance, various kinds of Receptors and ligands – Examples, Different modes of action of ligands, Qualification and characterization of receptors, different modes of signal transduction and amplification with examples, signaling through G-Proteins (Monomeric and trimeric), signaling for growth factors, second messengers, protein kinases, Ca ions and cAMP molecule in signaling.

UNIT V: CELL CULTURE 9

Definition, Media preparation, Propagation of eukaryotic and prokaryotic cell, cell lines, primary cultures, stock cell cultures, maintenance of cell lines in cell culture, explants cultures, differentiation and contamination

TEXT BOOKS:

1. P.K. Gupta, "Cell and Molecular Biology", Rastogi Publication, 2003
2. Molecular Biology of the Cell, Bruce Albert et al., Taylor and Francis, 2002

REFERENCE BOOKS:

1. Molecular Biology of the Cell, Baltimore, Damell J., Lodish, H. Baltimore, D., Freeman Publications, 2003
2. The Cell, T. Coopper, John Wiley and Sons, 2005
3. Cytology,Vermaand Aggarval, S. Chand Publications, 2003

.

BCS101	**FUNDAMENTALS OF COMPUTING AND PROGRAMMING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES

Students will understand the basics of computers and solve computer oriented problems using various computing tools.

COURSE OUTCOMES (COs)

CO1	Learn the fundamental principles in computing.
CO2	Learn to write simple programs using computer language
CO3	To enable the student to learn the major components of a computer system.
CO4	Computing problems
CO5	To learn to use office automation tools.
CO6	To interpret and relate programs

		Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low											
1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	L
2	CO1	H					H						
	CO2		L	H		M							
	CO3		L		S								
	CO4	M		M	W		M						
	CO5		L	L									
	CO6	H					H						
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Professional Elective (PE)		Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION TO COMPUTER 9

Introduction- Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers- Basic Computer Organization-Number system. Computer Software: Types of Software—System software-Application software-Software Development Steps

UNIT II PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program – Purpose – Algorithm – Flowcharts– Pseudo code Introduction to Office Packages: MS Word, Spread Sheet, Power Point, MS Access, Outlook.

UNIT III INTRODUCTION TO C 9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions. Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV ARRAYS AND STRUCTURES 9

Overview of C-Constants, Variables and Data types-Operators and Expressions -Managing Input and Output operators-Decision making-Branching and Looping.

UNIT V INTRODUCTION TO C++ 9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TEXT BOOKS:

1. Ashok, N.Kamthane,"Computer Programming", Pearson Education (2012).
2. Anita Goel and Ajay Mittal,"Computer Fundamentals and Programming in C", Dorling V Kindersley (India Pvt Ltd).,Pearson Education in South Asia,(2011).
3. Yashavant P. Kanetkar, "Let us C",13th Edition,BPB Publications(2013).
4. Yashavant P. Kanetkar,"Let us C++"10th Edition, BPB Publications (2013**).**

REFERENCES:

1. Pradeep K.Sinha, Priti Sinha "Foundations of Computing", BPB Publications (2013).
2. Byron Gottfried, "Programming with C", 2nd edition, (Indian Adapted Edition), TMH Publication.
3. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in 'C' First Edition, Oxford University Press(2009).
4. The C++ Programming Language , 4th Edition, Bjarne Stroustrop, Addison-Wesley Publishing Company (2013).

BSS101	**PERSONALITY DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	1	1	0	2
	Prerequisite – +2 Level Knowledge				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To make students groom their personality and prove themselves as good Samaritans of the society.

COURSE OUTCOMES (COs)

CO1	Individual or in-group class presentations pertaining to the applications of conce theories or issues in human development..
CO2	Scores obtained from essay and or objective tests.
CO3	Attendance, classroom participation, small group interactions.
CO4	Research and write about relevant topics.
CO5	Design and complete a research project that can take the form of a developmental intervi an observation or assessment through service learning.
CO6	Develop and maintain a Reflection

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	L
2	CO1	L		H				M					
	CO2		H	H				M					
	CO3							M	H				
	CO4									H	H		
	CO5							M			H	H	
	CO6							M					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 6

The concept personality- Dimensions of theories of Freud & Erickson- personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analyses.

UNIT II ATTITUDE & MOTIVATION 6

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III SELF-ESTEEM 6

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low selfesteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV OTHER ASPECTS OF PERSONALITY DEVELOPMENT 6

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics –Good manners and etiquette.

UNIT V EMPLOYABILITY QUOTIENT 6

Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TEXT BOOKS:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition, Prentice Hall.

REFERENCE BOOKS:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002

3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B. Body Language. Delhi: Rohan Book Company. 2004

BCE 101	**BASIC CIVIL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Civil Engineering				

OBJECTIVES: Understand the basic concepts of civil engineering.

COURSE OUTCOMES (COs)

CO1	Will gain knowledge in Design, concept preparation
CO2	Loading calculation
CO3	Structural component design
CO4	Drawing and chart preparation
CO5	Will understand the components of buildings.
CO6	Will learn the engineering aspects to dams , water supply and sewage disposal.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H	H			H		L					
	CO2					H	H						
	CO3							H	L				
	CO4									L			
	CO5										H	L	
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CIVIL ENGINEERING MATERIALS 8

Introduction – Civil Engineering – Materials – Stones – Bricks – Sand – Cement – Plain Concrete – Reinforced Cement Concrete – Steel Sections – Timber – Plywood – Paints – Varnishes (simple examples only)

UNIT II SURVEYING 5

Surveying – objectives – classification – principles of survey-Measurement of distances – Chain survey – Determination of areas – Use of compass – Use of leveling Instrument – (simple examples only)

UNIT III FOUNDATION FOR BUILDING 5

Bearing Capacity of Soil – Foundation – Functions – Requirement of good foundations – Types of foundations – Merits & Demerits.

UNIT IV SUPERSTRUCTURE 7

Stone Masonry – Brick Masonry – Columns – Lintels – Beams – Roofing – Flooring – Plastering– White Washing (Simple examples only)

UNIT V MISCELLANEOUS TOPICS 5

Types of Bridges –Dam- purpose – selection of site - Types of Dams – Water Treatment & Supply sources – standards of drinking- distribution system. – Sewage Treatment (simple examples only)

TEXT BOOKS:

1. Raju.K.V.B, Ravichandran .P.T, "Basics of Civil Engineering", Ayyappa Publications, Chennai, 2012.
2. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, (1st ed. 2005).
3. Dr.M.S.Palanisamy, "Basic Civil Engineering" (3rded. 2000), TUG Publishers, New Delhi/Tata McGrawHill Publication Co., New Delhi

REFERENCE BOOKS:

1. Rangwala.S.C, "Engineering Materials", Charotar Publishing House, Anand, 41st Edition: 2014.
2. National Building Code of India, Part V, "Building Materials", 2005
3. Ramesh Babu"A Textbook on Basic Civil Engineering" (1998). Anuradha Agencies, Kumbakonam.
4. RamamruthamS., "Basic Civil Engineering", DhanpatRai Publishing Co. (P) Ltd. (1999).

BME101	**BASIC MECHANICAL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

- The program educational objectives (PEOs) for the mechanical-engineering program are to educate graduates who will be ethical, productive, and contributing members of

society.

- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- The ability to apply principles of engineering, basic science, and mathematics to design and realize physical systems, components, or processes

COURSE OUTCOMES (COs)

CO1	an ability to apply knowledge of mathematics
CO2	an ability to apply knowledge of science, and engineering
CO3	Ability to design and conduct experiments, as well as to analyze and interpret data.
CO4	an ability to function on multi-disciplinary teams
CO5	ToprovidebasicKnowledgeofbasicmanufacturingprocess.
CO6	ability to identify, formulate, and solve engineering problems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ENERGY RESOURCESANDPOWER GENERATION 6

RenewableandNon-renewableresources-solar,wind,geothermal,steam,nuclearandhidel powerplants-Layout,
majorcomponentsandworking.ImportanceofEnergystorage,Environmentalconstraintsofpowergeneration usingfossil fuelsandnuclearenergy.

UNIT II IC ENGINES 6

Classification,workingprinciplesof petrol anddiesel engines-twostroke andfourstroke cycles,functionsofmain componentsofICengine.Alternatefuelsandemissioncontrol.

UNIT III REFRIGERATION AND AIR-CONDITIONINGSYSTEM 6

Terminologyof Refrigerationand Air-Conditioning,PrincipleofVaporCompression& Absorptionsystem- Layoutoftypicaldomesticrefrigerator-window&Splittyperoomairconditioner.

UNIT IV MANUFACTURING PROCESSES 6

BriefdescriptionofMouldmakesandcastingprocess,Metalforming,Classification typesofforging, forging operations, Briefdescription ofextrusion,rolling,sheetforging,anddrawing.Briefdescription ofwelding,brazing andsoldering.Principalmetalcuttingprocessesandcuttingtools,Brief descriptionofCentrelatheandradial drillingmachine.

UNITV MECHANICALDESIGN 6

Mechanicalpropertiesofmaterial-Yieldstrength,ultimatestrength,endurancelimitetc.,Stress-Strain curvesof materials.Stresses inducedinsimpleelements.Factorofsafety-Design ofShaftsandbelts. Typesofbearingsand itsapplications.Introductionto CAD/CAM/CIM&Mechatronics.

TEXTBOOKS:

1. T.J.Prabhuetal, "BasicMechanicalEngineering", SciTechPublications(p)Ltd,2000

REFERENCES:

1. NAGPAL,G.R,"PowerplantEngineering",KhannaPublishers,2004.
2. RAO.P.N,"ManufacturingTechnology",TataMcGraw-HillEducation,2000.
3. Kalpakjian,"ManufacturingEngineeringandTechnology",AdissoWesleypublishers,1995.
4. Ganesan.V,"Internalcombustionengines",TataMcGraw-HillEducation,2000.
5. C.P.Arora,"RefrigerationandAir Conditioning",TataMcGraw-HillEducation,2001.
6. V.B.Bhandari,"DesignofMachineelements",TataMcGraw-HillEducation,2010.

BCM1L1	BASIC CIVIL & MECHANICALENGINEERING PRACTICES LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Department of Mechanical Engineering& Civil Engineering				

OBJECTIVES

To provide exposure to the students with hands on experience on various basic Civil & Mechanical Engineering practices.

COURSE OUTCOMES (COs)

CO1	Learn Basic concepts
CO2	Students will get exposure regarding pipe connection for pumps & turbines and to study the joint used in roofs, doors, windows and furniture's.
CO3	Students will get exposure regarding smithy, foundry operations and in latest welding operations such as TIG, MIG, CO2, spot welding etc.,
CO4	Students will get hands on experience on basic welding techniques, machining and sheet metal works.
CO5	Students will get hands on experience on basic machining techniques
CO6	Students will get hands on experience on basic sheet metal techniques

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H	L										
	CO2				H								
	CO3					H	L	L					
	CO4		H				M		L			H	
	CO5		H				M		L			H	
	CO6		H				M		L			H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS

I. CIVILENGINEERINGPRACTICE

Buildings:

a) Studyofplumbingandcarpentrycomponentsofresidentialandindustrialbuildings.Safetyaspects.

PlumbingWorks:

a) Studyofpipelinejoints,itslocationandfunctions:valves,taps,couplings,unions,reducers,elbowsin householdfittings.

b) Studyofpipeconnectionsrequirementsforpumpsandturbines.

c) Preparationofplumbinglinesketchesforwatersupplyandsewageworks.

d) Hands-on-exercise:BasicpipeconnectionofPVCpipes&G.I.Pipes–Mixedpipematerialconnection–Pipe connectionswithdifferentjoiningcomponents.

e) Demonstrationofplumbingrequirementsofhigh-risebuildings.

CarpentryusingHandtoolsandPowertools:

a) Studyofthejointsinroofs,doors,windowsandfurniture.

b) Hands-on-exercise:Woodwork,jointsbysawing,planningandcutting.

c) Preparationofhalfjoints,MortiseandTenonjoints.

II MECHANICALENGINEERINGPRACTICE

Welding:

a) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

BasicMachining:

a) Simple Turning and Taper turning

b) Drilling Practice

SheetMetalWork:

a) Forming&Bending:

b) Modelmaking–Trays,funnels, etc.

c) Differenttypeofjoints
d) Preparationofair-conditioningducts
e) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

Machineassemblypractice:

a) Assembling,dismantlingand Studyofcentrifugalpump
b) Assembling,dismantlingand Studyofairconditioner
c) Assembling,dismantlingandStudyoflathe

Moulding:

a) Mouldingoperationslikemouldpreparationfor gearandstepconepulleyetc

Fitting:

a) Fitting Exercises–Preparationofsquarefittingandvee–fittingmodels.

Demonstration:

a) Smithyoperations,upsetting,swaging,settingdownandbending.Example–Exercise–Productionofhexagonalheaded bolt.
b) Gaswelding.

REFERENCES:

1. K. Jeyachandran, S. Nararajan& S, Balasubramanian, "A Primer on Engineering Practices Laboratory" ,Anuradha Publications, (2007).
2. T.Jeyapoovan, M. Saravanapandian& S. Pranitha, "Engineering Practices Lab Manual",Vikas Publishing House Pvt. Ltd. (2006)
3. H. S. Bawa, "Workshop Practice", Tata McGraw–Hill Publishing Company Limited, (2007).
4. A. Rajendra Prasad & P. M. M. S Sarma, "Workshop Practice", SreeSai Publication, (2002).
5. P. Kannaiah& K.L. Narayana, "Manual on Workshop Practice", Scitech Publication, (1999).

BPC 1L1/2L1	**PHYSICS AND CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				

OBJECTIVES: To impart knowledge to the students in practical physics and chemistry

COURSE OUTCOMES (COs)

CO1	Students will understand the concept of hall effect
CO2	Students will understand the concept of semiconductors. .
CO3	Student will understand the working of spectrometer.
CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M

	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective	Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
				√									
4	Approval	37th Meeting of Academic Council, May 2015											

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS1L5/2L5	NSS PRACTICAL	L	T	P	C
	Total Contact Hours – 45	0	1	2	1

OBJECTIVES

1. Understand the community in which they work and their relation
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop capacity to meet emergencies and natural disasters
4. Practice national integration and social harmony and
5. Utilize their knowledge in finding practical solutions to individual and community problems.

1. Regular Activities Programme

1) Traffic regulation
2) Working with Police Commissioner's Office
3) Working with Corporation of Chennai
4) Working with Health Department
5) Blind assistance
6) Garments collection
7) Non-formal education
8)Environmental Education, Awareness and Training (EEAT)
9) Blood donation

2.Special camp Programme

A) Legal awareness
B) Health awareness
C) First-aid
D) Career guidance
E) Leadership training - cum - Cultural Programme
F) Globalization and its Economic Social Political and Cultural impacts.

REFERENCE BOOKS:

1. National Service Scheme Manual, Government of India.
2. Training Programme on National Programme scheme, TISS.
3. Orientation Courses for N.S.S. Programme officers, TISS.
4. Case material as Training Aid for field workers, Gurmeet Hans.
5. Social service opportunities in Hospitals, Kapil K.Krishan,TISS.
6. Social Problems in India, Ram Ahuja.

BEN201	**ENGLISH II**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – English I				
	Course Designed by – Department of English				

OBJECTIVES

Students will be able to actively participate in group discussions. Students will have Telephonic Skills, Giving Directions and Information Transfer

COURSE OUTCOMES (COs)

CO1	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)
CO2	To make students comprehend the habit of intelligent Reading as well as Computer-based competitive exams glob

CO3	To achieve a reasonably good level of competency in Report Writing.
CO4	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)
CO5	To achieve a reasonably good level of competency in group discussions
CO6	To achieve a reasonably good level of competency in public speaking

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	M	L	H	L	M			H		M	L	
	CO2			H	L				H		M	L	
	CO3			H	L	M			H		H	L	
	CO4			H	L	M			H		M	L	
	CO5			H	L	M			H		M	L	
	CO6			H	L	M			H		M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
		√							
4	Approval		37th Meeting of Academic Council, May 2015						

UNIT I ORIENTATION 12

Numerical adjectives - Meanings in context - Same words used as different parts of speech -Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II ORAL SKILL 12

Listening to audio cassettes - CDs, News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - and Giving Instructions - Reading Comprehension answering questions. Inferring meaning.

UNIT III THINKING SKILL 12

Self- introduction describing –Group Discussion – Debate –Role play- Telephone- Things- etiquette- Recommendation and Sequencing jumbled sentences to make a suggestions-paragraph-advertisement and notice, Designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV WRITING SKILL 12

Definitions - Compound nouns - Abbreviations and acronyms – (a) business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) Letters to the editor (giving suggestions on an issue)

UNIT V FORMAL INFORMATION 12

Editing – Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

TEXT BOOK:

1. Meenakshi Raman, Sangeetha Sharma, Technical English for Communication: Principle and Practice, OUP, 2009.

REFERENCE BOOKS:

1. Sumanth , English for Engineers, Vijay Nicole , Imprints pvt ltd.2013.
2. Meenakshi Raman and Sangeetha Sharma, Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binodmishra, Communication skills for engineers and scientists, PHI Learning Pvt Ltd, New Delhi, 2010.

BMA201	**MATHEMATICS – II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – Mathematics I				
	Course Designed by – Department of Mathematics				

OBJECTIVES

Ability to apply these principles of mathematics in projects and research works.

COURSE OUTCOMES (COs)

CO1	Student shall be able to Solve differential equations, simultaneous linear equations, and sc special types of linear equations related to engineering.
CO2	Relate the use of mathematics in applications of various fields namely fluid flow, heat fl solid mechanics, electrostatics, etc.
CO3	Ability to test hypothesis
CO4	Find intensity of degree of relationship between two variables and also bring out regress equations.
CO5	Understand to solve matrix problems related to real life problems.
CO6	Formulate mathematical models

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H		L									
	CO2		H				H		L	L		M	
	CO3		H				H		L	L		M	
	CO4					M						M	
	CO5										M	M	
	CO6										M		

3	Category	Humanities & Social	Basic Sciences	Engg Sciences	Professional Core	Professional Electi	Non-Major Electi	Open Electi ve	Project/Term
			√						
4	Approval		37th Meeting of Academic Council, May 2015						

UNIT I ORDINARY DIFFERENTIAL EQUATION 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters **– Cauchy's** and L**egendre's linear equations** - simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient, divergence and curl –Directional derivatives –Irrotational and solenoidal vector fields – vector integration**– Green's theorem in a plane, Gauss divergence theorem and** S**toke's theorem (**without proofs) **–** simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable **–** Analytic functions **–** Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) **–** Harmonic and orthogonal properties of analytic functions **–** Harmonic conjugate **–** construction of analytic functions **–** conformal mapping: W= Z+C, CZ, 1/Z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration **– Statement and application of Cauchy's integral theorem and Cauchy's integral formula –**Taylor and Laurent expansions **–** Singular points **–** Residues **–** Residue theorem **–** Application of Residue theorem to evaluate real integrals **–** Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V STATISTICS 12

Mean, Median, Mode **–** Moments **–**Skewness and Kurtosis **–** Correlation **–** Rank Correlation **–** Regression **–**Chi square test for contingency tables.

TEXT BOOK:

1. R.M.Kannan and B.Vijayakumar" Engineering Mathematics–II "2nd Edition, SRB Publication, Chennai 2007.
2. Bali.N.P and Manish Goyal , "Engineering Mathematics", 3rd Edition, Laxmi Publications (P) Lltd, 2008 .
3. Grewal .B/S "Higher Engineering Mathematics", 40th Editon, Khanna Publications, Delhi, 2007

REFERENCES :

1. Ramana.B.V, "Higher Engineering Mathematic", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Gupta SC, and VK.Kapoor, "Fundamentals Mathematical Statistics", 11th edition, Sultan Chand Sons, New Delhi, 2014.

	ENGINEERING PHYSICS -II	**L**	**T**	**P**	**C**

BPH201	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING PHYSICS -I				
	Course Designed by – Department of Physics				

OBJECTIVES

- To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications
- To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

COURSE OUTCOMES (COs)

CO1	Understand about properties and advancements of conducting materials.
CO2	Understand the principle and properties semiconducting materials.
CO3	Acquire Knowledge on Magnetic and dielectric Materials.
CO4	To Know about the creation of new materials with novel properties
CO5	To Understand the impact of modern materials in technical uses.
CO6	Learn new engineering materials and its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L								
	CO5		L	L									
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications.

TEXT BOOKS:

1. Jayaraman D Engineering Physics II. Global Publishing House, 2014.
2. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
3. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

REFERENCES:

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4 http://ocw.mit.edu/courses/find-by-topic
5 http://nptel.ac.in/course.php?disciplineId=122
6 https://en.wikipedia.org/wiki/Engineering_physics

BCH 201	**ENGINEERING CHEMISTRY-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING CHEMISTRY –I				
	Course Designed by – Department of Chemistry				
OBJECTIVES To impart a sound knowledge on the principles of chemistry involving application oriented topics required for all engineering branches.					
COURSE OUTCOMES (COs)					

CO1	Students will understand the concepts and further industrial applications of surface chemistry
CO2	To impart knowledge about the Industrial importance of Phase rule and alloys
CO3	To make the students to be conversant with Analytical techniques of chemistry and their importance
CO4	To have an idea and knowledge about the Chemistry of Fuels and
CO5	Understanding of engineering materials
CO6	All about bonding and molecular structures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L		H		H				M	
	CO2		H			H		H					
	CO3	H		L		H		H				M	
	CO4			L		H		H					
	CO5			L		H		H					
	CO6			L		H		H		H		M	

3	Category	Humanities & Social	Basic Sciences	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project /Term Paper/ Semin
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I SURFACE CHEMISTRY 9

Introduction **:** Adsorption , absorption , desorption , adsorbent , adsorbate and sorption – (definition only) Differences between adsorption and absorption Adsorption of gases on solids – factors affecting adsorption of gases on solids – Adsorption isotherms –Frendlich adsorption isotherm and Langmuir adsorption isotherm Role of adsorbents in catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II PHASE RULE AND ALLOYS 9

Introduction **:**Statement of Phase Rule and explanation of terms involved – one component system – water system – Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) – eutectic temperature – eutectic composition – Pattinsons Process of desilverisation of Lead Alloys: Importance, ferrous alloys –nichrome and stainless steel – 18/8 stainless steel -heat treatment of steel – annealing – hardening – tempering normalizing – carburizing - nit riding . Non- ferrous alloys: Brass and Bronze

UNIT III ANALYTICAL TECHNIQUES 9

Introduction: Type of Spectroscopy - Atomic spectroscopy – molecular spectroscopy - Explanation IR spectroscopy – principles – instrumentation (block diagram only) – applications - finger print region UV-visible spectroscopy –– principle – instrumentation (block diagram only) – Beer-**Lambert's law**- – estimation of iron by colorimetry– Atomic absorption spectroscopy- principle - instrumentation (block diagram only) - estimation of Nickel by Atomic absorption spectroscopy

Flame photometry– principles – instrumentation (block diagram only) - estimation of sodium ion by Flame photometry

UNIT IV FUELS 9

Introduction **:** Calorific value – types of Calorific value - gross calorific value – net calorific value Analysis of Coal –- Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only) Flue gas analysis – importance - Orsat apparatus

UNIT V ENGINEERING MATERIALS 9

Introduction: Refractory's – classification – acidic, basic and neutral refractory's – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Manufacture of Refractory's: alumina bricks and Magnesite bricks, Abrasives – natural and synthetic abrasives Natural type : Siliceous - quartz ; Non –siliceous – diamond Synthetic Abrasives : silicon carbide and boron carbide. Lubricants: Liquid lubricants - Properties – viscosity index, flash and fire points, cloud and pour points, oiliness) Solid lubricants – graphite and molybdenum sulphide

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub. Co.Ltd, New Delhi,(2008)
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Spectroscopy

BCS 202	INTERNET PROGRAMMING	L	T	P	C
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Dept of Information Technology				

OBJECTIVES

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science.

COURSE OUTCOMES (COs)

CO1	To enable the student to learn the major components of a computer system.

CO2	To know the correct way of solving problem.
CO3	To identify efficient way of solving problem.
CO4	To learn to use office automation tools.
CO5	To implement office automation tools
CO6	To learn and write program in "C".

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Human	Basic Sc	Engg Sc	Professio	Core Elect	Non-	Open	Project
				√					

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I BASIC INTERNETCONCEPTS 6

Internet principles-IPaddressing-Internet Service Provider (ISP)-URL-Basic web concepts-World WideWeb (WWW)-Intranet and Extranet-Internet Protocols: HTTP, TCP, UDP, FTP, Telnet-Domain Name System(DNS)-E mail-Next generation internet.

UNIT II WEBDESIGNBASICS 6

Introduction to HTML–Structureof HTMLDocument– Tags-Headings–Links–Images–Lists–Tables –Forms–Frames-Style sheets andits types.

UNITIII DYNAMIC HTML 6

Introduction to DynamicHTML-Object modeland collections-Event model-Filters and transition-Data binding-Data control-Activexcontrol.

UNIT IV CLIENT ANDSERVERSIDEPROGRAMMING 6

VBScript&JavaScript:Introduction-Operators–Data type-Control structures-Looping–Classes andObjects–Arrays-Functions-Events-Exampleprograms.

UNITV INTERNETAPPLICATIONS 6

Onlinedatabase-functionsofonlinedatabase-MeritsandDemerits-InternetInformationSystems (IIS)-EDIapplications inbusiness and its types-Internet commerce-Types and Applications

.

TEXT BOOKS:

1. Deitel, Deitel and Nieto, ''Internet and World Wide Web- How to program'', Pearson Education Publishers, 5th edition, 2008.

2. Elliotte Rusty Harold, ''Java Network Programming'', O'Reilly Publishers, 2010
3. Java Script: A Beginners Guide John Pollock 4th Edition, TMH Edition (2013)
4. VB Script Beginners Guide, Jyoti B. Giramkar, Create Space Independent Publishing (2014)

REFERENCES:

1... Krishnamoorthy &S.Prabhu, ''Internet and Java Programming'', New Age International Publishers, 2010.
2. Thomno A.Powell, ''The Complete Reference HTML and XHTML'', fourth edition, Tata McGraw Hill, 2001
3. E Commerce Kamlesh K.Bajaj, Debjani Nag, Tata McGraw Hill, Second edition, 2010

BFR 20	**FRENCH**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

Language gives access and insights into another culture. It is a fundamental truth that cultures define themselves through languages.

COURSE OUTCOMES (COs)

CO1	Introduce the basics of the language to beginners
CO2	Understand a dialogue and dialogue presentation
CO3	To develop their knowledge as well as their communicative skills so as to be able to respond in simple everyday contexts.
CO4	Synchronies I includes documents which initiate the learners to another world, another culture and which acclimatize them to the authentic use of the French language through the exploitation of written and iconographic documents. The Indian context has been used.
CO5	Grammatical and lexical notions as well as activities required for communication are learnt by the students.
CO6	Interpreting skills and confidence in the language.
CO6	Interpreting skills and confidence in the language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humaniti	Basic Sc	Engg Sc	Prof es	Core El	Non - M	Ope	Proj ect /T er
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 8

At the airport: Savoir– faire: exchanging greetings, self introduction, introducing another, welcoming someone, identifying someone - Grammar: verbs 'to be', 'to call oneself', subject pronouns, interrogation

UNIT II GRAMMAR 8

At the University: Savoir-faire: enquiring after one's welfare, taking leave, expressing appreciation - Grammar: definite & indefinite articles, gender of nouns, adjectives, present tense of regular 'er' verbs, 'to have', 'to learn', negation, irregular verbs

UNIT III CONVERSATION 8

At the café: Savoir –faire: speaking about one's likes, giving information, expressing admiration, asking information about someone - Grammar: Interrogative adjectives, irregular verbs, possessive and interrogative adjectives

UNIT IV PROPOSAL WRITING 7

At the beach: Savoir faire: proposing an outing, accepting/ refusing the proposal - Grammar: singular & plural, indefinite pronoun, demonstrative adjectives, negation, irregular verbs

UNIT V FORMAL LETTERS 7

A concert: Savoir –faire: inviting, accepting, expressing one's inability to accept an invitation

UNIT VI REGULAR & IRREGULAR VERBS 7

Grammar: Present tense of more irregular verbs, contracted articles, future tense, interrogative adverbs, **At Nalli's** Savoir- faire: asking the price of an article, protesting against the price, Grammar: possessive adjectives, Exclamative adjectives, imperative tense

REFERENCES:

1. Course Material: Synchronie I –Méthode de Français
2. Madanagobalane -Samita Publications, Chennai, 2007

	GERMAN	L	T	P	C
BGM201	Total Contact Hours – 45	3	0	0	3
	Prerequisite +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

At the end of this course, students shall be able to obtain good knowledge of the language, to r write and speak German, whereby the emphasis is laid on speech.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand German lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

Course structure:

A. German Language (speaking, reading, writing, grammar and test)
B. Life in Germany (shopping, restaurant, doctor, government, bank, post)
C. The German Way (introduction, doing business, conversation, meetings, dining)
D. Germany (Culture, Climate)

UNIT I PRONOUNCIATION 9

Welcome: Introduction to the Language, Spelling and Pronunciation (The alphabets and numbers) Greetings, ordering, requesting, saying thank you - Grammar **– the article "the", conjugation** of verbs

UNIT II SELF INTRODUCTION 9

Shopping - Grammar **–** adjectives, endings before nouns, practice. Self introduction

UNIT III TRAINING 9

Addresses, Occupations, Studies - Grammar - **'to be', the definite/indefinite** articles, individual Training

UNIT IV ORAL **9**

Leisure Time, Sports, Hobbies - Grammar – position of a verb in a main clause , oral practice

UNIT V NARRATION **9**

At a Restaurant, Food and Drink - Grammar – the personal pronoun in the Nominative and Accusative, Narrating an event

RESOURCES:

1. Sprachkurs Deutsch 1 (Verlag Diesterweg), New Delhi Learning Centre

BJP201	**JAPANESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Japanese language, Japanese culture and heritage
To impart knowledge Japanese lifestyle.
To give sufficient exposure to develop basic conversational skills.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Japanese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CULTURAL HERITAGE 9

Introduction-history and origin of Japanese language-Japan and its cultural heritage-Self introduction-counting numbers (1-100)-time-conversation with the use of audio devices, grammar– usage of particles wa, no, mo and ka

UNIT II USAGE 9

Greetings, seasons, days of the week and months of the year-numbers (up to 99,999)-grammar– usage of kore, sore, are, kono, sono, ano, koko and kochira, arimasu and imasu-i-ending and na-ending adjectives-use of audio and drills for practice

UNIT III ORAL 9

Asking the price–associated vocabulary-usage of particles ni, ga and ne- use of audio and drills for practice-Introduction to basic Kanji characters- use of audio and drills for practice

UNIT IV ART AND CULTURE 9

Family relationships- colours-Kanji (numbers) and festivals of Japan-religion-Japanese art and culture-ikebana, origami-introduction to hiragana- use of audio and drills for practice

UNIT V DRILLS AND PRACTICE 9

Vocobulary associated with directions-asking way-particles – e, de, mo, koko, soko, asoko, doko, nani, mae, ushiro, ue, shita- use of audio and drills for practice-introduction to katakana

TEXT BOOKS

1. Japanese Hiragana and Katakana for beginners, Timothy G. Stout, 2011
2. Genki I: An integrated course in elementary Japanese, Eri Banno and Yuko Ikeda, 2011

REFERENCE BOOKS

1. Japanese Reader collection Volume I, Yumi Boutwell and Clay Boutwell, Kotoba books, 2013
2. Living Language Japanese Complete Edition beginners through advanced course, Living Language, 2012

BKR201	KOREAN	L	T	P	C
	Total Contact Hours - 45	3	1	0	3

	Prerequisite – +2 Level English
	Course Designed by – Department of English

OBJECTIVES

To have a basic knowledge of Korean language, Korean culture and heritage

To impart knowledge on Korean lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Korean lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PLANNING 9

Asking/giving reasons for studying Korean, making plans for the holiday, writing letters, describing past travel experiences and future travel plans, shopping in a grocery store, shopping in electronics store, storytelling Grammar: would like to (do), want to (do), construct future tense.

UNIT II MODIFIERS 9

Asking about feelings, asking about problems and giving advice, brief introductions - Grammar: Noun modifier, please try doing (something), irregular adjective/verb

UNIT III PLACING ORDERS 9

Asking about hobbies, asking about abilities (sports), job requirements, Ordering things for delivery, ordering a meal at a restaurant - Grammar: Sentence ending for the honorific form, please do something for me, have tried (something),

UNIT IV DESCRIPTIONS 9

Asking about evening plans, making plans with others, making preparations - Asking about rooms, describing your room to your classmates, describing your house. Grammar: to know/not know how to do something, must (do), have to (do), should,

UNIT V GRAMMAR 9

Describing your plans and giving reasons, cancelling appointments. Grammar: Shall we~? / Should we~?, with, and, irregular verbs/adjective, so, because, cannot, intend to, plan to, or hope to, (more) than, the most, tag question/is n't it? ,will (do)

COURSE MATERIAL:

Korean for Non-Native Speakers (Student Book 1B) Korean Language Education Center, Sogang University

BCN201	**CHINESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Chinese language, Chinese culture and heritage

To impart knowledge on Chinese lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Chinese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT 1 RISE OF DIALECTS 9

History, Origins, Old and middle Chinese, Rise of northern dialects

UNIT II VARIETIES 9

Influences 3 Varieties of Chinese. 1.Classification 2.Standard Chinese and 3.Nomenclature

UNIT III CHARACTERS 9

Chinese characters, Homophones, Phonology

UNIT IV TRANSCRIPTIONS 9

Tones, Phonetic transcriptions, Romanization, Other phonetic transcriptions

UNIT V GRAMMAR 9

Grammar and morphology, Vocabulary, Loanwords, Modern borrowings and loanwords

REFERENCES:

1. Hannas, William C. (1997), Asia's Orthographic Dilemma, University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-1892-0" 978-0-8248- 1892-0.
2. Qiu, Xigui (2000), Chinese Writing, trans. Gilbert Louis Mattos and Jerry Norman, Society for the Study of Early China and Institute of East Asian Studies, University of California, Berkeley, ISBN HYPERLINK http://en.wikipedia.org/wiki/Special:BookSources/978-1-55729-071-7,978-1-55729-071-7.
3. Ramsey, S. Robert (1987), The Languages of China, Princeton University Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-691-01468-5" 978-0-691-01468-5.
4. Schuessler, Axel (2007), ABC Etymological Dictionary of Old Chinese, Honolulu: University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-2975-9"978-0-8248-2975-9.
5. R. L. G. " Language borrowing Why so little Chinese in English?" The Economist. June 6, 2013.

BBT201	**PRINCIPLES OF GENETICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – Basic biology, concepts in genetics				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a fundamental knowledge on genetics, its laws, genes and chromosomes, inheritance, heredity, causes of genetic disorders and the methods of gene transfer

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals of genetics and the Mendelian laws

CO2	To understand about the structure and organization of chromosomes in prokaryotes and eukaryotes
CO3	To understand about the structure and organization of chromosomes in eukaryotes
CO4	To understand the concept of alleles in blood grouping and sex determination
CO5	To know the concept of linkage and crossing over of genes
CO6	To get a basic knowledge of the methods of gene transfer

UNIT I BASICS OF GENETICS 6

Classical genetics, Mendelian Laws- Mendel's experiment-monohybrid cross-phenotype, genotype, Dihybrid inheritance, Interaction of genes, Fine structure of Genes

UNIT II CHROMOSOMES 6

Chromosome structure and organization in prokaryotes and eukaryotes, unusual chromosomes-chromosome banding, chromosome abnormalities- genetic disorders

UNIT III ALLELES 6

Classical concepts of Pleomorphism, Multiple alleles, ABO blood groups, Rh factor, sex linkage in Drosophila, linkage in human beings, mechanism of sex determination, XX-XY mechanisms of sex determination, sex determination in Drosophila, environmental factors and sex determination, sex differentiation.

UNIT IV CROSSING OVER 6

Coupling and Repulsion-Hypothesis, Test cross in maize and crossing over, theory of crossing over, molecular mechanism of crossing over, sex chromosomes and sex linked inherited disorders, colour blindness, hemophilia, Muscular dystrophy.

UNIT V GENE TRANSFER 6

Transformation, Tansduction, Conjugation, Plasmids and Episomes

TEXT BOOKS:

1. Principles of Genetics, Gardner, Simmons and Snustad, John Wiley and Sons (Asia), 2002
2. Genes VIII, Lewin, International Edition, Prentice Hall, 2004

REFERENCE BOOKS:

1. Instant Notes in Genetics, P.C. Winter, G.I. Hickey and H.L. Fletcher, Viva Books Private Limited, 2003
2. Weblink: nptel

BEE 201	**BASIC ELECTRICAL ANDELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Engineering Mathematics, Engineering Physics-I & II				
	Course Designed by – Department of Electrical & Electronics Engineering				
OBJECTIVES: To understand the laws of electrical engineering.					

COURSE OUTCOMES (COs)	
CO1	Students will gain knowledge regarding the various laws and principles associated with electrical systems.
CO2	Students will gain knowledge regarding electrical machines and apply them for practical problems.
CO3	Students will gain knowledge regarding various types semiconductors.
CO4	Student will gain knowledge digital electronics.
CO5	Student will gain knowledge on electronic systems.
CO6	Students will acquire knowledge in using the concepts in the field of electrical engg. projects and research.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L			
	CO2		H	M			L		L	L			
	CO3		H	M			L		L				
	CO4	M	H	M			L		L	L			
	CO5	M	H	M			L		L				
	CO6		H				L		L	H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ELECTRIC CIRCUITS 6

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem –Thevenin's and Norton's Theorem -Problems.

UNIT II ELECTRICAL MACHINES 6

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT III BASIC MEASUREMENT SYSTEMS 6

Introduction to Measurement Systems, Construction and Operating principles of PMMC, Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method **–** and Energy meter.

UNIT IV SEMICONDUCTOR DEVICES 6

Basic Concepts of semiconductor devices **–** PN Junction Diode Characteristics and its

Applications – HWR, FWR –Zener Diode – BJT (CB, CE, CC) configuration & Characteristics.

UNIT V DIGITAL ELECTRONICS 6 (

Number system – Logic Gates – Boolean Algebra– De-**Morgan's Theorem** – Half Adder & Full Adder – Flip Flops.

TEXT BOOKS:

1. N.Mittal "Basic Electrical Engineering". Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
3. Jacob Millman and Christos C-Halkias, "Electronic Devices and Circuits", Tata McGraw Hill

REFERENCE BOOKS:

1. Edminister J.A. "Theory and Problems of Electric Circuits" Schaum's Outline Series. McGrawHill Book Compay, 2nd Edition, 1983.
2. Hyatt W.H and Kemmerlay J.E. "Engineering Circuit Analysis", McGraw Hill Internatinal Editions, 1993.
3. D. P. Kothari and I. J. Nagrath" Electric Machines"Tata McGraw-Hill Education, 2004
4. Millman and Halkias, "Integrated Electronics", Tata McGraw Hill Edition, 2004.

BCS2L1	INTERNET PRACTICES LABORATORY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Internet Programming				
	Course Designed by – Dept of Information Technology				

OBJECTIVES

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer sc

COURSE OUTCOMES (COs)

CO1	To enable the student to learn the major components of a computer system.
CO2	To know the correct and efficient way of solving problem.
CO3	To identify and implement the correct and efficient way of solving problem.
CO4	To learn to use office automation tools.
CO5	To infer from use office automation tools.
CO6	To learn and write program in "C".

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M

	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective	Non-Major Elective	Open Elective	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. **HTML (Hypertext Mark-up Language):**
   Basics of HTML.
   How to create HTML Document
   Steps for creating a simple HTML Program.
   a) Favorite Personality
   b) Resume Preparation
2. **ADVANCED HTML:** Advanced Topics of HTML
   a) Time Table
   b) Table Creation
3. **JAVASCRIPT:**
   Script Basics.
   Incorporating JavaScript into Web page.
   a) Star Triangle
   b) Temperature Converters
   Script Basics.
   Incorporating JavaScript into Web page.
   a) Star Triangle
   b) Temperature Converters
4. **VBSCRIPT:**

VBScript Basics.
Incorporating VBScript into HTML.
a) Changing Background Color
b) Simple Calculator

5. **WEB DESIGN:**

Inserting External Media in the Web Page.
a) Forms and Links
b) Frames with Links and Lists
To export a Dream weaver Document as XML File, checking entries, working in frames, windows control, the java script URL.

	COMPUTER PRACTICE LABORATORY	**L**	**T**	**P**	**C**

BCS 2L2	Total Contact Hours - 45	0	0	3	1
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Department of Computer Science &Engineering				

OBJECTIVES: To impart basic computer knowledge

COURSE OUTCOMES (COs)

CO1	Demonstrate major algorithms and data
CO2	Implementation of array operations
CO3	Implementation of binary tree.
CO4	Implementation of linked list
CO5	Students will able to do analyse data using spread sheet
CO6	Student will able to understand the basics of C programming.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H	H	L	H		H		L		H	H	H
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

A) WORD PROCESSING **6**

Document creation, Text manipulation with Scientific Notations. Table creation Table formatting and Conversion. Mail merge and Letter Preparation. Drawing-Flow Chart

B) SPREAD SHEET **9**

Chart-Line Xy Bar and Pie – Formula-Formula Editor-Spread sheet-Inclusion of Object, Picture and Graphics Protecting the document and sheet-Sorting and Import/Export features.

C) SIMPLE C PROGRAMMING* **15**

Data types, Expression Evaluation, Condition Statement. Arrays structures and Unions – Functions

D) SIMPLE C++PROGRAMMING **15**

-Classes and Objects

-Constructor and Destructor

***For Programming exercises Flow chart and Pseudo code are essential.**

BEE2L1	**BASIC ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Basic Electrical and Electronics Engineering				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To enhance the student with knowledge on electrical and electronic equipments.

COURSE OUTCOMES (COs)

CO1	Students will able to handle basic electrical equipments.
CO2	Students will able to do staircase wiring.
CO3	Students will able to understand domestic wiring procedures practically.
CO4	Student will able to assemble electronic systems.
CO5	Students will understand all the fundamental concepts involving electrical engineering
CO6	Students will understand all the fundamental concepts involving electronics engineering

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	
	CO5	M	H	M			L		L		M	H	
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

I LIST OF EXPERIMENTS FOR ELECTRICAL ENGINEERING LAB

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit

4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

II LIST OF EXPERIMENTS FOR ELECTRONICS ENGINEERING LAB

1. Study of electronic components and equipments.
   a. Resistor colour coding using digital multi-meter.
   b. Assembling electronic components on bread board.
2. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

BPC 1L1/2L1	**PHYSICS AND CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				

OBJECTIVES: To impart knowledge to the students in practical physics and chemistry

COURSE OUTCOMES (COs)

CO1	Students will understand the concept of hall effect
CO2	Students will understand the concept of semiconductors. .
CO3	Student will understand the working of spectrometer.
CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

I -LIST OF EXPERIMENTS – PHYSICS

14. Determination of Wavelength, and particle size using Laser
15. Determination of acceptance angle in an optical fiber.
16. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
17. Determination of wavelength of mercury spectrum – spectrometer grating
18. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
19. Determination of Young‟s modulus by Non uniform bending method
20. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
21. Determination of Young‟s modulus by uniform bending method
22. Determination of band gap of a semiconductor
23. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
24. Determination of Dispersive power of a prism - Spectrometer
25. Determination of thickness of a thin wire – Air wedge method
26. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS1L7/BSS2L7 YOGA FOR EMPOWERMENT

L T P C
0 1 2 1

OBJECTIVE:

Providing Value Education to improve the Students' character - understanding yogic life and physical health - maintaining youthfulness - Measure and method in five aspects of life

UNIT I PHYSICAL HEALTH 6

Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment.

Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.

Yogasanas 1: Pranamasana - Hastha Uttanasana - Pada Hasthasana - Aswa Sanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana.

Pranayama: Naddi suddi - Clearance Practice - Benefits.

Simplified Physical Exercise - Kayakalpa Practices - Meditation Practices.

UNIT II LIFE FORCE 6

Reasons for Diseases: Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)

Philosophy of Kaya kalpa: Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind.

Maintaining youthfulness: Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid - Measure and method in five aspects of life - Controlling undue Passion.

Kayakalpa practice: Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

UNIT III MENTAL HEALTH 6

Mental Frequencies: Beta, Apha, Theta and Delta wave-Agna Meditation explanation-benefits.

Shanti meditation: Shanthi Meditation explanation-benefits

Thuriya Meditation: Thuriya Meditation explanation-benefits

Benefits of Blessing: Self blessing(Auto suggestion) - Familyblessing-Blessing the others-World blessing-Divineprotection

UNIT IV VALUES 6

Human Values: Self control-Self confidence - Honesty Contentment - Humility-Modesty Tolerance – Adjustment - Sacrifice-Forgiveness

Purity(Body,Dress,Environment)-Physicalpurity-Mentalpurity - Spiritual purity

Social Values :

Non violence-Service Patriotism-Equality

Respectforparentsandelders-careandprotection-Respectforteacher Punctuality-TimeManagement

UNIT V MORALITY (virtues) 6

Importance of Introspection: I-Mine (Ego, Possessiveness)

SixEvilTemperaments-Greed-Anger-Miserliness-Immoralsexualpassion-InferiorityandsuperiorityComplex-Vengeance

Maneuvering of Six Temperaments:Contentment-Tolerance-Charity-Chastity – Equality-Pardon (Forgiveness)
FiveessentialQualitiesacquiredthroughMeditation:Perspicacity – Magnanimity – Receptivity-Adaptability-Creativity(ImprovedMemoryPower)

Total periods: 30

REFERENCE BOOKS:

1. Yoga for modern age - ThathuvagnaniVethathiri Maharishi
2. Simplified Physical Exercises - ThathuvagnaniVethathiri Maharishi
3. Kayakalpam - Thathuvagnani VethathiriMaharishi
4. Thirukkural -Rev.Dr.G.U.pope
5. Mind-ThathuvagnaniVethathiriMaharishi
6. SoundHealththroughyoga-Dr.Chandrasekaran
7. Light on yoga -BKS.lyenger
8. □□□□□□□□□ – □□□□□□□□□□□□□□□□□□□□□□□□□□□□□

SEMESTER III

BAC301	**PRODUCTION OF AGRICULTURAL CROPS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – plus 2 biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES
To give a basic knowledge of agricultural crops and its production

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals in the production of cereals
CO2	to know the various technologies to grow cereals
CO3	To know the fundamentals in the production of millets
CO4	To get idea about technologies to grow pulses
CO5	To know about technologies to grow oilseeds (Kharif)
CO6	To understand about the fundamentals in the production of oilseeds (Rabi)

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CEREALS 9

Rice, Maize, Wheat, Oat, Barley, Rye and Triticale - Origin, geographic distribution, economic importance, soil and climatic requirements, varieties, cultural practices (from land preparation to harvest) and yield

UNIT II MILLETS 9

Sorghum, Pearl millet, Small millets - Finger millet, Foxtail millet, little millet, Kodo millet, Barnyard millet and Proso millet - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield

UNIT III PULSES 9

Redgram, Blackgram, Greengram, Bengalgram, Horsegram, Cowpea, Soybean and Lentil - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield

UNIT IV OILSEEDS (KHARIF) 9

Groundnut, sesame, sunflower, castor, Origin, and geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield.

UNIT V OILSEEDS (RABI) 9

Rape seed and mustard, safflower, Linseed, Niger - Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices, yield

TEXT BOOK:

1. Ahlawat, I.P.S., Om Prakash and G.S. Saini. 1998. Scientific Crop Production in India. Rama publishing House, Meerut.

REFERENCE BOOKS

1. Chidda Singh. 1997. Modern techniques of raising field crops. Oxford and IBH Publishing Co Pvt. Ltd, New Delhi.

2. Singh. S.S. 1997, Crop management under irrigated and rainfed conditions, Kalyani Publishers, New Delhi

BAC302	AGRICULTURAL BOTANY	L	T	P	C
	Total Contact Hours - 60	3	1	0	4
	Prerequisite – Biology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES To provide a basic knowledge of basic botany of agricultural crops	
COURSE OUTCOMES (COs)	
CO1	to understand the classification of plants
CO2	to know the uses of poaceae
CO3	to know the economic uses of papilonaceae
CO4	to get an idea about th uses of plants belonging to papilonaceae
CO5	to know about the uses of other ornamental and vegetable crops
CO6	to know about the uses of fibre crops

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M			L	L	M
	CO2	H	M	M	H								
	CO3	H				H		M					M
	CO4	H	M		H	H							
	CO5	H	M	M		H		M					
	CO6	H			H			M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI INTRODUCTION 12

Bentham and Hooker's classification of plant kingdom — International code of nomenclature and its major guidelines – author citation – Agricultural classification of crops; General morphology: Life span, habit, root, stem, leaf - petiole, leaf margin, leaf apex, leaf shape, venation and phyllotaxy; Modification of roots and leaf; Floral morphology: Kinds of bracts, inflorescence; Structure of flower, androecium, gynoecium, placentation, types of fruits.

UNIT II ECONOMIC USES OF POEACEAE 12

List of cultivated crops, economic parts, chromosome number and family description of Poaceae: Key botanical features of Rice, Wheat, Sorghum, Maize, Pearl millet, Finger millet, list of small millets, Guinea grass, Napier grass, and Sugarcane

UNIT III ECONOMIC USES OF PAPILIONACEAE 12

List of cultivated crops, economic parts, chromosome number and family description of Papilionaceae: Key botanical features of Red gram, Soybean, Black gram, Green gram, Cowpea, Lablab, and Groundnut.

UNIT IV ECONOMIC USES OF OTHER PLANTS 12

List of cultivated crops, economic parts, chromosome number and family description of the following families and Key botanical features of the crops given against them: Pedaliaceae - Gingelly; Asteraceae- Sunflower, Safflower, Euphorbiaceae: Castor; Jatropha and Tapioca; Arecaceae: Coconut; Solanaceae: Tobacco, Potato, Chilli

UNIT V ECONOMIC USES OF FIBRE CROPS 12

List of cultivated crops, economic parts, chromosome number and family description of the following families and key botanical features of the crops given against them , Malvaceae: Cotton, Mesta and Bhendi.

TEXT BOOK

1. Daniel Sundararaj, D. and G. Thulasidas, 1993. Botany of field crops. MacMillan India Ltd., New Delhi.
2. Sambamurthy, V.S. and N.S. Subramanian, 1989. Text Book of Economic Botany, Wiley Eastern, New Delhi

REFERENCE BOOKS

1.Purse glow, 1988. Tropical Crops – Monocotyledons, The English Language book Society and Longman Co., Singapore
2. Purse glow. 1988. Tropical Crops - Dicotyledons. The English language book Society and Longman Co., Singapore.
3. Albert F. Hill and O.P. Sharma, 1996. Economic Botany. Tata McGraw - Hill Publishing Co. Ltd., New Delhi.
4. John Joel, A., C. Vanniarajan, T.S. Raveendran, and A. Gopalan 2006. Fundamentals of Crop Botany, Directorate of ODL, Tamil Nadu Agricultural University, Coimbatore–641 003

BAC303	**PLANT BIOCHEMISTRY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Chemistry and Biology				
	Course Designed by – Dept. of Industrial Biotechnology				

COURSE OUTCOMES (COs)	
CO1	to understand the fundamentals of biomolecules, their classification, structure
CO2	to apply the basic concept of carbohydrates, proteins ,lipids, nucleic acids and enzymes in metabolism.
CO3	to know the application of biomolecules in functioning of biological system
CO4	to get a basic knowledge of macromolecules in living organism and its energetic
CO5	To know basic concepts of enzymes

CO6	to understand the fundamentals function of biomolecules

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M				H						L
	CO2								H			H	
	CO3	H		H		H				H	H		H
	CO4	H	M				H	H					
	CO5	H										H	
	CO6	H		H					H		H		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CARBOHYDRATES AND LIPIDS 9

Introduction- scope and importance in Agri. Biotechnology Concept of life and living processes: nature of biological material- classification, structure and function, occurrence of simple and derived carbohydrates-Lipids: classification, structure and function, occurrence of simple and derived lipids

UNIT II AMINO ACIDS AND PROTEINS 9

Amino acids: structure, classification and properties. Peptides: chemistry and function- structure Proteins: classification based on composition and biological functions-four levels of protein structure

UNIT III VITAMINS AND ENZYMES 9

Water soluble vitamins, their coenzyme forms, sources and biochemical functions-Fat soluble vitamins: sources and functions. Enzymes: historical perspective, naming and classification, factors affecting enzyme activity, mechanism of enzyme action, enzyme units.

UNIT IV NUCLEIC ACIDS AND CHROMOSOMES 9

Nucleic acid structure and function, physical and chemical properties, spectroscopic and thermal properties, *in vitro* denaturation and renaturation of DNA, DNA as genetic material

UNIT V BIOENERGETICS 9

Principles of thermodynamics and their applications in biochemistry -introduction and thermodynamic state functions, first and second law of thermodynamics, concept of free energy, standard free energy change, biological oxidation-reduction reactions, redox potential. High energy phosphate compounds, free energy of hydrolysis of ATP and sugar phosphates.

Text Book

1. 'Gaw A, 2008, "Clinical biochemistry" Elsevier Health Sciences, 4th.Ed.
2. J.L. Jain, 2008, "Fundamentals of biochemistry" S. Chand.8th Ed

Reference Books

1. J.L. Jain , , 2007 ,"Text Book Of Biochemistry' ,14th Ed
2. Zubey 2004 "Biochemistry" III Ed,
3. Voet&Voet 2006, "Biochemistry" V ed,.
4. Lehninger Nelson &Cox , 2005 "Principles of Biochemistry",4th Ed
5. Weblink: nptel

BAC304	**AGRICULTURAL MICROBIOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic concepts in biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of microbes and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the source of microbes and their role in biotechnology
CO2	to get the knowledge of microbial diversity classification and morphology
CO3	to know the visualization of microbes by different microscopes
CO4	to know the cause, symptoms, diagnosis and treatment of diseases causing pathogens
CO5	to get a basic knowledge of the microbial nutrition and growth
CO6	To get knowledge about classification of microbes

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M			H	H	H	H		H
	CO2	H		M									
	CO3	H						H		H			H
	CO4	H		M	M			H					
	CO5	H				H	H						
	CO6	H		M	M					H			H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO MICROBIOLOGY 9

Development and scope of microbiology - Spontaneous generation theory – Germ theory – Germ theory of diseased –Contributions by Antonie van Leeuwenhock, Louis Pasteur, John Tyndall, Robert Koch, Joseph Lister, Winogradsky, Beijierinck, Alexander Fleming, Waksman and others in the development of microbiology and their discoveries.

UNIT II MICROSCOPY 9

Microscopy – Principles of optics – Resolving Power – Numerical aperture, magnification, aberrations – Different types of microscopes – Light microscope, Dark field, phase contrast, U. V. Microscopes, Electron microscope (Scanning – Transmission types) – Micrometry.

UNIT III GENERAL FEATURES OF MICROORGANISMS 9

Structure and organization of microbial cell – Prokaryotes – Eukaryotes – Morphology and fine structure of different microorganisms-Distribution of microorganisms – Groups of microorganisms and their importance – Bacteria, Fungi, actinomycetes, algae, protozoa and viruses

UNIT IV MICROBIAL NUTRITION AND GROWTH 9

Methods of isolation and purification – pure culture methods – preparation of media – Different types of nutritional media – Staining techniques – Simple staining, differential staining, structural staining – preservation of the microbial culture. Nutritional types: autotrophy, heterotroph, phototroph, chemolithotroph - Growth curve – Continuous culture, synchronous culture- chemostat – Energy production by aerobes, anaerobes, photosynthetic organisms – Biosynthesis of proteins and other macro molecules.

UNIT V CLASSIFICATION OF MICROORGANISMS 9

Classification of microorganisms – General principle and outline of classification in bacteria, fungi, algae, etc- Viruses and bacteriophages – chemical nature – Life cycle – lytic and lysogenictypes – importance

TEXT BOOKS

1. Michael J. Pelzar, J.R.E.C.S Chan, Noel R. Erieg, 2005, "Microbiology " TATA McGraw Hill, 5thed

2. Anantha Narayan, C.K. Jayaram Paniker, 2009, "Text Book of Microbiology" Orient Blackswan, 7th ed

REFERENCE BOOKS

1. Presscott and Dunn, 2006, "Industrial Microbiology" CBS Publishers& Distributors.
2. Daniel V.Lim, "Microbiology", Kendall Hunt, 2002 ed
3. Michael T Madigan, John M. Martinko, Kelly S. Bender, Daniel H. Buckley, David A. Stahl and Thomas Brock, 2017, Brock Biology of Microorganisms, 15th Edition, Pearson Publishers
4. Weblink: nptel

BBT305	INSTRUMENTATION FOR BIOTECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – basic principles in instrumentation				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES

To provide a basic knowledge of the working principle of instruments and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of instruments and their different mode of applications
CO2	to know the principle, working concept and its applications
CO3	to find the various laboratory work based on instruments
CO4	to know the different types of instruments based on various parameters
CO5	to get a basic knowledge of equipments and their role in biological systems in relevant industries
CO6	To understand about working principles about instruments

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H				H					
	CO2	H	H	H	H					H		H	
	CO3	H						H					
	CO4	H						H			M		
	CO5	H						H					
	CO6	H			H			H					H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I RADIATION TECHNIQUES 9

Sources of radiation- absorptivity-Lambert Beers law, deviations, detectors, photometric accuracy, Rayleigh scattering, Fourier transform, calibration and standardization, atomisation, flame atomisation, turbidimetric and nephlometric titrations -scattering in gases.

UNIT II ELECTROCHEMICAL TECHNIQUES 9

Principles: redox potential-pH electrode-ion selective and gas sensing electrodes-Clarke oxygen electrode and its application-biosensors.

UNIT III SPECTROSCOPIC TECHNIQUES 9

Colorimetry-UV-visible spectrophotometry-ORD-CD-X-ray spectroscopy-IR spectroscopy-ESR spectroscopy-NMR spectroscopy-Mass spectroscopy

UNIT IV SEDIMENTATION TECHNIQUES 9

Centrifugation principles-centrifuges and its types-differential and density gradient centrifugation-analysis of subcellular fractions-assessment of purity and determination of relative molecular mass

UNITV RADIOISOTOPE TECHNIQUES 9

Nature of radioactivity-Detection and measurement of radioactivity-GM counter-Scintillation counting-photographic emulsions-radiotracer techniques-autoradiography

TEXT BOOK

1. Willard and Merrit, "Instrumental Methods of Analysis", VI Edition, CBS Publishers and Distributors.
2. Asokan, Practical Biochemistry, IV edition

REFERENCES

1. Ewing GW, "Instrumental Methods of Chemical Analysis", McGraw Hill Book Company, 1989.
2. Braun H., "Introduction to Chemical Analysis", McGraw Hill, 1987.
3. Keith Wilson and Walker, Practical Biochemistry, V edition, Cambridge editions.

	PRINCIPLES OF PLANT BREEDING	L	T	P	C
BAC305	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES To provide basic knowledge about general techniques involved in plant breeding													
COURSE OUTCOMES (COs)													
CO1	to understand the basics of genetics												
CO2	to know about population genetics and its significance												
CO3	to know about types and structure of genes												
CO4	to know about techniques in isolation and characterization of genes												
CO5	to get idea about polymorphism at DNA level												
CO6	to know about modern concepts in genetics												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M	H	H		L	L	L	M
	CO2	H	M	M	H	H	H	M	H				M
	CO3	H	M		H		H	H			L	L	
	CO4	H	M		H	H	H	M			L		M
	CO5	H	M	M	H	H	H	M	M	M	L	L	
	CO6	H			H	H	H	M				L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)	
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I: INTRODUCTION **9**

Beginning of genetics; Cell structure and cell division; Early concepts of inheritance, Mendel's laws; Discussion on Mendel's paper, Chromosomal theory of inheritance.-Multiple alleles,Gene interactions.

UNIT II: SEX DETERMINATION AND LINKAGE

Sex determination, Sex differentiation and sex-linkage, Sex-influenced and sex-limited traits; Linkage- Coupling and repulsion detection, estimation; Recombination and genetic mapping in eukaryotes. 9

UNIT III: POPULATION GENETICS

Population - Mendelian population – Random mating population - Frequencies of genes and genotypes-Causes of change: Hardy-Weinberg equilibrium-Structural and numerical changes in chromosomes; Nature, structure and replication of the genetic material; Genetic code

UNIT IV: GENE STRUCTURE **9**

Genetic fine structure analysis, , Split genes, Transposable genetic elements, Overlapping genes, Pseudogenes, Oncogenes, Gene families and clusters- Regulation of gene activity in prokaryotes; Bacterial plasmids, insertion (IS) and transposable (Tn) elements

UNIT V: MODERN CONCEPT OF GENETICS AND MUTATION **9**

Methods of studying polymorphism at biochemical and DNA level; Transgenic bacteria and bioethics; Gene silencing; - Concepts of Eugenics, Epigenetics, Genetic disorders and Behavioural genetics , types of mutation

TEXT BOOK

1.Gardner EJ & Snustad DP. 1991. Principles of Genetics. John Wiley & Sons
2.Klug WS & Cummings MR. 2003. Concepts of Genetics. Peterson Edu
3.Lewin B. 2008. Genes IX. Jones & Bartlett Publ
4.Russell PJ. 1998. Genetics. The Benzamin/Cummings Publ. Co

REFERENCE BOOKS

1.Snustad DP & Simmons MJ. 2006. Genetics. 4th Ed. John Wiley & Sons
2.Strickberger MW. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India
3.Tamarin RH. 1999. Principles of Genetics. Wm. C. Brown Pub

BAC3L1	PLANT BIOCHEMISTRY LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic concepts in chemistry and biology				
	Course Designed by – Dept. of Agricultural Biotechnology				

OBJECTIVES

To provide a basic knowledge of biochemical components and its functions and their Applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of biomolecules, their classification,structure and functions
CO2	to apply the basic concept of carbohydrates, proteins,lipids, nucleicacids and enzymes in metabolism
CO3	to know the application of biomolecules in functioning of biological system
CO4	to get a basic knowledge of macromolecules in living organism and its energetics
CO5	To know basic concepts of enzymes
CO6	To understand about compound identification

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H			H			H	H	
	CO2	H	H	H	H			H			H	H	
	CO3	H	H	H	H			H			H	H	
	CO4	H	H	H	H			H			H	H	
	CO5	H		H				H			H	H	
	CO6	H	H				M	M	M				

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Preparation of normal, molar and percent solutions.
2. Preparation of different buffer solution and measure pH.
3. Qualitative analysis of Unknown sugar- Monosaccharides,disaccharides and polysaccharides.
4. Estimation of sugar- Benedicts method.
5. Qualitative of unknown protein- Albumin,casein and gelatin.
6. Quantitative test for aminoacids- Ninhydrin method.
7. Quantitative test for protein – Biuret method.
8. Quantitative test for protein –Lowry method.
9. Quantitative test for protein – Bradford method
10. Spectrophotometric analysis of DNA.

BBT3L2	**INSTRUMENTAL METHODS OF ANALYSIS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic chemistry and physics				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic knowledge of the working principle of instruments and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	To understand the fundamentals of instruments and their different mode of applications
CO2	to know the principle, working concept and its applications

CO3	to find the various laboratory work based on instruments
CO4	to know the different types of instruments based on various parameters
CO5	to get a basic knowledge of equipment and their role in biological systems in relevant industries
CO6	To understand about basic working principles of equipment

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H					H				M	
	CO2	H		H	L			H	L		L		H
	CO3	H	H			L		H		L		M	
	CO4	H	H				L	H				M	L
	CO5	H	H					M				H	
	CO6	H	M			M				M			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS

1. Working principle of colorimeter and spectrophotometer
2. Difference between the spectrophotometer and colorimeter.
3. Validating beer lamberts law using colorimeter-potassium permanganate
4. Validating beer lamberts law using colorimeter-copper sulphate
5. Validating beer lamberts law using colorimeter-potassium dichromate
6. Determination of λ max.
7. Estimation of SO^{2-}_4 by nephlometry
8. Measurement of turbidity in water by nephlometry
9. Measurement of hydrogen ion in water samples
10. Preparation of buffer
11. Determination of moisture content
12. Precipitation of protein using ammonium sulphate.

	CELL BIOLOGY LAB	L	T	P	C
BBT3L3	Total Contact Hours - 45	0	0	3	2
	Prerequisite – basic cell biology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge about cell biology	
COURSE OUTCOMES (COs)	
CO1	to understand the fundamentals of instruments and their different mode of applications
CO2	to get idea about slide preparation
CO3	to know about blood grouping
CO4	to get knowledge about mitosis
CO5	to get a basic knowledge of extraction of plant pigments
CO6	To understand about preservation technique

		Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low											
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H	H			H					
	CO2	H	H					H	M				
	CO3	H			H	H	H	H					
	CO4	H						H					
	CO5	H						H					
	CO6	H			H			H					
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/ Term paper Seminar/ Internship (PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS

1. Study of Microscope
2. Spotters
3. Permanent Slide preparation
4. Killing and Fixing
5. Mitosis on onion root tip
6. Cryopreservation
7. Preparation of Blood smear
8. Separation of plasma and serum from blood sample
9. Total RBC and WBC Count
10. Osmosis
11. Extraction of pigments

BAC401	**PLANT MOLECULAR BIOLOGY**	**L**	**T**	**P**	**C**

	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basics of Cell biology and biochemistry				
	Course Designed by – Dept. of Agricultural Biotechnology				

OBJECTIVES

To provide a basic understanding of molecular level of DNA and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of central dogma of biological systems
CO2	to know the concept of cell replication,transcription and translation
CO3	to comprehend DNA and its role in functioning of a cell
CO4	to know the functioning of regulatory factors and its application in maintaining cell activity
CO5	to get a basic knowledge of the DNA and RNA
CO6	to get a basic knowledge of the proteins

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			H		H					
	CO2	H							H		H	H	H
	CO3	H		H	H	H	H	H				M	
	CO4	H						M					
	CO5	H						H					
	CO6	H		H						H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I DNA STRUCTURE 9

DNA as the vehicle of inheritance-structure of DNA-forms of DNA-nucleic acid biosynthesis-experimental evidence: Griffith, McLeod, McCarty and Avery, Hershey–Chase experiments-Definition of gene-organization of genes and non coding DNA in prokaryotes- Eukaryotes–unique, moderately repetitive and highly repetitive DNA sequence-satellite DNA- Cot value-DNA binding proteins

UNIT II DNA REPLICATION 9

DNA replication in prokaryotes and eukaryotes- modes of replication-semi continuous and semi discontinuous replication- Okazaki fragments- RNA primers – enzymes of replication – DNA polymerases I, II, III, -DNA modifying enzymes: topoisomerases-helicases- binding proteins and ligases- replication in E.coli–replisomes-events at OriC (initiation), events on the replication fork (elongation) and termination- Fidelity of replication-Sigma or rolling circle mode of replication in Φ x 174-Inhibitors of replication.

UNIT III DNA REPAIR 9

Repair of DNA–types of damages- repair by direct reversal of damage- excision repair-recombination repair- SOS repair-Mutation: definition-type of mutations (spontaneous and induced) point mutation-Gene mutation and chromosomal aberrations- Cause of mutations-chemical and physical agent

UNIT IV TRANSCRIPTION 9

Transcription in prokaryotes and eukaryotes: RNA polymerases–enzyme structure- role of sigma factor- promoter-closed and open promoter complexes-Initiation-elongation and termination of RNA synthesis-Post transcriptional modification in prokaryotes and eukaryotes-transcription factors

UNIT V GENETIC CODE 9

Genetic code–Basic features of genetic code-Deciphering of genetic code-Wobble hypothesis-Protein biosynthesis-activation of amino acids- initiation-elongation and termination of translation in prokaryotes and eukaryotes-Post translational modifications-Inhibitors of translation.-Regulation of gene expression in prokaryotes and eukaryotes- operon concept

TEXT BOOKS

1. Biochemistry by Jeremy M. Berg, John L. Tymoczko and LubertStryer, 2006
2. Lehninger, Principles of Biochemistry, David L. Nelson and Michael M. Cox, 2008
3. James D. Watson, Tania A. Baker, Stephen P. Bell, and Alexander Gann, Molecular Biology of the Gene (6th ed), 2007

REFERENCE BOOKS

1. R.L. Adams, J.T. Knowler, and D.P. Leader, The Biochemistry of the Nucleic Acids, 1992
2. Stephen Neidle, Principles of Nucleic Acid Structure, 2007
3. Robert Weaver, Molecular Biology, 2007
4. Weblink: nptel

BAC402	**CROP PHYSIOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Chemistry and Biology				
	Course Designed by – Dept. of Agricultural Biotechnology				

COURSE OUTCOMES (COs)	
CO1	to understand the fundamentals of crop physiology
CO2	to apply the basic concept of carbohydrates, proteins ,lipids, nucleicacids and enzymes in metabolism.

CO3	to know the application of biomolecules in functioning of biological system
CO4	to get a basic knowledge of macromolecules in living organism and its energetic
CO5	To know basic concepts of enzymes
CO6	to understand the fundamentals function of biomolecules

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M				H						L
	CO2								H			H	
	CO3	H		H		H				H	H		H
	CO4	H	M				H	H					
	CO5	H										H	
	CO6	H		H					H		H		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PLANT WATER RELATIONS **9**

Importance of Crop Physiology in Agriculture – cell organelle- plasma membrane, chloroplast, mitochondria, peroxisome and vacuole - Structure and role of water –water potential and its components – diffusion – osmosis – imbibition - plasmolysis – Field Capacity and Permanent Wilting Point- Mechanisms of water absorption – Pathways of water movement – Apoplast and symplast - Translocation of water – ascent of sap – mechanisms - Transpiration – significance – structure of stomatal pore- mechanisms of stomatal opening and closing – guttation – antitranspirants

UNIT II PLANT MINERAL NUTRITION **9**

Criteria of essentiality - classification of nutrients – macro, micro, mobile, beneficial elements and immobile – mechanism of nutrient uptake- Physiological functions, deficiencies and disorders of macro and micro nutrients – Hidden hunger- Foliar nutrition- root feeding and fertigation – sand culture, hydroponics and aeroponics

UNIT III PHOTOSYNTHESIS AND RESPIRATION **9**

Light reaction – Photosystems- red drop and Emerson enhancement effect- Photolysis of water and photophosphorylation - Z scheme - Photosynthetic pathways – C_3 and C_4, CAM – difference between three pathways - Factors affecting photosynthesis- Photorespiration – pathway and its

significance - Phloem transport – Munch hypothesis - Phloem loading and unloading - Source and sink strength and their manipulations - Glycolysis – TCA cycle - Oxidative phosphorylation – difference between photo and oxidative phosphorylation – energy budgeting - respiratory quotient

UNIT IV GROWTH AND DEVELOPMENT 9

Growth – phases of growth - Factors affecting growth – Hormones- classifications - Biosynthetic pathway and role of auxins - Biosynthetic pathway and role of gibberellins and cytokinins- Biosynthetic pathway and role of ethylene and ABA- Novel and new generation PGR's – Brassinosteroids and salicylic acid - Growth retardants – Commercial uses of PGR's- Photoperiodism - short, long and day neutral plants – Chailakhyan's theory of flowering-Forms of phytochrome - Pr and Pfr - regulation of flowering - Vernalisation - Theories of vernalisation – Lysenko and Chailakhyan's theories- Seed germination - physiological and biochemical changes - seed dormancy and breaking methods - Senescence and abscission – physiological and biochemical changes -Physiology of fruit ripening- climacteric and non-climacteric fruits - factors affecting ripening- Manipulations

UNIT V STRESS PHYSIOLOGY 9

Classification of stresses - Physiological changes and adaptations to drought, flooding, high and low temperature, salinity and UV radiation – compatible osmolytes – membrane properties — compartmentalization – stress alleviation - Global warming – green house gases – physiological effects on crops - Carbon Sequestration

Text Books

1. P. Boominathan, R. Sivakumar, A. Senthil, and D. Vijayalakshmi. 2014. Introduction to Plant Physiology, A.E. Publications. Coimbatore
2. Jain, V.K. 2007. Fundamentals of plant physiology, S.Chand & Company Ltd., New Delhi.
3. Taiz. L. and Zeiger. E., 2010 (Fifth edition). Plant Physiology. Publishers: Sinauer Associates, Inc., Massachusetts, USA.

e- books and e-references

·**http://www.plantphys.org**

http://www. Biologie. Uni-hamburg. de/b-online

BAC403	**ENZYMOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	4
	Prerequisite – Basic Chemistry and Biology				
	Course Designed by – Dept. of Agricultural Biotechnology				

COURSE OUTCOMES (COs)	
CO1	to understand the fundamentals of biomolecules, their classification, structure
CO2	to apply the basic concept of carbohydrates, proteins ,lipids, nucleicacids and enzymes in metabolism.
CO3	to know the application of biomolecules in functioning of biological system
CO4	to get a basic knowledge of macromolecules in living organism and its energetic
CO5	To know basic concepts of enzymes
CO6	to understand the fundamentals function of biomolecules

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M				H						L
	CO2								H			H	
	CO3	H		H		H				H	H		H
	CO4	H	M				H	H					
	CO5	H										H	
	CO6	H		H					H		H		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI: ENZYMES **12**

Classification - IUB system, rationale, overview and specific examples. Characteristics of enzymes, enzyme substrate complex. Concept of active centre, binding sites, stereo specificity and ES complex formation. Effect of temperature, pH and substrate concentration on reaction rate. Activation energy. Transition state theory. Enzyme activity, international units, specific activity, turnover number.

UNIT II ENZYME CATALYSIS **12**

Enzyme catalysis-Factors affecting catalytic efficiency - proximity and orientation effects, distortion or strain, acid - base and nucleophilic catalysis. Isoenzymes and multiple forms of enzymes. Mechanism of action chymotrypsin, ribonuclease.

UNIT III ENZYME KINETICS **12**

Michaelis - Menten Equation - form and derivation, steady state enzyme kinetics. Significance of Vmax and Km. Bisubstrate reactions. Graphical procedures in enzymology - advantages and disadvantages of alternate plotting. Enzyme inhibition - types of inhibitors - competitive, noncompetitive and uncompetitive, their mode of action and experimental determination.

UNIT IV ALLOSTERIC INTERACTIONS **12**

Protein ligand binding including measurements, analysis of binding isotherms, cooperativity and kinetics of allosteric enzymes. Enzyme regulation: Product inhibition, feedback control, enzyme induction and repression and covalent modification. Allosteric regulation.

UNIT V IMMOBILIZED ENZYMES **12**

Relative practical and economic advantage for industrial use, effect of partition on kinetics and performance with particular emphasis on charge and hydrophobicity (pH, temperature and Km). Various methods of immobilization - ionic bonding, adsorption, covalent bonding (based on R groups of amino acids), microencapsulation and gel entrapment.

TEXT BOOK:

1. Enzyme Kinetics (1995) – Palmer, London: Portland Press

REFERENCE BOOKS

1. Enzyme Kinetics - Dixon , 1972, wiley publishers
2. Fundamental of Enzymology – Price & Steven , 1999-Bowker company
3. The Enzymes Vol. 1 & 2 – Boyer, 1983
4. Enzyme Structure & Mechanism – Alan Fersht, 1985, W.H. Freeman
5. Enzyme Biotechnology – Tripathi, G, 2009- ABD Publishers.
6. Industrial Enzyme & their Application (1998) –Uhlig, H.
7. Enzyme 3rd Ed. (1979) – Dixon M. & Webb, E.C.

BAC404	**PROCESS ENGINEERING IN BIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	4
	Prerequisite – Engg Mathematics-I, Engg Mathematics –II, Principles of chemical Engineering.				
	Course Designed by – Dept. of Agricultural Biotechnology				

OBJECTIVES

To study the development of bioprocesses

COURSE OUTCOMES (COs)	
CO1	Students will know about the design of a fermenter.
CO2	Students will know about the stoichiometry and energetics of cell growth and product formation
CO3	To acquire the knowledge of bioprocesses
CO4	To analyze various parameters to be monitored and controlled during fermentation processes
CO5	To facilitate the design and optimization of media for various fermentation processes
CO6	Tto know about product optimization

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M		M				M		L	M
	CO2	H	M	M	H	H		M			L	L	
	CO3	H	M		H			M	M	L		L	M
	CO4	H	M			H	M				L		M
	CO5	H	M	M	H	H		M		L	L	L	
	CO6	H			H	H	M	M	L		L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI BASIC STOICHIOMETRY 12

Basic stoichiometric calculations: mole, molar mass, normality, molarity, molality, mole fraction, mass fraction, Ideal gas law, Raoult's law, Dalton's law, Amagat's law, Average molecular weight and density

UNIT II

STOICHIOMETRY OF BIOPROCESS 12

Unit operation & Process - Stoichiometry of Cell growth and product formation- elemental balances- degrees of reduction of substrate and biomass-available electron balances-yield coefficients of biomass and product formation- Fermentor - types of bioreactor: Air lift bioreactor, fluidized bed bioreactor, photobioreactor.

UNIT III HEAT & MASS TRANSFER **12**

Modes of heat transfer- Heat transfer through compound wall- Heat flow through cylinder-Heat exchanger- Theory of Shell and Tube heat exchanger and double pipe heat exchanger- Mass transfer: Derivation of Diffusion of A through non diffusing B in gases and Liquids and Equimolar counter diffusion.

UNIT IV FLUID MECHANICS **12**

Fluids –Types of fluid - Nature of flow – Reynold's experiment- Bernoulli's equation - Flow meters: Manometers - types of manometers —Venturi meter and orifice meter- Weirs and notches-Pumps: single acting and double acting pump -Centrifugal Pump -Work of consumption of single and double acting pumps.

UNITV **12**

Post-Harvest Unit Operations - Grading, cleaning, washing, sorting, shelling, dehusking, decortication, milling, polishing, pearling, fermentation, drying -size reduction: cryogenic grinding, crystallization, filtration, membrane processing, microfiltration, ultra-filtration, reverse osmosis, evaporation, distillation, mixing, clarification, coagulation- separation: sedimentation, pressing, expelling, leaching, extraction, extrusion.

Text book

1. K.A.Gavhane, 2009, "Introduction to process calculations Stoichiometry" NiraliPrakasham Publications 22nd.

Reference Books

1. K.A. Gavhane, 2009, "Fundamentals of chemical engineering" NiraliPrakasham Publications 22nd.
2. McCabe and Smith,2002, "Unit operations in Chemical Enginering", Tata McHraw Hill Pblications, 6th Ed.
3. K.A. Gavhane, 2009, "Unit operations I Fluid flow & Mechanical operations" NiraliPrakasham Publications, 17th.
4. Bhat & Vora,2001, 'Stoichiometry", Tata McGraw Hill Ltd, III Ed.
5. Weblink: nptel

BAC405	**PRODUCTION OF HORTICULTURAL CROPS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – Physical Sciences				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To study the nature and facts about environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human

world; envision the surrounding environment, its functions and its value.

5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context
CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I: INTRODUCTION **9**

Horticulture – Origin, definitions – role of fruit crops in national economy - pollination mechanism – fruitfulness and causes of unfruitfulness. Propagation – definition – methods - merits and demerits – propagation through seeds - dormancy and methods of overcoming dormancy – vegetative propagation – merits and demerits – cutting, layering, grafting and budding – rootstock influence – stock / scion relationship– micro propagation.

UNIT II: CROP PRODUCTION TECHNIQUES IN TROPICAL FRUIT CROPS 9

Scope and importance of fruit crops- classification of fruit crops – area, production, productivity and export potential. Climate and soil requirements – varieties – propagation - planting density

and systems of planting -cropping systems - after care - training and pruning - water, nutrient and weed management –fertigation - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest- post harvest management. **Crops**: Mango, Banana, Grapes, Citrus (sweet orange, mandarin, acid lime), Papaya, Indian goose berry (Aonla)

UNIT III: CROP PRODUCTION TECHNIQUES IN SUBTROPICAL 9

Climate and soil requirements – varieties – propagation - planting density and systems of planting -cropping systems - after care - training and pruning - water, nutrient and weed management - special horticultural techniques - plant growth regulation - important disorders – maturity indices and harvest- post harvest management. **Crops**: Sapota, pomegranate,Guava, Pineapple, Jack, Apple, Pear, Plum.

UNIT IV: STATUS OF PRODUCTION, PRINCIPLES OF CROP PRODUCTION 9

Scope and Importance of plantation crops - area and production- export potential- classification of plantation crops- planting and cropping systems - principles of canopy management and growth regulation. Climate and soil requirements- varieties- propagation- nursery management- planting density and systems of planting- cropping systems- after care- training and pruning- water, nutrient and weed management- shade management-intercropping -mulching-cover cropping -harvest- post harvest management and processing-**Crops:** Tea, coffee, rubber

UNIT V: CROP PRODUCTION TECHNOLOGIES IN PLANTATION CROPS 9

Climate and soil requirements- varieties- propagation- nursery management- planting density and systems of planting- cropping systems- after care- training and pruning- water, nutrient and weed management- shade management-intercropping – multi-tier cropping system-mulching-top working and other special horticultural practices- maturity indices and harvest- post harvest management and processing-**Crops:** cocoa, cashew, coconut, arecanut, oil palm and palmyrah

Reference text books

1. Kumar, N. 2014. Introduction to Horticulture. Oxford & IBH Publishing co. Pvt. Ltd.

2. Chadha, K.L and Pareek, O.P. 1996. (Eds.). Advances in Horticulture. Vols. IIIV., Malhotra Publ. House

3. Kumar, N. 2014. Introduction to Spices, Plantation, Medicinal and Aromatic crops, IBH Publishing Co. Pvt. Ltd., New Delhi.

4. Alice Kurian and Peter, K.V. 2007. Horticulture science series Vol. 08, New India, Publishing Agency, New Delhi.

5. Veeeraragavathatham, D and et al.,2004. Scientific fruit culture, Sun Associates, Coimbatore.

BCE406	ENVIRONMENTAL STUDIES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Physical Sciences				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

7. To study the nature and facts about environment.
8. To find and implement scientific, technological, economic and political solutions to environmental problems.
9. To study the interrelationship between living organism and environment.
10. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
11. To study the dynamic processes and understand the features of the earth's interior and surface.
12. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context
CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance, Need for public awareness.

Natural Resources: Renewable And Non – Renewable Resources

Natural resources and associated problems

a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.
b) Water resources: Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.
c) Mineral resources: Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources: World food problems, changes caused by agriculture and overgrazing , effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.
f) Land resources: Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 8

Concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-

Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics: Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III BIODIVERSITY AND ITS CONSERVATION 7

Introduction and Definition- genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega-diversity nation, Hot-spots of biodiversity -Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution 7

Definition, Causes, effects and control measures of ;- Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management : floods earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8

From Unsustainable to Sustainable development, Urban problems related to energy, nuclear accident and holocaust, case studies, wasteland reclamation, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection Act, Forest Conservation Act, Issues involved in enforcement of environmental Legislation, public awareness –

Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel –oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes – Noise produced by fire crackers – Noise pollution – Noise level standards for fire crackers – Intensity of sound – Impact on hearing – Safety measures.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations, population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXTBOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
3. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, 1989.
4. Benny Joseph, "Environmental Studies"., TATA McGraw Hill, 2010

REFERENCES

1. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, EnviroMedia 2009
2. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
4. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno Science Publications 2013
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB),2001.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
8. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
9. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publish Co. Pvt. Ltd. 345p.
12. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut.
13. http://eng.mft.info/uploadedfiles/gfiles/c8e31c9e52d84c3.pdf

BAC4L1	**AGRICULTURAL MICROBIOLOGY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite- Microbiology, Molecular biology				

	Course Designed by – Dept. of Agricultural Biotechnology

OBJECTIVES-

To provide a basic understanding of microbes and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the source of microbes and their role in biotechnology
CO2	to get the knowledge of microbial diversity classification and morphology
CO3	to know the visualization of microbes by different microscopes
CO4	to know the cause, symptoms, diagnosis and treatment of diseases causing pathogens
CO5	to get a basic knowledge of the microbial nutrition and growth
CO6	To understand about various identification methods of microorganisms

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1											H	
	CO2	H						H					
	CO3	H	H										
	CO4									L			
	CO5						L						L
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Microscopes – handling light microscope.
2. Micrometry- measurement of microorganisms.
3. Sterilization – equipment and apparatus used for sterilization.
4. Media preparation for bacteria, fungi and actinomycetes.
5. Isolation of microorganisms-serial dilution plate technique.
6. Purification and preservation of bacteria
7. Purification and preservation of fungi.
8. Staining techniques- simple and negative staining.
9. Differential staining - Gram-staining
10. Structural staining - spore staining.
11. Morphology of bacteria- cell arrangement.
12. Growth of bacteria - turbidometric method.
13. Physiological characters of bacteria.
14. Biochemical characters of bacteria.
15. Identification of bacteria.

16. Identification of fungi

.

BAC4L2	PROCESS ENGINEERING LAB	L	T	P	C
	Total Contact Hours - 60	0	0	3	2
	Prerequisite – Bioprocess engg., Unit Operation				
	Course Designed by – Dept. of Agricultural Biotechnology				

OBJECTIVES

To provide basic knowledge about bioprocessing

COURSE OUTCOMES (COs)

CO1	to get knowledge on biomass
CO2	to know about enzyme kinetics
CO3	to understand about immobilization of enzyme
CO4	to get idea about mass transfer
CO5	to know about death kinetics
CO6	to know about product optimization

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1											H	
	CO2	H						H					
	CO3	H	H										
	CO4									L			
	CO5						L						L
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Estimation of biomass production
2. Plate assay for amylase enzyme.
3. Enzyme kinetics
4. Immobilization of enzyme.
5. Solid state fermentation.
6. Production of wine
7. Estimation of alcohol concentration in wine.
8. Estimation of acid concentration in wine.
9. Production of soap and analyse its properties.
10. Production of biodiesel and analyse its properties.
11. Activity of Various Natural Substances on the Growth of Malassezia furfur
12. Production of biofertilizer and analyse plant growth.
13. Leaching.
14. Determination of Coefficient of discharge (C_d) of notch.
15. Study of shell and tube heat exchanger.

BAC4L3	**PLANT MOLECULAR BIOLOGY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	0	0	3	2
	Prerequisite – Biochemistry, Bioorganic chemistry				
	Course Designed by – Dept. of Agricultural Biotechnology				

OBJECTIVES

To provide a basic understanding of molecular level of DNA and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of central dogma of biological systems
CO2	to know the concept of cell replication,transcription and translation
CO3	to comprehend DNA and its role in functioning of a cell
CO4	to know the functioning of regulatory factors and its application in maintaining cell activity
CO5	to get a basic knowledge of the DNA and RNA
CO6	to get a basic knowledge of the proteins

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H	H	H		H	H				H
	CO2		H	H			M					M	
	CO3	H		M	M	H					M		

	CO4		L	L				L	L	L			L
	CO5			H	H		M			H		M	M
	CO6	M	M	M					M		M	M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Extraction of plant genomic DNA.
2. Extraction of Bacterial genomic DNA
3. Extraction of Animal DNA
4. Agarose gel electrophoresis.
5. Restriction Digestion of DNA.
6. Ligation of E-CoR1 digest of λDNA
7. Isolation of plasmid DNA by alkaline lysis
8. Effect of UV radiation on bacterial survival (induced mutagenesis.
9. Transformation.
10. Poly acrylamide –SDS slab gel electrophoresis of proteins

BAC4S1	TECHNICAL SEMINAR I	L	T	P	C
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – General Biochemistry, General Microbiology, Cell Biology				
	Course Designed by– Dept. of Agricultural Biotechnology				

OBJECTIVES

To enable students to create the habit of exploring new avenues of biotechnology and to improve their presentation skills

COURSE OUTCOMES (COs)

- It is a one credit course offered in the IV Semester
- Each student will be allocated topics for presentation
- There are 2 hours allocated per week for the students give their presentation. This will be considered for the award of internal marks.
- The final topic will be presented on the day of the external examination in the presence of the internal examiner. The student will be judged based on the presentation and how he or she defends the selected topic.

BMA505	PROBABILITY AND STATISTICS	L	T	P	C
	Total Contact Hours - 60	3	1	0	4
	Prerequisite – Engg Mathematics-I &II				
	Course Designed by – Dept. of Mathematics				

OBJECTIVES

To provide a basic knowledge of probability and statistics

COURSE OUTCOMES (COs)

CO1	to understand the importance and the application of Probability in Engineering
CO2	to know Discrete and Continuous Random variables, Random Processes and their applications
CO3	to know about testing the parameters based on samples
CO4	to know about techniques of sampling, and estimating and testing the parameters
CO5	to know about various testing methods
CO6	To know about how design of experiments are to be analysed

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M			H	H	L	L	H
	CO2	H	M	M				H					
	CO3	H			H	H	H	H			L	L	M
	CO4	H	M			H			H		L	H	M
	CO5	H	M	M	H	H		M					
	CO6	H			H		M	M		H	M	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I PROBABILITY AND RANDOM VARIABLES 12

Probability concepts, Random Variables, discrete and continuous functions of random variables. Moment generating function of Binomial, Poisson, Geometric, Uniform, Exponential and Normal distribution (Problems)

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 12

Joint distributions - Marginal and Conditional distributions – Expectation and conditional expectations. Transformation of Random Variable, Central limit theorem (for independent and identically distributed random variables)

UNIT III BASIC STATISTICS 12

Measures of central tendency – Measures of dispersion – Moments, Skewness & Kurtosis – Correlation, and Regression and Rank Correlation.

UNIT IV TESTING OF HYPOTHESIS 12

Introduction – Large sample tests based on normal distribution - Test for single mean, difference between means, proportion, difference between proportions, standard deviation, difference between standard deviation. Chi-square test for goodness of fit, independence of attributes.

UNIT V ANALYSIS OF VARIANCE 12

Small sample tests based on T and F distribution - Test for, single mean, difference between means, Paired t-test, test for equality of variances, ANOVA – one – way classification, Two-way classification.

Text Books

1. S.C.Gupta & V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi, 2003. [Units I to III].
2. S.C. Gupta and V.K. Kapoor, "Applied Statistics". Sultan Chand and Sons, New Delhi 2004 [Units IV & V].
3. Douglas C. Montgomory. "Design and Analysis of Experiments, Student Solutions Manual", 8th Edn: Wiley India Pvt Ltd., New Delhi-2. 2012.

Reference Books

1. Veerarajan T. "Probability Statistics and Random Processes" Tata McGraw Hill, New Delhi 2003.
2. W.W. Daniel, "Biostatistics-A foundation for Analysis of Health Sciences", John Wiley and Sons, New Delhi 2000.
3. Douglas C. Montgomery and George C. Runger. "Applied Statistics and Probability For Engineers", 6th Edn. Wiley India Pvt Ltd., New Delhi-2. 2010.
4. Tirupathi R.Chandrauptta. "Quality and Reliability in Engineering". Book Vistas, New Delhi.

BAC501	PLANT GENETIC ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3

	Prerequisite – Molecular biology, Cell biology, Microbiology
	Course Designed by – Dept. of Industrial Biotechnology

OBJECTIVES

To provide a basic understanding of recombinant mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of genetic engineering
CO2	to apply the concept of recombinant DNA in plant, animal and microbial systems and growth in real life situations
CO3	to get the knowledge of molecular scissors and its role in creating transgenic products
CO4	To know the techniques related to screening of recombinant products
CO5	to get a basic knowledge of the applications of transgenes in agriculture
CO6	to know about gene transfer methods

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	H	H	L	H
	CO2	H	M	M	H	H	M	M	H		L		
	CO3	H	M		H					H	M	L	H
	CO4	H	M			H	H	M	M		M	M	M
	CO5	H	M	M		H		M		M		L	H
	CO6	H			H	H			L				M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CLONING 9

Introduction to Genetic engineering.- Restriction enzymes, Restriction sites, Linkers and adapters. Markers for screening- Vectors- Characteristics- plasmid: EcoIi -.pBR 322, Cosmid- Shuttle vectors, pblue script vectors, Expression vectors, BAC, YAC, MAC. Characterization of recombinant clones by Southern, Northern, Western Blotting

UNIT II CONSTRUCTION OF LIBRARIES 9

Overlapping and Non overlapping DNA fragments, Genomic library- Purification and Separation of RNA. cDNA library construction, Genome mapping, Polymerase Chain Reaction – methods, types and Applications. Semi quantitative and Real time PCR,

UNIT III NUCLEIC ACID SEQUENCING AND LABELLING 9

Nucleic acid sequencing methods-Maxam Gilbert chemical sequencing, Sanger dideoxy enzymatic method- DNA Labelling: Nick translation, RNA labeling and Fluorescent labeling and non isotopic labeling methods

UNIT IV GENE TRANSFER IN PLANTS 9

Method of gene transfer to plants- agrobacterium mediated / chemical mediated, Biolistics. Transgenic plants- Ri and Ti plasmids, Screening of recombinants -Direct and indirect methods, Single cell proteins using fungi.

.

UNIT VAPPLICATIONS 9

Transgenic plants for insect, disease, stress & herbicide resistance – edible vaccines and plantibodies – methods of crop improvement through genetic engineering – Fruit ripening-Antisense RNA technology

TEXT BOOK

1. **1.** Adrian Slater, 2006, "Plant biotechnology", 3rd Ed,
1. Brown TA, 2000, "Gene cloning-and introduction" VNR (U.K) Co Ltd.

REFERENCE BOOKS

2. C. B. Nirmala, G. Rajalakshmi, Chandra Karthick. 2009," Plant Biotechnology
3. Setlow JK,2004, "Genetic engineering: principles and methods" Springer.
4. Fridal R,2006, "Genetic engineering" Lerner publications.
5. LeVine H,2006, "Genetic engineering-A reference handbook" ABC-CLIO.
6. Levine AD,2009, "Cloning" The Rosen publishing group, 1st.
7. Weblink: nptel

BAC502	**PLANT PATHOLOGY AND DISEASE MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Microbiology				
	Course Designed by – Dept of Industrial Biotechnology				
OBJECTIVES: To provide a basic knowledge on plant diseases, symptoms and causative organisms					
COURSE OUTCOMES (COs)					
CO1	to understand the concept of pathogenesis				
CO2	to know about the types of fungal diseases in plants				
CO3	to understand about the various bacterial diseases in plants				
CO4	to study the various aspects of viral diseases				

CO5	to understand the concept of disease management												
CO6	to know the measures taken to control diseases in plants												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H		H	H	H	H	M	L	M
	CO2	H	M	M	H							L	M
	CO3	H				H			H	L			
	CO4	H	M				M	M				L	
	CO5	H	M	M		H				M	L		
	CO6	H				H		L	M		L	L	M
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)				
					√								
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I: INTRODUCTION AND PATHOGENESIS 9

Plant Pathology-Definition-History of plant Pathology-causes of plant diseases-Biotic and abiotic; Pathogenesis-Mode of infection-pre penetration, penetration and post penetration; Effect of pathogen on physiological functions of the plants; Role of enzymes and toxins on disease development-Plant defense mechanisms.

UNIT II: FUNGAL DISEASES IN PLANTS 9

General characters of fungi-structure, Reproduction – outline of asexual and sexual reproduction ; Molecular phylogeny of fungi; Fungal diseases- Damping off, Downy mildews, White Rusts, Powdery Mildew, Rots, smuts, Bunt, Rust, Wilt, Head blight, Root rots, Leaf spots, Leaf blights, Anthracnoses, Galls-Symptoms-causative organisms –Pathogenesis.

UNIT III: BACTERIAL DISEASES IN PLANTS 9

General characters of Phytopathogenic bacteria ;Bacterial diseases-Blight, Leaf streak, Citrus canker, Black rot, Wilt, Brown rot, Yellow ear rot, Black leg, Fire blight of Apples and pears, Crown gall, Stalk rot, scab, Ratoon stunting of sugarcane-Angular leaf spot-Symptoms-causative organisms –Pathogenesis.

UNIT IV: VIRAL DISEASES IN PLANTS AND OTHER CAUSATIVE AGENTS 9

Viral diseases –Mosaic disease, Leaf roll, Leaf curl, Bunchy disease-Tristeza of citrus -symptoms-causative organisms-pathogenesis; General characters and symptoms of candidatus phytoplasma – spiroplasma-algae-viroids-Phanerogamic parasites, Vectors -types and Mode of spread.

UNIT V: PLANT DISEASE MANAGEMENT 9

Principles and Methods of plant disease management –Avoidance-Exclusion-Eradication of pathogens-Protection –Resistance; Management of plant diseases –Regulatory-cultural-biological-physical-chemical strategies; Seed health certification system –Resistance Breeding - Integrated disease management.

References

1. Agrios, G.N. 2005. Plant Pathology – (5th Edition). Academic Press, New York.
2. Alexopoulos,C.J., Mims,C.W. and Blackwell, M.2010 Introductory Mycology. John Wiley and Sons Ltd., N.York.
3. Alice D, and Jeyalakshmi C 2014. Plant Pathology. A.E Publications ,Coimbatore
4. Dube, H.C.2009. A textbook of Fungi, Bacteria and Viruses, Vikas Publishing House P. Ltd, New Delhi.
5. Mehrotra, R.S. and Aneja, K.R. 1990. An Introduction to Mycology, Wiley E.Ltd. New Delhi.
6. Singh, R.S.1982. Plant Pathogens – The Fungi. Oxford and IBH Publishing Co., New Delhi.
7. Vidyasekaran, P. 1993. Principles of Plant Pathology –. CBS Publishers & Distributors, New Delhi.

BAC503	**INTRODUCTION TO SILVICULTURE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	4
	Prerequisite – Environmental studies, Agricultural Botany				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide basic understanding on Silvicultural practices

COURSE OUTCOMES (COs)

CO1	to understand basic concepts in forestry
CO2	to know about the interaction between forest and people
CO3	to know about the concept of agroforestry
CO4	to know about agroforestry species and forest mensuration
CO5	to know about the agroforestry practices
CO6	to know about the applications of agroforestry

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	H	H	M	M

	CO2	H		M	M	H	M					M	
	CO3	H	M			H			M	M	M		H
	CO4	H			M	M	M		M			L	M
	CO5	H	M	M	M	L		L	L	L	M	M	L
	CO6	H	L	M				L					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO FORESTRY 12

Forest – Forestry – Definition, objectives, classification and historical perspectives in India- Role of forest – tangible and intangible benefits- Geographical distribution of world and Indian forests – Forest types – definition and major forest types of India - Forest cover of India as per Forest Survey of India - Definition of Silvics and Silviculture – objectives – its relation with other branches of forestry - International forestry organizations.

UNIT II FORESTS AND PEOPLE 12

Social forestry – Definition, history, objectives – Components – Farm forestry, Extension forestry, Community forestry, Recreation forestry, Urban forestry – Benefits of social forestry - Important social forestry schemes implemented in India - Definition, origin and evolution of JFM in India – Salient features of JFM – Organisational structure in JFM- Benefit sharing mechanism

UNIT III AGROFORESTRY CONCEPT AND SYSTEMS 12

Land use and land capability classification - Agroforestry – definition and scope – History of agroforestry – Components of agroforestry, benefits and limitations - Overview of global agroforestry - traditional agroforestry practices in Asia and India - Agroforestry system classification – structural, functional, ecological and socio-economic basis

UNIT IV AGROFORESTRY TREE SPECIES AND MENSURATION 12

Important farm grown trees - Silvicultural characters – Regeneration techniques – Tending – Rotation – Yield and Uses of *Tectona grandis, Santalum album,* Casuarina species, Eucalyptus species, *Azadirachta indica, Melia dubia, Leucaena leucocephala, Aibizia lebbeck, Acacia nilotica, Acacia leucophloea, Acacia auriculilformis, Ailanthus excelsa, Dalbergia sissoo,*

Gmelina aroborea and *Pterocarpus marsupium* - Forest Mensuration – definition, objectives – Diameter, girth and height measurement methods–standard rules governing breast height measurement – Volume estimation in standing and felled trees

UNIT V AGROFORESTRY PRACTICES 12

Agroforestry practices for arid and semi arid regions – Agroforestry for problem soils - salt affected soils, waterlogged areas – Multifunctional agroforestry – green manure, fuel wood and fodder production – agroforestry for soil and water conservation, wasteland development – Carbon sequestration through agroforestry approaches – Timber transit rules for farm grown trees - National Agroforestry policy, 2014

Text Books

1. Divya, M.P., K.T.Parthiban, K.Srinivasan, K.Vanangamudi and M.Govinda Rao. 2008. A text book on Social Forestry and Agroforestry. Satish Publishers, Delhi

2. Dwivedi, A.P. 1992. Agroforestry Principles and Practices. oxford & IBH publishing Co., New Delhi

3. Khanna, L. S. 1991. Principles and Practice of Silviculture. Khanna Bandhu, Dehradun.

4. Chaturvedi, A. N and Khanna, L. S. 2000. Forest Mensuration. International Book Distributors, Dehradun.

BAC504	PLANT CELL AND TISSUE CULTURE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic sciences, microbiology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a knowledge about tissue culture and its applications

COURSE OUTCOMES (COs)

CO1	to understand the uses of tissue culture
CO2	to know about the concept of variation
CO3	to know about the types of culture
CO4	to study about protoplast culture
CO5	to get knowledge about the applications of tissue culture
CO6	to get ideas about various importance of tissue culture

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	L	M	L	L	M

	CO2	H	M	M	H	H						L	M
	CO3	H	M		H	H		M	H	H	L		
	CO4	H	L		H			M			L	L	M
	CO5	H	M	M	H	H					L		M
	CO6	H			H	H	L	M	M	L		L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

History-organization of tissue culture lab-sterilization methods-lab requirements: equipments, culture vessels-culture media: constitution, types of media, preparation: MS medium, White's, Gamborg, Nitsch medium-plant growth hormones- Auxins - Cytokinins – Gibbrellins -Abscissic acid - Ethylene – Polyamines

UNIT II TISSUE CULTURE AND VARIATION 9

Tissue culture as a source of genetic variability: somoclonal and gametoclonal variation, sources and causes of variation, selection of variants-micropropagation as a tool of in vitro multiplication

UNIT III TYPES OF CULTURE 9

General terms in Tissue culture-embryogenesis and organogenesis-cytodifferentiation-callus culture-anther culture-haploid culture-embryo culture-meristem culture-single cell culture

UNIT IV PROTOPLAST CULTURE 9

Protoplast isolation, culture and fusion-selection of hybrid cells –regeneration of hybrid plants-somatic hybridization and cybridization –somatic embryogenesis and artificial seeds

UNIT V APPLICATIONS OF TISSUE CULTURE 9

Production of plants for crop improvement- secondary metabolite production through plant cell cultures-presentation of plant genetic resources-Gene conservation bank-application in plant pathology

TEXT BOOKS

1. Plant Biotechnology – S Ignacimuthu, S J Oxford and IBH, New Delhi,1996.

2. Applied Biotechnology and Plant Genetics – M Sudhir, Domain publishers & distributors, 2000

REFERENCE BOOKS

1. S.S. Purohit, Textbook of Plant Biotechnology, 2015, Bio Green Books

3. Plant Biotechnology: Recent Advances – P C Trivedi, Panima publishing corporation, 2000

BAC5L1	PLANT GENETIC ENGINEERING LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Molecular biology,rDNATechnology,Microbiology.				
	Course Designed by – Dept. of Agricultural Biotechnology				

OBJECTIVES

To provide a basic understanding of recombinant mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of genetic engineering
CO2	to apply the concept of recombinant DNA IN plant, animal and microbial systems and growth in real life situations
CO3	to get the knowledge of molecular scissors and its role in creating transgenic products
CO4	to know the techniques related to screen the recombinant products.
CO5	to get a basic knowledge of the applications of transgenes in agriculture, health care and biological products in relevant industries
CO6	To get knowledge about PCR

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H		H	M	H	H	L	L	M
	CO2	H	M				L		H	M	L		
	CO3	H	M	H	H	H	H	M	H	H	L		
	CO4	H			H	H	H	M	M	M		L	M
	CO5	H	M	M	H					L	L	L	
	CO6	H			H	H	H	M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS

1. Extraction of DNA
2. Agarose gel electrophoresis
3. Restriction digestion of DNA
4. Ligation of digested DNA
5. Preparation of competent cell
6. Transformation
7. Southern hybridization
8. AFLP
9. GFP cloning
10. Polymerase Chain reaction

BAC5L2	**PLANT CELL AND TISSUE CULTURE LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Biochemistry, Microbiology, Environmental Biotechnology				
	Course Designed by – Dept. of Agricultural Biotechnology				

OBJECTIVES: To provide knowledge about environmental science and technology

COURSE OUTCOMES (COs)

CO1	to know about analysis of water
CO2	to understand about microbial examination of effluent
CO3	to get basic idea about adsorption of dye
CO4	to know about microbial remediation
CO5	to get basic idea about bioremediation
CO6	to know about analysis of soil

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M	M		M	H		L	
	CO2	H	M	M	H	H		M			L	L	
	CO3	H	M		H		M	M					M
	CO4	H	M		H	H			L	M		L	M
	CO5	H	M	M	H	H	M	M			L		M
	CO6	H			H	H				L	L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS

1. Tissue culture lab practices
2. Sterilisation techniques for tissue culture
3. Preparation of culture medium
4. Callus culture using Daucus carota.
5. Nodal bud culture of Hibiscus.
6. Micropropagation of Rose
7. Rooting and hardening
8. Preparation of Synthetic seeds.
9. Embryo culture.
10. Anther culture

BAC5L3	**PLANT PATHOLOGY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Plant biotechnology, Animal biotechnology, Genetic engineering				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide a basic understanding of plant and animal cell culture techniques

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of plant biotechnology
CO2	to know about sterilization techniques
CO3	to know about plant tissue culture
CO4	to know about animal cell culture
CO5	to get a basic knowledge of the applications using plant biotechnology
CO6	to get a basic knowledge of the applications using animal biotechnology

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M	H	H	L	M			
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H	M	H	L	M	L		M
	CO4	H	M		H	H		M			L	L	
	CO5	H	M	M	H	H	H	H		M	L	L	M
	CO6	H			H	H		M	M			L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS

1. General characters of fungi – Types of mycelia -Types of vegetative, asexual and sexual spores- asexual and sexual fruiting bodies.
2. Study of important taxonomic characters and symptoms produced by *Plasmodiophora*, *Pythium* and *Phytophthora*.
3. Study of important taxonomic characters and symptoms produced by *Sclerospora, Peronospora, Peronosclerospora Pseudoperonospora* and *Plasmopara*
4. Study of important taxonomic characters and symptoms produced by *Albugo and Rhizopus.*
5. Study of important taxonomic characters and symptoms produced by *Taphrina, Capnodium, Cercospora,* (*Mycospaerella*), *Botryodiplodia* (*Botryosphaeria*), *Drechslera* (*Helminthosporium)* and *Alternaria*
6. Study of important taxonomic characters and symptoms produced by *Eurotium, Talaromyces, Erysiphe, Leveillula, Phyllactinia, Uncinula , Podosphaera and Sphaerotheca*
7. Study of important taxonomic characters and symptoms produced by *Claviceps, Fusarium* (*Gibberella, Nectria*) and *Verticillim*
8. Study of important taxonomic characters and symptoms produced by *Colletotrichum (Glomerella), Pestalotia (Pestalosphaeria), Pyricularia* (*Magnoporthe*)*Sarocladium* and *Macrophomina*
9. Study of important taxonomic characters and symptoms produced by *Puccinia, Uromyces,* and *Hemileia*
10. Study of important taxonomic characters and symptoms produced by *Ustilago, Sphacelotheca (Sporisorium), Tolyposporium (Moesziomyces),and Exobasidium*
11. Study of important taxonomic characters of *Agaricus*, *Pleurotus, Calocybe, Volvariella* and symptoms produced by *Athelium, Thanetephorus* and *Ganoderma*
12. Symptoms of bacterial diseases – leaf blight, leaf streak, canker, scab, crown gall, wilt and soft rot.

BAC601	**FERMENTATION TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Microbiology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge of Biological processes.	
COURSE OUTCOMES (COs)	
CO1	To understand the development of bioprocess techniques.
CO2	To know about the instrumentation and control for bioprocess operations
CO3	To get idea about fermentation techniques
CO4	To know about fermentation products
CO5	To know about various bioreactors

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		H			L	L	
	CO2	H	M	M	H	H		M		M	L		M
	CO3	H			H	H	M	H	H			L	M
	CO4	H	M		H			M			L		
	CO5	H	M	M	H	H		M	M	M	L		M
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)	
							√						
4	Approval	Academic Council, July 2018											

UNIT –I INTRODUCTION TO FERMENTATION

History of fermentation - Media sterilization, Batch Process (thermal death kinetics), continuous sterilization process; sterilization of fermenter and other ancillaries, filter sterilization of air and media- Upstream process.

UNIT II INSTRUMENTATION AND CONTROL OF PROCESS PARAMETERS 9

Main parameters to be monitored and controlled in fermentation processes: Temperature, pressure, pH, flow, dissolved oxygen, dissolved CO_2- cell mass, cell number, solid-substrate fermentation and its applications.

UNIT III FERMENTATION TECHNIQUES 9

Fermentation- Definition & types - Submerged and Solid state. Fermentors & its types (Tower, cylindroconical & airlift) – Batch fermentation – Continuous fermentation.

UNIT –IV FERMETATION PRODUCT 9

Production of beverages – beer and wine- vitamin B12–Antibiotics- penicillin - Bakers yeast, Details of mushroom development- Oyster (Pleurotus) and Button (Agaricus) mushroom.

UNIT –V DOWNSTREAM PROCESSING 9

Downstream process- Intercellular and extracellular- Centrifugation, filtration, Floatation-solvent extraction, precipitation- cell disruption- physical and Chemical methods.

TEXT BOOK:

1. Stanbury P T and Whitaker 1984, Principles of Fermentation Technology,

Pergamon Press. NY

REFERENCES

1. Casida, L E JR 1968 Industrial Microbiology. New Age International Publishers.

2. Prescott and Rehm 1979. Industrial Microbiology. Wiley and Sons.

BAC602	**BIOFERTILIZERS AND BIOPESTICIDES**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									3	0	0	3
	Prerequisite – Agricultural microbiology												
	Course Designed by – Dept of Agricultural Biotechnology												
OBJECTIVES: To provide a basic knowledge of biofertilizers and biopesticides													
COURSE OUTCOMES (COs)													
CO1	to understand the production of symbiotic nitrogen fixers												
CO2	to know about non symbiotic nitrogen fixers												
CO3	to get idea about mycorrhizal biofertilizers												
CO4	to know about PSMs and their uses												
CO5	to know about biopesticides												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H		H	H	H	H	M	L	M
	CO2	H	M	M	H							L	M
	CO3	H				H			H	L			
	CO4	H	M				M	M				L	
	CO5	H	M	M		H				M	L		
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
							√						
4	Approval	Academic Council, July 2018											

UNIT I SYMBIOTIC NITROGEN FIXERS **9**

Introduction-history-symbiotic and non symbiotic nitrogen fixation-Symbiotic N2 fixers: Rhizobium - Isolation, characteristics, types, inoculum production and field application-Frankia biofertilizer

UNIT II NON SYMBIOTIC NITROGEN FIXERS **9**

Free living Azotobacter- free isolation, characteristics, mass inoculums, production and field application; Azospirillum isolation, characteristics, mass production, Acetobacter isolation and characterization, mass production-blue green algae biofertilizers-Azolla-green manuring

UNIT III MYCORRHIZAL BIOFERTILIZERS **9**

Importance of mycorrizal inoculum, types of mycorrhizae and associated plants, Mass inoculum production of VAM, field applications of Ectomycorrhizae and VAM.

UNIT IV PHOSPHATE SOLUBILIZERS **9**

Phosphate solubilization in plants-Phosphate solubilizing microbes - Isolation, characterization, mass inoculum production, field Application, Plant growth promoting Rhizoflora (PGPR)

UNIT V BIOPESTICIDES **9**

Biocontrol-agents of biocontrol-antagonism-biopesticides vs chemical pesticides-field application of biocontrol-bacterial pesticides; *Bacillus thuringiensis*, production, Field applications-mycopesticides-viral pesticides-biological control of weeds

TEXT BOOK

1. Singh B.D, (2003), Biotechnology, Kalyani Publishers
2. R.C. Dubey, (2009), A Textbook of Biotechnology, S Chand and Company, Ltd

REFERENCE BOOK

1. Kannaiyan, S. (2003). Bioetchnology of Biofertilizers, CHIPS, Texas.
2. Mahendra K. Rai (2005). Hand book of Microbial biofertilizers, The Haworth Press, Inc. New York.
3. Reddy, S.M. et. al. 2002), Bioinoculants for sustainable agriculture and forestry, Scientific Publishers

BAC603	**ENTOMOLOGY AND PEST MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – basics of entomology				
	Course Designed by – Dept. of Agricultural Biotechnology				

OBJECTIVES

To provide a basic understanding on entomology and pest management

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of insect morphology

CO2	to know about insect taxonomy
CO3	to give an idea on pest management
CO4	to learn about pest of field crops
CO5	to get a basic knowledge pest of horticultural crops
CO6	To know about storage pests

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						H		H			
	CO2	H		H				H		H			
	CO3	H		H				H		H			
	CO4	H		H	M			H		H			
	CO5			H		H	H	H	H				H
	CO6	H				H		H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INSECT MORPHOLOGY ANATOMY AND PHYSIOLOGY 9

Position of insects in the animal kingdom and their relationship with other classes of Arthropoda; Reasons for insect dominance. General organisation of insect body wall - structure and function, cuticular appendages, moulting; Body regions - insect head, thorax and abdomen, their structure and appendages. Digestive, excretory, respiratory, circulatory and reproductive systems in insect

UNIT II TAXONOMY OF APTERYGOTA, EXOPTERYGOTA AND ENDOPTERYGOTA 9

Insect systematics; Distinguishing characters of agriculturally important orders and families of Hexapoda. Apterygota (Thysanura, Diplura, Protura and Collembola); Exopterygota (Ephemeroptera, Odonata, Orthoptera, Phasmida, Dictyoptera, Embioptera, Dermaptera, Hemiptera, Isoptera, Psocoptera,Mallophaga, Thysanoptera and Siphunculata). Distinguishing characters of agriculturally important families of Lepidoptera, Coleoptera, Diptera, Hymenoptera, Siphonaptera, Neuroptera and Strepsiptera

UNIT III ECOLOGY AND PEST MANAGEMENT 9

Pests – definition and categories – pest outbreak – factors governing pest outbreak– pest monitoring, surveillance and forecasting. Economic Threshold Level – Economic Injury Level- Integrated Pest Management – history, principles and strategies – requirements for successful pest management programme; Cultural, physical, mechanical, ecological engineering methods and host plant resistance in pest management

UNIT IV PESTS OF FIELD CROPS 9

Distribution, bionomics, symptoms of damage and management strategies for insects and non-insect pests of rice, wheat, maize, sorghum, cumbu, ragi, tenai,redgram, green gram, black gram, bengal gram, cowpea, groundnut, castor, gingelly, sunflower, safflower, jatropa, soybean and mustard. Distribution, bionomics, symptoms of damage and management strategies of insects and non-insect pests of cotton and sugarcane, green manures (Sunhemp, Sesbania, Daincha, Glyricidia), forage crops (Lucerne and Subabul)

UNIT V PESTS OF HORTICULTURAL CROPS AND STORAGE PEST 9

Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Brinjal, Bhendi, Tomato, Chillies, Onion, Garlic, Moringa, Amaranthus, Crucifers, Cucurbits, Mango, Citrus, Banana, Guava, Grapevine and Sapota. Distribution, bionomics, symptoms of damage and management strategies of insect and non insect pests of Pomegranate, Papaya, Aonla, Apple, Pine apple, Custard apple and Jack, Potato, Sweet potato, Tapioca, Yam, Colocasia, Coconut, Arecanut, Tea, Coffee, Cashew, Cocoa, Betelvine, Ginger, Turmeric, Coriander, Cardamom, Pepper, Curry leaf and Tamarind, Rose, Jasmine, Crossandra, Chrysanthemum, Tuberose, Cut flowers, Glory lily, Coleus, Stonebreaker, Aswagantha, Senna, Periwinkle and Lawn. Distribution, bionomics, symptoms of damage and management strategies of pests of and stored products. Rodents and birds of agricultural importance and their management- Locusts and their management

TEXT BOOKS:

1. Richards O.W. and R.G. Davies. 1977. *Imm's General Text Book of Entomology*. Vol.I and II. Chapman and Hall Publication, London. 1354p. {ISBN 0412 15220 7

REFERENCES:

1.Chapman, R.F. 1998. *The Insects: Structure and Function*. Fourth Edition. Cambridge University Press. 770p. {ISBN 0 521 78732 7}
2. Snodgrass, R.E. 1994. *Principles of Insect Morphology*. CBS publishers and distributors, New Delhi. 667p.
3. David, B.V. and V.V. Ramamurthy. 2011. *Elements of Economic Entomology*, Namrutha Publications, Chennai, 386 p. {ISBN: 978-81-921477-0-3}
4. Srivastava, P. D. and R. P. Singh. 1997. An Introduction to Entomology. Concept Publishing Company, New Delhi.

BSS601	**VALUE EDUCATION AND PROFESSIONAL ETHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – English & Professional Courses				
	Course Designed by – Dept. of Management Studies				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
- To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)

CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing
CO4	To learn more of Engineer as Responsible Experimenter.
CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To learn more of Responsibilities and Rights as Professional and facing Global Challenges

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe- Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.

UNIT III MIND CULTURE & TENDING PERSONAL HEALTH 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelizing the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV: ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS'SRESPONSIBILITIES FOR SAFETY 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Challenger, case study-Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies

UNIT V: ENGINEERS'S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership

TEXT BOOKS

1. Value Education for Health, Happiness and Harmony, the World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata Mcgraw Hill, Newyork 2005 (Units IV & V)

REFERENCE

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004 (Units IV-V)

BAC6L1	FERMENTATION TECHNOLOGY LAB	L	T	P	C
	Total Contact Hours - 45	0	0	2	1

	Prerequisite – Bioprocess Engg., Unit Operation
	Course Designed by – Dept. of Agricultural Biotechnology

OBJECTIVES: To provide basic knowledge about bioprocessing

COURSE OUTCOMES (COs)

CO1	to get knowledge on biomass
CO2	to know about enzyme kinetics
CO3	to understand about immobilization of enzyme
CO4	to get idea about mass transfer
CO5	to know about death kinetics
CO6	to know about product optimization

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H	H	M		M		H	L		M
	CO2	H	M	M	H	H			M			L	
	CO3	H	M	M	H			M			L	L	M
	CO4	H	M	H	H	H			H	M		L	M
	CO5	H	M	M		H	L	M			L	L	
	CO6	H		H	H	H		M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				

4	Approval	Academic Council, July 2018

LIST OF EXPERIMENTS

1. Fermentative production of amylase by *Aspergillus niger*.
2. Production of wine and analyse its properties.
3. Brewing of beer and analyse its properties
4. Production of Antibiotic Bacitracin by bacillus sp.
5. Production of Vitamin B_{12}.
6. Cultivation of mushroom *in vitro* studies.
7. Fermentation of citrus juices.
8. Bio-ethanol production
9. Production of probiotics from lactic acid bacteria.
10. Operational procedures of bioreactors.
11. Bio-ethanol production by using *Zymomonas mobilis*.
12. Bio-surfactant production

BAC6L2	BIOFERTILIZERS AND BIOPESTICIDES LAB	L	T	P	C
	Total Contact Hours - 45	0	0	2	1
	Prerequisite – Microbiology, pathology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide basic knowledge about preparation of biofertilizers and biopesticides

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of preparation of biofertilizers
CO2	to know about Rhizobial, Azotobacter and Azospirillum biofertilizers
CO3	to know the protocol for preparation of PSM and mycorrhizal biofertilizers
CO4	to know about bacterial pesticides
CO5	to study the preparation of mycopesticides

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	H		M	H	M	M	M				L	
	CO2	H	M	M	H	H		M		M	L	L	M
	CO3	H	M	M	H	H	L		H		L		M
	CO4	H	M			H		M			L	L	M
	CO5	H	M	M	H	H		M		M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
								√	
4	Approval	Academic Council, July 2018							

LIST OF EXPERIMENTS

1. General protocol for production of biofertilizers and biopesticides
2. Preparation of Rhizobial biofertilizer
3. Preparation of Azotobacter biofertilizer
4. Preparation of Azospirillum biofertilizer
5. Preparation of Frankia Biofertilizer
6. Preparation of Blue green algae biofertilizer
7. Preparation of Azolla

8. Preparation of PSMs
9. Preparation of mycorrhizal biofertilizer
10. Biocontrol agents
11. Preparation of Bacillus thuringiensis biopesticides
12. Preparation of Mycopesticides

BAC6L3	**CROP PRODUCTIONLAB-AGRICULTURAL CROPS**										**L**	**T**	**P**	**C**
	Total Contact Hours - 45										0	0	2	1
	Prerequisite – crop production of Agricultural crops													
	Course Designed by – Dept. of Industrial Biotechnology													
OBJECTIVES: To provide knowledge about production of crops														
COURSE OUTCOMES (COs)														
CO1	to know about land preparation													
CO2	to know about nursery preparation													
CO3	to understand about fertilizer and pesticide application													
CO4	to get basic idea about harvesting and post harvesting													
CO5	to get basic idea about yield calculation													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low														
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	
2	CO1	H	M	M		M				M		L	M	
	CO2	H	M	M	H	H		M			L	L		
	CO3	H	M		H			M	M	L		L	M	
	CO4	H	M			H	M				L		M	
	CO5	H	M	M	H	H		M		L	L	L		
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)					
					√									
4	Approval	Academic Council, July 2018												

LIST OF EXPERIMENTS

1. Tillage and land configuration
2. Seed treatment and sowing
3. Nursery preparation
4. Fertilizer schedule calendar
5. Weeding
6. Pesticide application
7. Harvesting

8. Post harvesting
9. Storage
10. Yield calculation

BAC6P1	MINI PROJECT	L	T	P	C
	Total Contact Hours -60	0	0	4	2
	Prerequisite – Biochemistry, Microbiology, Bioprocess, Plant and Animal Biotechnology				
	Course Designed by– Dept. of Industrial Biotechnology				

OBJECTIVES: To enable students to do independent research

COURSE OUTCOMES (COs)

- It is a two credit course offered in the VI Semester
- Each student will be allocated a guide and a research topic at the end of the V semester. This will help them to collect sufficient literature during their vacation. A guide will have a maximum of four students
- There are 4 hours allocated per week for the students to do research. This will be considered for the award of internal marks.
- There will be three reviews to assess the progress of their research
- The final review will be on the day of the external examination in the presence of the an external and internal examiner. The student will be judged based on the presentation and how he or she defends the selected topic.

BBT701	RESEARCH METHODOLOGY AND INSTRUMENTATION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biochemistry, Instrumental method of analysis, Downstream processing				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide basic knowledge about various instrumentation techniques and data documentation

COURSE OUTCOMES (COs)

CO1	to understand the biochemical analysis
CO2	to know about spectroscopic and microscopic techniques
CO3	to know about the separation techniques
CO4	to get ideas about ethical issues related to research
CO5	to know about data documentation
CO6	To prepare research articles

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	H	M	M	H	M		H	H	H	M	M	M
	CO2	H	M	M	H	H		H			L	L	
	CO3	H	M	H	H	H		M	H		M		M
	CO4	H	M	H	H	H	H	H		M		M	H
	CO5	H	M	M	H	H		M	H		L	L	M
	CO6	H	H	H	H	H		H		M	L		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BASIC PRINCIPLES FOR BIOCHEMICAL ANALYSIS 9

Introduction – preparation of organ and tissue samples for analysis – cell disruption methods – physiological solutions: buffers and growth media for plants, animals and microbes – Medium standardization - cell sorting, isolation and enumeration techniques – cryopreservation – elucidating metabolic pathways by tracer studies.

UNIT II SPECTROSCOPIC AND MICROSCOPY TECHNIQUES 9

Introduction – UV – visible spectroscopy – NMR spectroscopy – IR and Raman spectroscopy – atomic spectroscopy - Introduction to microscopy – Election microscopy –ultramicrotome- phase contrast microscopy – Fluorescent and confocal microscopy.

UNIT III SEPARATION TECHNIQUES 9

Introduction to chromatography and electrophoresis – gel filtration – ion exchange – affinity – GC – HPLC - partition chromatography – electrophoresis of proteins and nucleic acids – immune precipitation techniques – ELISA.

UNIT IV ETHICAL ISSUES IN BIOTECHNOLOGY 9

Legal and socio economic impacts of biotech research – bio safety regulation – r-DNA guidelines- issues involved in experimenting with animals – Experimental protocol approvals – contaminant levels and environmental effects- impact of GM organisms and GM foods – IPR and patents.

UNIT V DATA ANALYSIS AND DOCUMENTATION 9

Sampling concepts for statistical analysis – Mean, median, standard deviation, standard error – ANNOVA – Guidelines for thesis writing: literature collection methods – writing of abstract, introduction and review of literature – results, discussion and summary – guidelines to publish articles in journals.

TEXT BOOKS

1. Keith Wilson and John Walker,2004, Practical biochemistry, Principles and techniques – Cambridge publication
2. N. Gurumani, 2006, Research methodology for biological sciences, MJP publishers.

REFERENCE BOOKS

1. P. Ramadass, 2009, Research and writing: Across the disciplines, MJP publishers.

BAC701	**BIOTECHNOLOGY OF BIOTIC AND ABIOTIC STRESS TOLERANCE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biochemistry, Crop Physiology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide basic knowledge on plant stress and its prevention and consequences

COURSE OUTCOMES (COs)

CO1	to understand the types of abiotic and biotic stress factors
CO2	to analyze the factors responsible for disease and pest resistance
CO3	to remember the various enzymatic pathway involved in stress tolerance
CO4	to understand the concept of host response to disease resistance
CO5	to analyze the efficiency of transgenic plants in stress tolerance
CO6	To understand the mechanisms involved in abiotic stress tolerance

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		H	H	H	M	M	M
	CO2	H	M	M	H	H		H			L	L	
	CO3	H	M	H	H	H		M	H		M		M
	CO4	H	M	H	H	H	H	H		M		M	H
	CO5	H	M	M	H	H		M	H		L	L	M
	CO6	H	H	H	H	H		H		M	L		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION **9**

Prospects & Perspective of Biotic & abiotic stress resistant plants, Genetics of host-pathogen interactions, Mechanism of plant resistance- Role of jasmonates and salicylic acid in systematic resistance induction on wounding.

UNIT II INSECT PEST RESISTANCE 9

Insect pest resistance – Structural/ morphological changes; Protease and amylase inhibitors; polyphenol oxidases; peroxidases; lectins; chitinase; seed proteins; their limitations and resistance-significance in multi-gene pyramiding. Vertical and Horizontal resistance to pathogens.

UNIT III HYPERSENSITIVE HOST RESPONSE 9

Hypersensitive host response (HRGP) and apoptosis in relation to plant defence. Virulence-Avirulence in host–pathogens interaction. Race specific Resistance Gene Analogues (RGAs). Pathogenesis related proteins – groups with examples (Glucanases; chitinases; osmotin, chitin binding proteins; thaumatin like proteins; micropeptidal defensins; phytoallexins) and their role.

UNIT IVFIELD TESTING FOR TRANSGENIC PLANTS 9

Role of Phenylalanine ammonia lyase, callose synthases, detoxification for pathogen resistance. Ribosome inactivating protein (RIP).Field testing of transgenic plants for fungal, bacterial, viral and pest resistance. Prospects and perspectives. Biopesticides-Developing antagonistic strains suitable for varying stress conditions

UNIT V ABIOTIC STRESS TOLERANCE 9

Biochemical basis of abiotic stresses namely osmotic (drought, salinity), temperature, heavy metals, air and water pollutants, synthesis and functions of proline and glycine betaine in stress tolerance-interaction between biotic and abiotic stresses; stress adaptation. Reactive oxygen species and biotic and abiotic stress, antioxidants, enzymes defence system. Role of calcium, nitric oxide and salicylic acid in plant development. Molecular strategies for imparting tolerance against abiotic stress.

Text book:

- Li PH & Sakai A. 1987. Plant Cold Hardiness. Liss, New York Luginpill P. 1969.
- Developing Resistant Plants - The Ideal Method of Controlling Insects. USDA, ARS, Washington DC.
- Maxwell FG & Jennings PR. (Eds.). 1980. Breeding Plants Resistant to Insects. John Wiley & Sons.
- Painter RH. 1951. Insect Resistance in Crop Plants. MacMillan, New York.
- Russel GE. 1978. Plant Breeding for Pest and Disease Resistance. Butterworths.

Reference:

1. Verma DPS & Kohn TH. 1984. Genes Involved in Microbe-Plant Interactions. Springer Verlag.
2. Molecular Plant-Microbe Interactions. Journal Published by APS.
3. Basra AS. 1997. Stress Induced Gene Expression in Plants. Harwood Academic Publ.
4. Chessin M, DeBorde D & Zipf A. 1995. Antiviral Proteins in Higher Plants. CRC Press.
5. Crute IR, Burdon JJ & Holub EB. (Eds.). 1997. Gene-for-Gene Relationship in Host-Parasite Interactions. CABI.

6. Hopkins WG & Huner NPA. 2004. Introduction to Plant Physiology. John Wiley & Sons.
7. Salisbury FB & Ross C. 1992. Plant Physiology. 4th Ed. Wadsworth Publ. Taiz L & Zeiger E. 2006. Plant Physiology. 4th Ed. Sinauer Associates.
8. Kosuge T & Nester EW. 1989. Plant-Microbe Interactions: Molecular and Genetic Perspectives. Vols I-IV. McGraw Hill.

BAC702	**FOOD BIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – microbiology, pathology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: The students understand concepts involved in microbial contamination of food and methods to control the food preservation

COURSE OUTCOMES (COs)

CO1	To understand the factors responsible for food spoilage
CO2	To investigate the microbes involved in the food spoilage
CO3	To analyze the techniques by which the food is preserved
CO4	To study the different toxins produced by the bacteria and fungi
CO5	To study the different food products by using the microbes as a source
CO6	To understand the quality control standards in food

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	H		M	H	M	M	M				L	
	CO2	H	M	M	H	H		M		M	L	L	M
	CO3	H	M	M	H	H	L		H		L		M
	CO4	H	M			H		M			L	L	M
	CO5	H	M	M	H	H		M		M	L	L	M
	CO6		H		H		M	H				H	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
								√	

4	Approval	Academic Council, July 2015

UNIT I INTRODUCTION **9**

Food and Microorganisms – Important microorganisms in food (Bacteria, Mold and yeasts); Factors affecting the growth of microorganisms in food – pH, moisture, oxidation – Reduction potential, Nutrient content and Inhibitory substances and biological structure.

UNIT II FOOD PRESERVATION **9**

Principles of food preservation – General principles and application methods – Asepsis – Techniques of removal – use of temperature (low & high) - Drying, radiation and chemical preservatives

UNIT III FOOD SPOILAGE AND ITS CAUSES **9**

Spoilage of food – cereals, vegetables, fruits, egg and milk – canned foods and sea foods.

UNIT IV FERMENTED FOODS **9**

Fermented food – pickled cucumber, Sauerkraut- soysauce, Bread, Idli – Fermented dairy products – Yoghurt and cheese.

UNIT V FOOD BORNE DISEASES **9**

Food borne diseases & Food Quality control Measures – Food poisoning and Food borne infections – Bacterial and Mycotoxins- Investigation of food poisoning outbreaks- food standards, quality control- HACCP, FDA, WHO

References

1. Frazier. W.C and D.C Westhoff. 1978. Food Microbiology. 3rd ed. Tata Macgraw Hill publishing Co., New Delhi.

2. Jay,J.M .1991 . Modern Food Microbiology 4th edition, Van Nostra and Rainhokdd Co.

3. Adams. M. R and M. D Moss. 1995. Food Microbiology. New Age International limited.

Roday. S. Food Hygeine and Sanitation. Tata Mcgraw Hill Publications.1998.

BAC7L1	**FOOD BIOTECHNOLOGY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	2	1
	Prerequisite – microbiology				
	Course Designed by – Dept. of Industrial Biotechnology				
OBJECTIVES: To provide basic technologies involved in food processing					
COURSE OUTCOMES (COs)					
CO1	To know about preservation techniques				

CO2	to understand basic concepts in sterilization of food products
CO3	to know about various dryers
CO4	to know about the mixing equipment for various products
CO5	to know about various preservation techniques for food products

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		H	H		L	L	
	CO2	H	M	M	H	H		M		M	L	L	
	CO3	H	M		H	H		M				L	M
	CO4	H	M		H		L				M	L	M
	CO5	H	M	M	H	H		M	M		L		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	Academic Council, July 2015							

LIST OF EXPERIMENTS

1. Isolation, identification of storage microflora from food stuffs/vegetable/fruit
2. Food colorants from microbes and their separation by HPTLC
3. Estimation of carotenes and xanthophylls from fruits/vegetables
4. Extraction and estimation of antioxidant in vegetables/fruits/food
4. Extraction and Characterization of Gluten
5. Extraction and Characterization of chitin
6. Estimation of caffeine from tea/coffee
7. Estimation of phytic acid from grains
8. Estimation of trypsin inhibitor
9. Estimation of capsaisin
10. Extraction of alginate from red algae

	CROP PRODUCTION LAB- HORTICULTURAL CROPS	**L**	**T**	**P**	**C**
BAC7L2	Total Contact Hours - 45	0	0	2	1
	Prerequisite – crop production of Horticultural crops				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To provide knowledge about production of crops													
COURSE OUTCOMES (COs)													
CO1	to know about land preparation												
CO2	to know about nursery preparation												
CO3	to understand about fertilizer and pesticide application												
CO4	to get basic idea about harvesting and post harvesting												
CO5	to get basic idea about yield calculation												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M		M				M		L	M
	CO2	H	M	M	H	H		M			L	L	
	CO3	H	M		H			M	M	L		L	M
	CO4	H	M			H	M				L		M
	CO5	H	M	M	H	H		M		L	L	L	
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)				
					√								
4	Approval	Academic Council, July 2018											

LIST OF EXPERIMENTS

1. Studying and practicing different propagation techniques of horticultural crops
2. Nursery practices for production of seedlings in containers and raised bed nursery preparation for horticultural crops
3. Practicing seed treatment, sowing of seeds, layout of main field preparation and practicing main field preparation, ploughing and formation of irrigation channels
4. Practicing basal application of fertilizers, FYM
5. Preparation of ridges and furrows /paired row systems
6. Practicing direct sowing and transplanting techniques
7. Practicing irrigation methods and formulating and practicing fertigation schedule to fruits, vegetable and flower crops
8. Practicing earthing up and hand weeding
9. Practicing special horticultural practices (training/ staking/ pruning)
10. Recording observations of growth parameters and Yield parameters
11. Practicing foliar application of nutrients/ growth regulators, herbicides, fungicides and pesticides
12. Identification of different physiological disorders, nutrient deficiency symptoms and their management

13. Practicing harvesting techniques fruits/vegetables /flowers
14. Practicing post harvest operations (cleaning/grading/packing/storage)
15. Working out the economics of cultivation (Cost of Cultivation)

BAC7P1	**TERM PAPER**	**L**	**T**	**P**	**C**
	Total Contact Hours -60	**0**	**0**	**4**	**2**
	Prerequisite – Biochemistry, Microbiology, Bioprocess, Plant and Animal Biotechnology				
	Course Designed by– Dept. of Agricultural Biotechnology				

OBJECTIVES

To enable students to do independent research

COURSE OUTCOMES (COs)

- It is a two credit course offered in the VII Semester
- Each student should register for the course
- Each student will be allocated a guide and a research topic at the end of the VI semester. This will help them to collect sufficient literature during their vacation. A guide will have a maximum of four students
- There are 4 hours allocated per week for the students to do research. This will be considered for the award of internal marks.
- There will be three reviews to assess the progress of their research
- The final review will be on the day of the external examination in the presence of an external and internal examiner. The student will be judged based on the presentation and how he or she defends the selected topic. The student also should publish a paper in a journal or in a conference proceeding

BAC8P1	**PROJECT WORK**	**L**	**T**	**P**	**C**
	Total Contact Hours -18 per week	0	0	18	9
	Prerequisite – Biochemistry, Microbiology, Bioprocess, Plant and Animal Biotechnology, Downstream process				
	Course Designed by– Dept. of Industrial Biotechnology				

OBJECTIVES: To enable students to do independent research

COURSE OUTCOMES (COs)

- It is a nine credit course offered in the VIII Semester
- Each student will be allocated a guide and a research topic at the end of the VII semester. This will help them to collect sufficient literature during their vacation. A guide will have a maximum of four students
- There are 18 hours allocated per week for the students to do research. This will be considered for the award of internal marks.
- There will be three reviews to assess the progress of their research
- The final review will be on the day of the external examination in the presence of an external and internal examiner. The student will be judged based on the presentation and how he or she defends the selected topic.

ELECTIVES

BACE01	**IMMUNOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – basics of immune system				
	Course Designed by – Dept. of Agricultural Biotechnology				

OBJECTIVES

To provide a basic understanding of biological defense mechanisms and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the fundamentals of immune system
CO2	to apply the techniques for antigen and antibody reaction
CO3	to give the mechanism of immune response against antigens
CO4	to know the natural barrier against pathogens
CO5	to get a basic knowledge of the applications of immunology in transplantation
CO6	To understand about techniques in immunology

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						H		H			
	CO2	H		H				H		H			
	CO3	H		H				H		H			
	CO4	H		H	M			H		H			
	CO5			H		H	H	H	H				H
	CO6	H				H		H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I THE IMMUNE SYSTEM 9

Introduction, Immunity, antigens &their classification, complement and their biological functions, types of immune responses, anatomy of immune response.

UNIT II HUMORAL IMMUNITY 9

B-lymphocytes and their maturation, activation &differentiation, structure and function of immunoglobulin, immunoglobulin classes, antibody production, mono-clonal antibodies and diagnosis major histocompatibility complex

UNIT III CELLULLAR IMMUNOLOGY 9

T -Lymphocytes their classification, maturation, activation & differentiation, antigen presenting, cells (APC), macrophages, langerhans cells, their origin and function, mechanisms of phagocytosis, Cytokines and their role in immune response, immunosuppression, immune tolerence

UNIT IV ANTIGEN - ANTIBODY INTERACTION AND HYPERSENSITIVITY9

Principle and application: Precipitation- immuno diffusion &widal test, Agglutination reactions, radio immuno assay, ELISA, Complement fixation test, Immuno fluorescence technique, Immunoelectrophoresis-Hypersensitivity reactions

UNITV TRANSPLANTATION AND AUTO IMMUNITY 9

Graft rejection, evidence and mechanisms of graft rejection, prevention of graft rejection-immunosuppressive drugs, mechanisms of immunity to tumour antigens. Auto antibodies in humans, pathogenic mechanisms -autoimmune diseases- treatment of auto immune disorders

TEXT BOOKS:

1. Janis Kuby,2007, “Immunology” W.H. Freeman & Co. 6th ed.
2. Roitt I, 2001, "Essential Immunology". Blackwell Scientific Publications, Oxford,

REFERENCES:

1. Tizard, 1992, “Introduction to Immunology” Saunders collage publication, 3rded.
2. Abbas,2009, “Basic Immunology” W.B. Saunders Company, 2nded.

BACE03	**BIODIVERSITY CONSERVATION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite- Botany, Environmental studies				
	Course Designed by – Department of Industrial biotechnology				
OBJECTIVES To learn about the conservation of biodiversity					
COURSE OUTCOMES (COs)					
CO1	to understand what is diversity				
CO2	to learn about the threats to diversity				
CO3	to know the methods of conservation of diversity				

CO4	to learn the sustainable methods of diversity
CO5	to have a knowledge about various policies
CO6	to understand the different acts enacted to protect biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	L
2	CO1	M							H			H	
	CO2				M		H						
	CO3										M		
	CO4		M						H				
	CO5					M							
	CO6							M			H	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval								

UNIT I TYPES, FUNCTIONS AND BENEFITS OF BIODIVERSITY 9

Types of Biodiversity: Species, Genetic and Ecosystem diversity – Alpha, beta, and gamma diversity – Biodiversity and ecosystem function – Megadiversity zones and Biodiversity Hot Spots in India – Ecologically Sensitive Areas (ESA) in India - Use of Biodiversity: Source of food, medicine, raw material, aesthetic and cultural uses – Biodiversity Prospecting: Significance of Indigenous Knowledge Systems

UNIT II THREATS TO BIODIVERSITY 9

Natural and anthropogenic threats to biodiversity – Human-Animal conflict with special reference to elephants and tigers - IUCN Threat Categories – Red Data Book – Wildlife exploitation - Species extinctions – Endangered and endemic species of flora and fauna in India - Over-harvesting and Climate change on biodiversity - Causes and Impacts of Invasive species to biodiversity

UNIT III CONSERVATION STRATEGIES 9

Current practices in conservation: Habitat or Ecosystem Approaches - Species-based Approaches - Social Approaches: Chipko Movement – In-situ conservation: Afforestation, Social Forestry, Agro-forestry, Botanical gardens, Zoos, Biosphere Reserves, National Parks,

Sanctuaries, Protected Area Network, Sacred Groves and Sthalavrikshas – Ex-situ conservation: Cryopreservation, Gene Banks, Seed Banks, Pollen Banks, Sperm Banks, DNA Banks, Tissue Culture and Biotechnological Strategies

UNIT IV SUSTAINABLE MANAGEMENT OF BIORESOURCES 9

National Biodiversity Authority (NBA) – Functions of State Biodiversity Board (SBB) and Biodiversity Management Committee's (BMC) – The role of WWF, FAO, UNESCO, UNDP and UNEP for biodiversity conservation – An elementary account on WTO, GAAT and TRIPS – Biopiracy rights of farmers, breeders and indigenous people –Biodiversity informatics with special reference to plant genetic resources

UNIT V POLICIES, PROGRAMMES AND ACTS FOR CONSERVATION 9

Status and protection of species in National and International levels – Role of CITES and IUCN – Convention on Biological Diversity (CBD) – Nagoya Protocol – Man and Biosphere Programme (MAB) – Policies implemented by MoEF for biodiversity conservation – Salient features of Biological Diversity Act 2002 – Ecosystem restoration

Text/Reference book

1. Gary K Meffe and Ronald Carroll C (1994) Principles of Conservation Biology. Sinauer Associates Inc., Massachusetts.

2. Krishnamurthy KV (2003) An Advanced Textbook on Biodiversity – Principles and Practice, Oxford and IBH Publishing, New Delhi.

3. Kumar HD (1997) General Ecology. Vikas Publishing House (P) Ltd., New Delhi.

4. Muthuchelian K (2013) Uyir Virimam (Tamil), Pranisha Pathippagam, Madurai.
5. Sharma PD (2000) Ecology and Environment. Rastogi Publications, Meerut, India.

6. Singh MP, Singh BS and Soma S. Dey (2004) Conservation of Biodiversity and Natural Resources. Daya Publishing House, New Delhi.

Web References

1. www.iucn.org
2. www.cites.org
3. www.cbd.int
4. www.fao.org/Ag/agp/agpc/doc/Publicat/TAPAFON/TAP_7.pdf
5. www.wri.org/biodiv/bp-home.html

BACE04	PRINCIPLES OF SEED TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – General biology, Cell biology, Agrl. Botany				
	Course Designed by – Dept of Biotechnology				

OBJECTIVES: To provide a basic knowledge about seeds its quality, handling and production methods

COURSE OUTCOMES (COs)

CO1	to understand basic concepts of seed and its quality
CO2	to know about the seed production principles
CO3	to know about production of seeds of agricultural crops
CO4	to know about production of seeds of vegetable crops
CO5	to understand the post harvest handling of seeds

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	M	L	L	H
	CO2	H	M	M	H	H	H		H	H	M	H	
	CO3	H			H				M	M	L	L	
	CO4		M	H	H	H	M	M	L	M		M	H
	CO5		M	M	H	H	M	M	M	M		L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	Academic Council, July 2018							

UNIT I - INTRODUCTION TO SEED AND SEED QUALITY 9

Seed - definition - Seed structure - Seed development and maturation - Germination -phases of seed germination - Dormancy - types of seed dormancy - Seed senescence - causes of seed senescence - Seed quality characteristics - significance - Classes of seed - Generation system of seed multiplication in seed supply chain .

UNIT II - PRINCIPLES OF SEED PRODUCTION 9

Seed replacement rate and varietal replacement - Seed Multiplication Ratio - Seed renewal period - Causes of varietal deterioration and maintenance - Genetic and agronomic principles of

seed production - Factors affecting quality seed production - Methods of seed production of varieties and hybrids.

UNIT III - SEED PRODUCTION TECHNIQUES OF AGRICULTURAL CROPS 9

Floral biology and pollination behavior - seed production techniques of rice, maize, sorghum and bajra varieties and hybrids - redgram varieties and hybrids - blackgam and greengram varieties - groundnut and sesame varieties - sunflower, castor and cotton varieties and hybrids – Bt cotton.

UNIT IV - SEED PRODUCTION TECHNIQUES OF VEGETABLE CROPS 9

Floral biology and pollination behavior - seed production techniques of tomato, chillies, brinjal, bhendi, onion, snakegourd, bittergourd, pumpkin, ashgourd, ribbedgourd and bottlegourd varieties and hybrids.

UNIT V - POST HARVEST SEED HANDLING TECHNIQUES 9

Threshing - methods - Drying - methods of seed drying - advantages and disadvantages -Seed processing – definition - importance - Seed cleaning and grading - upgrading - equipments - working principles - Seed treatment - importance - types - Seed invigouration techniques - seed hardening - seed fortification - seed priming - Seed enhancement techniques - seed coating - seed pelleting.

Text books

1. Agrawal, R.L. 1996. Seed Technology, Oxford & IBH Publishing Co., New Delhi.

Bhaskaran, M. *et al.,* 2004. Principles of seed production. Scientific Publishers, Ludhiana.

BACE06	**BIOREMEDIATION TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioprocess technology, Microbiology				
	Course Designed by – Dept. of Industrial Biotechnology				
OBJECTIVES: To provide basic knowledge about the bioremediation techniques					
COURSE OUTCOMES (COs)					
CO1	To know about the types of bioremediation				
CO2	to understand basic techniques in bioremediation				
CO3	to know about bioremediation of chlorinated compounds				
CO4	to know about the nuclear waste bioremediation				
CO5	to know about remediation of oil spills				

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		L	L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M	L	M	L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M	M	H	L	L	M
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)		Open Elective (OE)		Project/ Term paper Seminar/ Internship (PR)	
						√							
4	Approval	Academic Council, July 2018											

UNIT I BIOREMEDIATION **9**

Types of Bioremediation, Factors affection Bioremediation .Bioremediation Mechanisms.Limitations of Bioremediations. Microbes for Bioremediation :Essential Chararcteristics of Microbes for Bioremediation, Microbial Adapadation for Adverse conditions. Microbes involved in Bioremediation. Metabolic process involved in bioremediation. Bioremediation Techniques : Insitu & Exsitu bioremediation techniques. Phytoremediation

UNIT II SPECIFIC BIOREMEDIATION TECHNOLOGIES **9**

Application, specific advantages and disadvantages of specific bioremediation technologies - land farming, prepared beds, biopiles, composting, bioventing, biosparging, pump and treat method, constructed wet lands, use of bioreactors for bioremediation.

UNIT III BIOREMEDIATION OF CHLORINATED COMPOUNDS **9**

Bioremediation of phenols, chlorinated phenols, chlorinated aliphatic compounds, heterocyclic compounds, cyanides, dyes; Rhizoremediation: a beneficial plant-microbe interaction; Molecular techniques in bioremediation- Enhanced biodegradation through pathway engineering; Biodegradation of polyhalogenated compounds by genetically engineered bacteria.

UNIT IV NUCLEAR WASTE BIOREMEDIATION **9**

Spent fuel characterisation, storage and disposal; Partitioning, transmutation and conditioning; Measurement of Radioactivity in the environment; Basic actinide research.

UNIT V HEAVY METAL AND OIL SPILL BIOREMEDIATION **9**

Heavy metal pollution & sources; Microbial interactions with heavy metals - resistance &tolerance ;Microbial transformation; Accumulation and concentration of metals. Biosorption of heavy metals by microbial biomass and secondary metabolites – Biosurfactants.

Advantages of biosurfactants over chemical surfactants- Biotechnology and oil spills; Improved oil recovery.

REFERENCES

1. Bruce E. Rittmann, Perry L. McCarty, "*Environmental Biotechnology: Principles and Applications"* McGraw-Hill, 2001.
2. Phillip L. Buckingham , Jeffrey C. Evans," *Hazardous Waste Management"* Waveland Pr Inc; Reissue edition 1, 2010.
3. S. K. Agarwal, *"Environmental Biotechnology*", APH Publishing, 2000
4. Martin Alexander, "*Biodegradation & Bioremediation",* Academic press, 1999.
5. Karrely D., Chakrabarty K., Omen G.S, "*Biotechnology and Biodegradation*", Portfolio Pub. Co., 1990.

P. Rajendran, P. Guansekaran, "*Microbial Bioremediation*", Mjp Publishers, 2011.

BACE07	**FUNDAMENTALS OF SOIL SCIENCE**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									3	0	0	3
	Prerequisite –												
	Course Designed by –												
OBJECTIVES:													
COURSE OUTCOMES (COs)													
CO1													
CO2													
CO3													
CO4													
CO5													
CO6													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H		H	H	H	H	M	L	M
	CO2	H	M	M	H							L	M
	CO3	H				H			H	L			
	CO4	H	M				M	M				L	
	CO5	H	M	M		H				M	L		
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	Academic Council, July 2015							

Unit I

Soil as a natural body, Pedological and edaphological concepts of soil. Components of soil. Soil genesis: Composition of Earth's crust- soil forming rocks and minerals – Primary and secondary minerals. Weathering of rocks and minerals. Factors of soil formation. Soil forming processes. Soil Profile.

Unit II

Soil physical properties: Soil texture, structure, density and porosity, soil colour, consistence and plasticity. Soil water retention, movement and availability. Soil air, composition, gaseous exchange-problem and its effect on crop growth. Source, amount and flow of heat in soil, Soil temperature and crop growth.

Unit III

Soil physico chemical and chemical properties: Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability. Electrical conductivity. Soil colloids - inorganic and organic. Silicate clays: constitution and properties, sources of charge, ion exchange, cation and anion exchange capacity and base saturation.

Unit IV

Soil organic matter: composition, properties and its influence on soil properties. Humic substances - nature and properties. Soil Biology: Soil organisms : macro and micro organisms, their beneficial and harmful effects. Soil enzymes.

UNIT V

Soil pollution – Types and behaviour of pesticides. Inorganic contaminants. Prevention and mitigation of soil pollution.

BACE09	**FARMING SYSTEM AND SUSTAINABLE AGRICULTURE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite-				
	Course Designed by				

OBJECTIVES:

COURSE OUTCOMES (COs):

1. Students get knowledge about basic principles and concepts in cropping and farming systems
2. Provides hands on experience in establishing different IFS models for different ecosystems
3. It gives idea and knowledge about low cost technologies in crop production and cost reduc strategies

CO1	Students get knowledge about basic definitions and concepts of cropping system
CO2	It deals with different indices for evaluation of cropping systems and their economic viability
CO3	students get information about the basic principles in farming systems
CO4	It gives knowledge about resources recycling and deals with the principles and concepts of LEISA, HEIA and conservation agriculture.
CO5	It gives idea and knowledge about low cost technologies in crop production and cost reduc strategies

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M		M				M		L	M
	CO2	H	M	M	H	H		M			L	L	
	CO3	H	M		H			M	M	L		L	M
	CO4	H	M			H	M				L		M
	CO5	H	M	M	H	H		M		L	L	L	
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	Academic Council, July 2015							

UNIT I CROPPING SYSTEM 9

Cropping systems - Definition - Principles - Concepts - Classification - mono cropping - intensive cropping -cropping systems of India and Tamil Nadu - Interaction between different cropping systems - Cropping system management - Resource management - land, nutrient, water and weed.

UNIT II EVALUATION OF CROPPING SYSTEM 9

Index for evaluation of cropping systems - Land use - yield advantages - Economic evaluation - sustainability.

UNIT III FARMING SYSTEM 9

Farming systems - Definition - Principles - Concepts - Enterprises selection and management - interaction between different enterprises with cropping - scope and advantages of Integrated Farming system - Integrated farming system models for different agro eco-systems - interaction between enterprises.

UNIT IV EVALUATION OF FARMING SYSTEM 9

Resource recycling in IFS - Evaluation indicators of integrated farming system - LEISA & HEIA - concepts and principles - Conservation agriculture - principles, concept and scope.

UNIT V RESOURCE AND LABOUR MANAGEMENT IN FARMING SYSTEM 9

Resource management under constraint situation - Cost reduction strategies in crop production - Non-monetary inputs and low cost technologies - Labour management - farming system and environment.

References

1. Palaniappan, SP and K. Sivaraman.1996. Cropping systems in the tropics Principles and management.New Age International (P) Ltd., New Delhi.

2. Jayanthi, C. Devasenapathy, P and C. Vennila. 2007. Farming Systems. Principles and practices. Satish Serial Publishing House.Delhi.

3. S.C. Panda. 2003. Cropping and Farming Systems. AgrobioPublishers. Jodhpur.

4. Jana, B.L. 2014. Farming Systems. Agrotech Publishing Academy, Udaipur Shagufta. 2015. Cropping and Farming Systems. APH publishing Corporation

E references:

1. www.agriinfo.in
2. www.fao.org
3. www.agritech.tnau.ac.in

BBTE10	PROTEOGENOMICS AND BIOINFORMATICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioorganic chemistry, Basic Biotechnology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of genomics and proteomics using software and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the classification of biological databases and its role in research
CO2	to apply the concept of genomics of different organism, gene expression and mapping situations
CO3	to know the tools for gene identification and prediction
CO4	to know the structural elucidation and prediction of proteins
CO5	to get a basic knowledge of techniques related to proteomics
CO6	To know about bioinformatics tools

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M		L	L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M	M		L	L	M
	CO4	H	M		H	H		M		M	L	L	M
	CO5	H	M	M	H	H		M	L		L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)

						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BIO INFORMATICS 9

Introduction to bioinformatics – Databases, Classification – Biological Databases, and application – Data mining and Applications – Sequence Database search – FASTA – BLAST.

UNIT II GENOMICS 9

Genome – Organization of Eukaryotic genome – Mitochondrion and chloroplast genome Mapping strategies – Genetic mapping and physical mapping – Genome mapping – Human genome project – Gene expression – Microarrays

UNIT III SEQUENCE TECHNOLOGIES 9

Alignment of multiple sequences – Methods and applications – Phylogenetic analysis – Tools for sequence alignment. Gene identification Methods and applications – Tools for gene prediction – Methods and applications

UNIT IV PROTEOMICS 9

Lifecycle of protein – Classification and structure visualization techniques – Protein databases – Prediction of primary and secondary structure – Prediction of 2D and 3D structure

UNIT V TOOLS OF PROTEOMICS 9

Protein extraction – Separation and digestion techniques – Mass spectrometry –MALDITOF – Peptide mass finger printing – Peptide sequence analysis – SALSA and TMS

TEXT BOOK

1. S.C. Rastogi, 2007, "Bioinformatics methods and applications ", Prentice – Hall of India Publication

REFERENCE BOOK

1. Lesk AM, 2007, "Introduction to Genomics", Oxford University Press, IV Ed.
2. Brownstein M.J, 2003, "Functional genomics methods and protocols", Humana Press, III ed.
3. Weblink: nptel

BBTE01	**FOOD PROCESS TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioprocess technology, Heat and mass transfer				
	Course Designed by – Dept. of Agricultural Biotechnology				

OBJECTIVES

To provide basic technologies involved in food processing

COURSE OUTCOMES (COs)

CO1	To know about preservation techniques
CO2	to understand basic concepts in sterilization of food products
CO3	to know about various dryers

CO4	to know about the mixing equipment for various products
CO5	to know about various preservation techniques for food products
CO6	to understand the microbiological aspects in food process

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M				L	M
	CO2	H	M	M	H	H			H	M	L	L	
	CO3	H	M		H	H		H				L	M
	CO4	H	M		H			M	L		L	L	M
	CO5	H	M	M	H	H		H		M	L	L	
	CO6	H			H	H	L	M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PHYSICAL TREATMETN OF FOOD 9

Thermal, electrical and rheological properties- Heat processing- Methods of applying heat to food - sterilization - Thermo bacteriology- dehydration and drying - free moisture - equilibrium moisture content- water activity- classification of dryers- tray, and freeze dryers, osmotic dehydration - foam mat drying- extrusion coking.

UNIT II BLENDING METHODS 9

Mixing of solids, Pastes and liquids - Characteristics of mixtures-Blending -emulsification-equipments - liquid, pastes, and plastic masses - dry powders - criteria of mixer effectiveness-mixing index

UNIT III PRESERVATION OF FOOD 9

Concentration - freeze concentration - freezing and storage of frozen products - low temperature preservation - irradiation of food products - microwave heating - dielectric heating of foods.

UNIT IV DAIRY FOODS 9

Physics and chemical properties of milk and their effect on design - heaters - coolers -heat exchange equipments - storage tanks - can washers - pasteurization - principles and methods - equipments - LTLT - HTST - UHT pasteurization - CIP unit -Homogenization - Theory and working of homogenizers - bottle fillers and cappers -cream separation - principles - types of separator - classifiers - butter churns - cheese plant equipments - ice cream freezers - drying equipments - drum drier and spray drier -membrane concentration equipments.

UNIT V FOOD MICROBIOLOGY 9

Food microbiology: food spoilage, food borne diseases, infections, intoxifications, utilization of microorganisms in food industries, Nutraceuticals. Quality control, Case studies on biotechnology in the evaluation of food quality.

Total No. of Periods: 45

Text Books

1. Lehninger and Beverlov, 2002, "Food Process Engineering". Reidal Publishing Co. Holland
2. Yin H.Hui, 2006, "Handbook of food science, technology and engineering" Wiley, Newyork, 2nd ed

Reference Books

1. Tucker & Woods, 1995, "Enzymes in food processing" Springer, 5thed.
2. Hamm & Hammilton, 2000, "Edible oil processing" Academic Press 5th ed
3. Fellows, 2009, "Food processing technology" 21th ed
4. Heldman, 2007,"Hand book of food engineering" CRC Press 2nd ed
5. P.G. Smith, 2003, "Food Process Engineering" Academic Plenum Pub, New York 1st ed
6. Srilakshmi,2005, "Food Science" MJP Publiashers, 3rd ed

Weblink: nptel

BACE10	DAIRY PROCESS TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Microbiology				
	Course Designed by – Agricultural Biotechnology				

OBJECTIVES

To learn the techniques involved in the processing of dairy products

COURSE OUTCOMES (COs)

CO1	To remember the ways to preserve milk
CO2	To understand the different types of processing of milk and its products
CO3	To analyze the presence of different contaminants in milk products
CO4	To understand the methods to produce powdered milk products
CO5	To analyze ways to increase the shelf life of milk and its products
CO6	To remember the ways to sanitize the dairy equipments

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H	H	H	L	H
	CO2	H	M	M	H	H	M	M	H		L		

	CO3	H	M		H					H	M	L	H
	CO4	H	M			H	H	M	M		M	M	M
	CO5			M		H		M		M		L	H
	CO6	H				H			M				M
3	Category	Humanities & Social Studies	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)				
					√								
4	Approval	Academic Council, July 2015											

UNIT I PRESERVATION OF MILK **9**

Preservation of raw milk: effects on physicochemical, microbial and nutritional properties of milk and milk products, preservation of raw milk by chemical preservatives; thermal processing for preservation.

UNIT II PROCESSING OF MILK **9**

Methods of determining lethality of thermal processing, UHT processed milk products, their properties and prospects, types of UHT plants, aseptic fillers, heat stability and deposit formation aspects, effect on milk quality; techno- economic considerations; retort processing.

UNIT III BACTOFUGATION AND BACTOTHERM **9**

Principles and equipment for bactofugation and Bactotherm processes, Microfluidization of milk: Principle, equipment, effects and applications, Homogenization and their applications in dairy industry.

UNIT IV DRYING OF MILK **9**

Dehydration: advances in drying of milk and milk products; freeze concentration, freeze dehydration: physicochemical changes during freeze drying and industrial developments.

UNIT V SHELF LIFE OF MILK PRODUCTS **9**

Sorption behaviour of milk foods, control of water activity of different milk products in relation to their chemical; microbiological and textural properties; hurdle technology and its application in development of shelf-stable and intermediate-moisture foods, Use of carbonation in extending the shelf life of dairy products-Cleaning and sanitization of dairy equipment: biological; detergents; Automation; Ultrasonic techniques in cleaning; bio-detergents, development of sanitizers- heat; chemical; radiation, mechanism of fouling and soil removal; Bio-films, assessing the effectiveness of cleaning and sanitization of dairy products.

Text Books

1. Burton H. 1998. Ultra-high Temperature Processing of Milk and Milk Products. Elsevier.
2. Fellow P. 1988. Food Processing Technology. Elliss Horwood Ltd.
3. Gould GW. 1995. New Methods of Food Preservation. Blackie.

Reference Books

1. IDF Bulletin 1981. New Monograph on UHT Milk. Document No. 133, Intern. Dairy Fed., Brussels.
2. Smit G. 2003. Dairy Processing – Improving Quality. CRC-Woodhead Publ.
3. Troller JA & Christian HB. 1978. Water Activity and Food, Food Science and Technology. A Series of Monograph Academic Press, London.
4. Walstra P, Geurts TJ, Noomen A, Jellema A & Van Boekel MAJS. 1999. Dairy Technology – Principles of Milk Properties and Processes. Marcel Dekker

BBTE07	**FOOD SAFETY AND QUALITY CONTROL**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Food process engineering, Microbiology, Bioprocess Engineering, Biochemistry				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES: To know about the safety regulations of food industries

COURSE OUTCOMES (COs)

CO1	To study the history of food safety regulations
CO2	to know about food adulteration
CO3	to understand about food management practices
CO4	to get basic idea about food hygiene
CO5	to get basic idea about microbial quality control
CO6	to get basic idea about food safety standards

UNIT I FOOD SAFETY REGULATIONS 9

History of food regulations in India- Legislations- Prevention of Food Adulteration act 1954, Food product order (1955), Solvent Extracted Oil, De-oiled Meal and Edible Flour (Control) Order, 1967, Meat Food Products Order (1973),Edible Oils Packaging, 1998, Edible Oils Packaging, 1998, Vegetable Oil Products Order, 1998, Milk & Milk Product Amendment Regulations – 2009.

UNIT II FOOD SAFETY MANAGEMENT 9

Introduction to concepts of food quality, food safety, food quality assurance and food quality management; objectives, importance and functions of quality control, Current challenges to food safety Food adulteration, nature of adulterants, methods of evaluation of food adulterants and toxic constituents.

UNIT III FOOD QUALITY MANAGEMENT 9

Principles of food quality assurance, total quality management (TQM)–good manufacturing/management practices, good hygienic practices, good lab practices, general

awareness and role of management practices in quality control Food safety management, applications of HACCP in food safety, concept of food traceability for food safety,

UNIT IV MICROBIAL CONTAMINATION 9

Microbial quality control: determination of microorganisms in foods by cultural, microscopic, physical, chemical methods. Statistical quality control in food industry Food safety and Standards Act 2006: salient provision and prospects

UNIT V FOOD SAFETY STANDARDS 9

Role of national and international regulatory agencies, Bureau of Indian Standards (BIS), AGMARK, Food Safety and Standards Authority of India (FSSAI), Introduction to WTO agreements: SPS and TBT agreements, Codex alimentarious commission, USFDA, International organization for standards (ISO) and its standards for food quality and safety (ISO 9000 series, ISO 22000, ISO 15161, ISO 14000)

TEXT BOOKS:

1. V. K. Kaushik (1999),Nutrition And Food Safety, Neha Publishers
2. Early. R. (1995): Guide to Quality Management Systems for the Food Industry, Blackie, Academic and professional, London.

REFERENCE BOOKS:

1. Andre, Gordan (2015), Food Safety and Quality Systems in Developing Countries, Elsevier
2. YasmineMotarjemi(2013), Food Safety Management, 1st Edition, Elsevier

BACE11	**SOIL AND APPLIED MICROBIOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	3	0	3
	Prerequisite – Agricultural microbiology				
	Course Designed by – Dept of Agricultural Biotechnology				

OBJECTIVES: To provide a basic knowledge of soil and industrial related microorganisms and its application

COURSE OUTCOMES (COs)

CO1	To illuminate the students about historical developments in soil microbiology and industrial microbiology.
CO2	To enlighten the students with the knowledge of microbial diversity in soils
CO3	The students must know about involvements of microorganism's Biogeochemical cycles.
CO4	To highlighted the role of soil microorganisms in soil fertility and plant growth promotion
CO5	To develop experimental skills in soil microbiology which includes isolation of beneficial microorganisms from soil and plant and their mass production
CO6	To make students gain expertise in practical aspects of production of industrial products

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H		H	H	H	H	M	L	M
	CO2	H	M	M	H							L	M
	CO3	H				H			H	L			
	CO4	H	M				M	M				L	
	CO5	H	M	M		H				M	L		
	CO6	H				H			H	L			
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)	
							√						
4	Approval	Academic Council, July 2015											

Unit I Introduction to Soil Microbiology

Soil Microbiology- definition and scope. Historical developments in soil microbiology. Diversity of soil microorganisms - culturable (bacteria, actinobacteria, yeasts, moulds and algae) and unculturable microorganisms - metagenomic approach - factors influencing the microbial diversity

Unit II Microbial Processes in soil

Organic matter decomposition and humus formation- C:N ratio.. Carbon cycle. Nitrogen cycle - biological nitrogen fixation (BNF) – nodulation and biochemistry of BNF. Phosphorus cycle and sulphur cycle. Microbial transformation of potassium, zinc and silica in soil – role of soil enzymes

Unit III Soil Microorganisms and plants

Rhizosphere, spermosphere, phyllosphere, epiphytic and endophytic microorganisms and their significance. and Plant growth promoting rhizobacteria. Soil microorganisms and their interactions – positive and negative interactions

Unit IV Microbial inoculants

Bioinoculants – types of bioinoculants – nitrogen fixers, P, K, Zn and Si solubilizers and phosphate mobilizers, sulphur oxidizers and PPFM. BGA and Azolla. Mass production and quality control of bacterial and fungal bioinoculants. Methods of application of bioinoculants.

Unit V Industrial Microbiology

Industrial utilization of microorganisms - Alcohol fermentation – wine and beer. Antibiotics and vitamin production. Microbes in food industry – single cell

protein, baker‘s and brewer‘s yeast and dairy products – cheese and yoghurt. Biofuels- ethanol and biodiesel.

Text Books

1. Alexander, M. 1977. Soil Microbiology. John Wiley and Sons. New York
2. Waiter.M.J.,N.L.Morgan,J.S.Rocky and G.Higton.1999. Industrial Microbiology – An Introduction. Blackwell Scientific
3. e book: Paul , E .A. 2007. Soil Microbiology, Ecology and Biochemistry. 3rd Ed., Academic Press, USA
4. e book: Waksman, S. A 1952.Soil Microbiology John Wiley & Sons, Inc.

Reference Books

1. Rangaswamy,G.and Bagyaraj, D.J. 1992. Agricultural Microbiology, Asia Publishing House, New Delhi.
2. Subba Rao,N.S.1999. Soil Microorganisms and plant Growth. Oxford and IBH, New Delhi
3. Osborn, M., Smith, C.J. 2005. Molecular Microbial Ecology. Taylor and Francis.

Web Pages

fire.biol.wwu.edu/hooper/416_05Ncycle1.ppt

www.fao.org/docrep/009/a0100e/a0100e05.htm

BACE13	GREENHOUSE TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Production of Agricultural crops/Production of Horticultural crops				
	Course Designed by – Dept. of Agricultural Biotechnology				

OBJECTIVES

To know about the concept and design of greenhouses

COURSE OUTCOMES (COs)

CO1	to know the
CO2	to apply the concept of genomics of different organism, gene expression and mapping situations
CO3	to know the tools for gene identification and prediction
CO4	to know the structural elucidation and prediction of proteins
CO5	to get a basic knowledge of techniques related to proteomics
CO6	To know about bioinformatics tools

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M		L	L	L	M

	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M	M		L	L	M
	CO4	H	M		H	H		M		M	L	L	M
	CO5	H	M	M	H	H		M	L		L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Types of green house, importance, functions and features of greenhouse- Scope and development of green house technology

UNIT II GREENHOUSE DESIGN 9

Location, planning of various components of green house- Design criteria and calculation- Construction material, covering material and its characteristics, growing media, green house irrigation system- nutrient management

UNIT III GREENHOUSE ENVIRONMENT 9

Greenhouse heating, cooling and shedding and ventilation system, Computer controlled environment.

UNIT IV GROWING PLANTS 9

Phytotrons, fertigation, roof system, containers and benches-Growing of ornamentals and vegetables under protected environment, physiology of plants in green house, pest and disease control.

UNIT V CONSUMABLES 9

Various containers used for protected cultivation of vegetable and flower, special horticultural practices i.e. training, dis-budding, de-shooting, supporting and bending.

Text / Reference books

1. Greenhouse Management of Horticultural Crops by S. Prasad and U. Kumar, Kalyani Publishers.

2. Greenhouse Technology and Management by Manohar. 2006. International Book Distribution Co., Lucknow.
3. Greenhouse Environment by Mastalez, J. W. 1977. John-Wiley and Sons, New York.
4. Greenhouse Management : Forcing of Flowers, Vegetables and Fruits by Taft, L. R. 2001. Daya Publication House, New Delhi.
5. Green House Operation & Management by Nelson, 2007.
6. Green House and Shelter structure for tropical regions/FAO by Zbeltitis.
7. Protected Cultivation by A. S. Jadhav, P. V. Patil and M. T. Patil.

Commercial Protected Floriculture by M. T. Patil and P. V. Patil

BACE14 LIVESTOCK AND POULTRY MANAGEMENT 3 0 0 3

UNIT I INTRODUCTION TO LIVESTOCK MANAGEMENT 9

Significance of Livestock and Poultry in Indian Economy – Livestock and Poultry census – Different livestock development programs of Government of India and Tamil Nadu- Various systems of livestock production-extensive – semi intensive - intensive- mixed- Integrated and specialized farms.

UNIT II DAIRY CATTLE MANAGEMENT 9

Important White and Black cattle breeds-classification-indigenous and exotic – Breed characteristics – Breeding - Cross breeding- Upgrading - Economic traits of cattle –Culling - Estrus Cycle – Artificial Insemination – Introduction to Embryo transfer – Housing – Space requirement calf and adult stock – System and types of housing - Feeding and Management of Calf, Heifer, Pregnant, Milch animal and working animals – Nutrition – Ration – Balanced Ration - Characteristics of ration and classification of feed and fodder –Total Mixed Ration **–** composition of concentrate mixture for different stage - Milking methods - Clean milk production – Factors affecting milk composition – Common diseases of cattle – classification – symptoms - preventing and control measures.

UNIT III SHEEP AND GOAT MANAGEMENT 9

Breeds - Sheep and goat classification — Economic traits - system of rearing - Housing Management – Floor space requirement - Care and Management of young and adult stock – Nutrition – Feed and fodders of Small ruminants – Flushing - Common diseases – prevention and control.

UNIT IV MANAGEMENT OF SWINE 9

Classification of breeds – Economic traits - Housing - Nutrition – creep feeding - Care and Management of Adult and Young Stock - Common disease- prevention and control.

UNIT V POULTRY MANAGEMENT 9

Classification of breeds - Commercial Strains of broilers and layers – Housing – brooding – deep litter and cage system – care and Management of broilers and layers -Nutrition of Chick, grower, Layer and broiler – Incubation and Hatching of Eggs - Common Diseases - Control and prevention.

Reference:

ICAR (2002) Hand of Animal Husbandry, ICAR, New Delhi

E- reference:

1. **http://www.elearnvet.net/**
2. **http://agridr.in/expert_system/cattlebuffalo/Breeding%20management%20of%20cattle%20and%20buffaloes-2.html**

BBTE16	**NANOBIOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biotechnology, Molecular biology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide basic knowledge about nanoscience involved in biotechnology

COURSE OUTCOMES (COs)

CO1	to understand the various nano devices
CO2	to know about nano molecules
CO3	to learn the applications of nanotechnology in proteins, lipids and nucleic acids
CO4	to know about the applications of nanotechnology in microbiology
CO5	to know about nano technology involved in drug delivery system
CO6	To understand about nanoparticles

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	M	M	M	H	M		H				L	M
	CO2	H	M	M	H	H		M			L		L
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H					L	L	M
	CO5	H	M	M	H	H		M				L	L
	CO6	H			H	H		M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Introduction to nanobiotechnology – nanodevices& techniques – micro &nanosystems – synthesis & characterization of nanoscale molecules – nanoarchitecture – fabrication technologies – self-assembly systems

UNIT II NANODEVICES 9

Inorganic nanoscale systems – properties of fullerene carbon nano tubes – quantum dots & wires – gold nanoparticles – nanopores.

UNIT III NANOMOLECULES 9

Nanomolecules in proteins, lipids RNA & DNA – peptide coupled nanoparticles – proteins nanodevices – cell nanotechnology – cell motility – nanomotors& cellular navigation – chemotaxis – transmembranesignaling – nanoscale artificial platform.

UNIT IV MICROBIAL NANOTECHNOLOGY 9

Nanotechnology and microorganisms – PHA – magnetosomes – cyanophycin inclusions – alginates – bacteriophages – bacterial spores – S – layer proteins – bacteriorhodopsin.

UNIT V NANOMEDICINE 9

Nanotechnology in drug delivery – nanoscale devices for drug delivery – micelles – protein targeting – protein interaction with other molecule – microarray – genomic chips – nanobiosensors – nanobiochips – Nanotechnology for cancer diagnosis & treatment.

TEXT BOOK

1. K.K. Jain , 2006, "Nanotechnology in molecular diagnostics – current techniques & applications", Horizon Bioscience publishers

REFERENCE BOOKS

1. Microbial bionanotechnology:Biological Self-Assembly Systems and Biopolymer-Based Nanostructuresed: Bernd Rehm, Taylor and Francis, 2006
2. Applications of nanoparticles in biology & medicine O.V. Salata, Journal of nanobiotechnology (2004),
3. Weblink: nptel

INTRODUCTORY NEMATOLOGY

Unit I: History and Development of Nematology, Importance of Nematodes and Beneficial nematodes

Introduction – Brief history and development of Nematology at National and International level – Position of nematodes in animal kingdom – Economic loss due to nematodes to crop plants.

Unit II: Morphology and Taxonomy of Nematodes

Morphology and Anatomy of nematodes (cuticle, cephalic region, alimentary, excretory, reproductive and nervous system, sense organs) – Taxonomy of plant parasitic nematodes – Classification, of nematodes based on feeding habits.

Unit III: Symptoms, Interaction and Bio-ecology of nematodes

Symptoms of nematode damage – interaction with other microorganisms (fungi, bacteria and viruses) – Biology and ecology of important plant parasitic nematodes (*Meloidogyne, Heterordera, Rotylenchulus, Tylenchulus* and *Radopholus*) - Life cycle of important plant parasitic nematodes (*Meloidogyne, Heterordera, Rotylenchulus, Tylenchulus* and *Radopholus*) – Interaction with other micro organisms.

Unit IV: Nematode Management

Principles of nematode management –Legislative (plant quarantine), physical methods (soil solarisation, hot water treatment, seed cleaning); cultural methods – (deep ploughing, fallowing, solarization, crop rotation, antinemic plants - Host plant resistance to nematodes; biological control – nematode trapping fungi, egg parasitic fungi, obligate parasites, PGPR and predators - chemical control – soil fumigants - Non fumigants-mode of action—formulations-methods of application--Integrated nematode management.

Unit V: Nematode pests of crops

Major nematode parasites and management in cereals (rice and wheat), millets (sorghum, and maize), pulses (redgram, blackgram, greengram and cowpea); oilseeds (castor, groundnut and gingely), fibre crops (cotton), vegetables (tomato, brinjal, bhendi, chilli and potato, cole crops (cabbage, carrot, cauliflower), fruits (banana, citrus, grapevine, guava and papaya), spices and plantation crops (turmeric, pepper, betelvine and coconut), flower crops (crossandra, jasmine, and tuberose), Carnation, rose, gerbera, chrysanthemum, eustoma medicinal and aromatic plants, (medicinal coleus, geranium and patchouli).Beet root, sugarbeet, tapioca, tuber crops (yam, dioscorea).

TEXT BOOK:

1. Dropkin, V.H.1980. Introduction to plant nematology. John Wiley and sons, INC. New York.

2. Singh, R.S and Sitaramaiah, K. 1994. Plant pathogens. The plant parasitic nematodes. Oxford & IBH pub. Co. Pvt. Ltd. New Delhi.
3. Paravata Reddy, P.1983. Plant nematology. Agricole Pub. Co., New Delhi.
4. Southey, J. F. Laboratory methods for work with plant and soil nematodes Tech. Bull. Min. Agric. Fish. Food. Her Majesty's Stationary office, London.

E- REFERENCES:

1. http://agritech.tnau.ac.in/

BBA008	**TOTAL QUALITY MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional ethics& Professional Courses				
	Course Designed by – Dept of Management studies				

OBJECTIVES:
To study about the management methods involved in quality assessment of a product

COURSE OUTCOMES (COs)

CO1	to study the basic definition of quality
CO2	to study the importance of customer satisfaction
CO3	to study the statistical methods of quality control
CO4	to explore the methods of benchmarking
CO5	to classify the products into quality standards
CO6	To know about quality principle

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		L	L	L	M
	CO2	H	M	M	H	H		M	L		L	L	M
	CO3	H	M		H	H	L	M		M	L	L	M
	CO4	H	M		H	H		M	M		L	L	M
	CO5	H	M	M	H	H		M		L	L	L	M
	CO6	H			H	H	L	M	L		L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Definition of Quality, Dimensions of quality, Quality planning, Quality costs- Analysis – Techniques for quality costs, Basic concepts of total Quality Management, Historical Review, Principles of TQM, Leadership- Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation

UNIT II TQM PRINCIPLES 9

Customer satisfaction-Customer Perception of Quality, Customer complaints, Service Quality, Customer Retention and, Employee Involvement- Motivation, Empowerment, Teams, Recognition Reward, Performance Appraisal, Benefits, Continuous process improvement- Jurantrlogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership- Partnering, sourcing, Supplier selection, Supplier rating, relationship development, Performance measure- Basic concepts, Strategy, Performance measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals- Measures of central Tendency and Dispersion, Population and sample, Normal curve, Control charts for variables and attributes, Process capability, Concept of six sigma, New seven management tools.

UNIT IV TQM TOOLS 9

Benchmarking- Reasons to Benchmark, Benchmarking process, Quality function Deployment (QFD)- House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM)- Concept, Improvement Needs, FMEA- Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and other Quality Systems, ISO 9000:2000 Quality system- Elements, Implementation of Quality systems, Documentation, Quality Auditing,
QS 9000, ISO 14000- Concept, Requirements and Benefits.

TEXT BOOK

1. R.Ramakrishnan, 2004, “A Text Book of Total Quality Management” V Ed.

REFERENCE BOOKS:

1. Ronald A. Armstrong , 2006, "Total Quality management", Chapman and Hall,
2. Suresh Lulta, 2002"Total Quality management" Vol. I and ll, ShahTrust, Mumbai

BBA009	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Value Education and Professional Ethics & Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

Strong intellectual property rights (IPR) protection is crucial to fostering trade, and achieving the goals and benefits of global integration. Countries with high standards of IPR protection tend to attract more investment, stimulate more innovation, thereby developing more rapidly. Countries with inadequate protection are often vulnerable to infringements of intellectual property rights that hinder trade flow and economic development.

Hence, the objective is to introduce IPR to the UG Engineering and Technology students.

COURSE OUTCOMES (COs)

CO1	Understand the principles, function and basic legal rules of IP Law.
CO2	Recognize the relevant criteria for generating and protecting intellectual works.
CO3	Recognize the intellectual property likely to be produced in the academic and professional environment.
CO4	Demonstrate appreciation and critical awareness of pertinent IP issues in the academic and professional lives.
CO5	Understand the relevance and impact of IP Law on academic/scientific works/studies.
CO6	Understand the different forms of infringement of intellectual property rights.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					H					H	
	CO2		H		M					H			
	CO3	M							M		H		
	CO4			M	H							H	
	CO5							M					
	CO6	H			H					M			L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I PROPERTIES AND TYPES 9

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i). Movable Property ii. Immovable Property and iii. Intellectual Property.

UNIT II PATENTS AND RIGHTS 9

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures..

UNIT III INTERNATIONAL TRADE 9

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV WTO 9

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V CASE STUDIES 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TEXT BOOKS:

1. Subbaram N.R. "Handbook of Indian Patent Law and Practice ", S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.

REFERENCES:

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.
4. www.ipmatters.net/features/000707_gibbs. html.
5. http://www.metastudio.org/Science%20and%20Ethics/file/readDoc/535a76367d9d331598f49e2d/34_Hb_on_IPR.pdf

BACE17	**MARKETING AND EXPORT OF BIOTECHNOLOGICAL PRODUCTS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioorganic chemistry, Basic Biotechnology				
	Course Designed by – Dept. of Industrial Biotechnology				

OBJECTIVES

To provide a basic understanding of genomics and proteomics using software and their applications from the perspective of engineers

COURSE OUTCOMES (COs)

CO1	to understand the classification of biological databases and its role in research

CO2	to apply the concept of genomics of different organism, gene expression and mapping situations
CO3	to know the tools for gene identification and prediction
CO4	to know the structural elucidation and prediction of proteins
CO5	to get a basic knowledge of techniques related to proteomics
CO6	To know about bioinformatics tools

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M		L	L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M	M		L	L	M
	CO4	H	M		H	H		M		M	L	L	M
	CO5	H	M	M	H	H		M	L		L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
						√			

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I

External trade in Agricultural products, Present status, policy and prospects under WTO regime, Export import policy, Regulation of Agricultural marketing system

UNIT II

Infrastructural facilities for exporting efficiency, Biotechnological Products in India, Quality parameters and quarantine procedures of export- Market integration: Types and effects Marketing costs margins and price spread.

UNIT III

Biotech industries & institutes in India & world, Concepts of Biotech park/ Biotech Hub to different small scale and large scale Agro-based products. Study the production techniques of biotech products.

UNIT IV

Collecting the information on export import data on biotech products, quality standards for export and their potential-Analyze data in relation to demand supply.

UNIT V

Comparison between non biotechnological products and biotechnological products. Safety and licensing for import and export of biotechnological products.

Text/Reference books:

1. Agriculture Marketing in India by Acharya and Agrawal 1999, Oxford IBH, N. Delhi.

Principles of Marketing by Kotlar and Armstrong 1997, Prentice-Hall, N. Delhi.

BBTE18	**INDUSTRIAL SAFETY ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Bioprocess, Enzyme Engineering & Technology, Basic Biotechnology				
	Course Designed by – Dept of Industrial Biotechnology				

OBJECTIVES: To provide a basic knowledge about Safety engineering

COURSE OUTCOMES (COs)

CO1	to understand basic concepts in hazard analysis
CO2	to know about safety and its management
CO3	to know about accidents and its preventive measures
CO4	to understand various personal protective equipment and first aid
CO5	to know about personal protective equipment
CO6	To know about fire and safety

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	M		L		M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M		M	L	L	M
	CO4	H	M		H	H		M	L		L	L	
	CO5	H	M	M	H	H		M		L	L		M
	CO6	H			H	H		M			L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)

						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INDUSTRIAL HAZARDS 9

Safety in Process Plants – Hazard Analysis – Types of Hazard – hazard Identification techniques Hazard Evaluation – Important Factories Act.

UNIT II CHEMICAL HAZARD 9

Hazards in work place: safety in the use of chemicals at work – Chemical hazard - Air-Borne Contaminants – particulate matter – Hazard and safety methods – hazards and Safety measures in Refineries , Paper and Pulp Industries- Safety Conditions in tanneries –Hazards of Pesticide – Sugar industry.

UNIT III SAFETY MANAGEMENT AND FIRE SAFETY 9

Introduction- Safety policy- Safety in electrical installation: Electrical shock and prevention-safety precautions for residential and commercial installation - Case study-Four stages of Fire-types of Fire Detectors – Fire safety in Industry – chemistry of fire- Types of Combustion- Fire Triangle- Fire extinguishing Technique – Engineering consideration for safety consideration

UNIT IV INDUSTRIAL ACCIDENTS 9

Industrial accidents – Classification – prevention – accident cost – Steps of investigation – Analysis of Accidents – Remedial Measures – Methods of Prevention – Safety Slogans – Case study

UNIT V PROTECTIVE EQUIPMENTS 9

Personal protective Equipment and personal Protection – Aim – Need – Types: Non Respiratory Protective equipment- Respiratory typeFirst aid – principles and methods – First aid training – Scope of first aid – Golden rules– First aid treatment : for wounds and Hemorrage , Shock , respiration :Schafer's Method, Shock. Fractures, Burns and Scalds, Unconsciousness, Heat exhaustion and Stroke– First aid Kit box A and B.

TEXT BOOK:

1. Nicholas, 2008, "Practical Guidance to Industrial Safety" 3rded
2. M.H.Fulekar, 2007, "Industrial Hygiene & chemical Safety" 2nded

REFERENCE BOOKS:

1. Rudd,2005, "Strategy of process engineering" Willey
2. Wang, Shannmas Hung, 2008, "Advanced hazardous industrial waste treatment" CRC Press.

BBTE19	BIOENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Industrial Biotechnology				
OBJECTIVES: To provide basic knowledge about Entrepreneurship					

COURSE OUTCOMES (COs)	
CO1	to understand the fundamentals of Entrepreneurship
CO2	to know about time management
CO3	to explore the avenues for financing a business venture
CO4	to know about various company laws
CO5	to understand Entrepreneurship in biotechnology
CO6	To get knowledge about decision making

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	G	h	I	j	k	l
2	CO1	H		M	H	M	M	M				L	
	CO2	H	M	M	H	H		M		M	L	L	M
	CO3	H	M	M	H	H	L		H		L		M
	CO4	H	M			H		M			L	L	M
	CO5	H	M	M	H	H		M		M	L	L	M
	CO6	H			H	H	M	M	M		L	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ENTREPRENEURSHIP FUNDAMENALS 9

Entrepreneur – Entrepreneurship – Enterprise – Writing good business plan – operations and management.

UNITII DECISION MAKING AND TIME MANAGEMENT 9

Entrepreneur psychology – personal decision making style – Decision making process – setting personal and Business goals – Setting time priorities – Business person working at home.

UNIT III FINANCE AND ECONOMIC FEASIBILITY 9

Financing the business– Raising venture capital – Financing sources – Pricing the product (or) Service – operating expenses Economic Analysis – Basic financial Analysis worksheets

UNIT IV COMPANY LAWS AND REGULATIONS 9

Forming company – Types of companies – Types of market – Proprietary information: Intellectual property, copy right, ownerships, Trademark, Patent – International Trade

UNIT V ENTREPRENEURSHIP IN BIOTECHNOLOGY 9

Various business opportunities in Biotechnology – Development of Biotech companies in India – Case studies on Biotech companies and its growth

TEXT BOOK

1. Exploring Entrepreneurship: D. Allan Barefield and George F. Smith, Ettmae Westbrook, Tennesse State University, 2006

REFERENCE BOOK

1. Entrepreneurship fundamentals by ZobiasKollmann International journal of Technology management,2007

B.TECH – BIOMEDICAL ENGINEERING
CURRICULUM AND SYLLABUS

I – VIII SEMESTERS

SEMESTER -I

THEORY

Sub Code	Category	Subject	L	T	P	C
BEN101	HS	English – I	3	1	0	3
BMA101	BS	Mathematics – I	3	1	0	3
BPH101	BS	Engineering Physics – I	3	0	0	3
BCH101	BS	Engineering Chemistry – I	3	0	0	3
BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
	HS	Foreign Indian Languages	3	0	0	3
BME 102	ES	Engineering Graphics	1	0	3	3
BEE101	ES	Basic Electrical and Electronics Engineering	2	0	0	2

PRACTICAL

BCS1L1	ES	Computer Practices Lab	0	0	3	1
BEE1L1	ES	Basic Electrical and Electronics Engineering Practices Lab	0	0	3	1
BSS1L4/ BSS1L5/ BSS1L6	HS	NSS/NCC/NSO* (*To be Conducted during Weekends)				1

Total No. of Contact Hours: 32 **Total No. of Credits: 26**

SEMESTER - II

THEORY						
Sub Code	**Category**	**Subject**	**L**	**T**	**P**	**C**
BEN201	HS	English – II	3	1	0	3
BMA201	BS	Mathematics – II	3	1	0	3
BPH201	BS	Engineering Physics – II	3	0	0	3
BCH201	BS	Engineering Chemistry – II	3	0	0	3
BCS201	ES	Internet Programming	2	0	0	2
BSS201	HS	Personality Development	2	0	0	2
BBT202	HS	Biology for Engineers	2	0	0	2
BME203	ES	Basic Mechanical Engineering	2	0	0	2
BCE201	ES	Basic Civil Engineering	2	0	0	2
PRACTICAL						
BCS2L1	ES	Internet Practice Lab	0	0	3	1
BCM2L1	ES	Basic Civil and Mechanical Engineering Practices Lab	0	0	3	1
BPC2L1	BS	Physics and Chemistry Laboratory	0	0	3/3	1
BSS2L7	HS	Yoga* (*To be Conducted during Weekends)				1

Total No. of Contact Hours: 33 **Total No. of Credits: 26**

SEMESTER III

THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BMA301	BS	Mathematics III	3	2	0	4
BBM301	PC	Anatomy and Physiology	3	0	0	3
BBM302	PC	Electrical Measurements and Instrumentation	4	0	0	4
BCE406	HS	Environmental Studies	3	0	0	3
BBM303	PC	Microprocessors and its Applications	3	0	0	3
BBM304	PC	Introduction to Electronic Devices & Circuits	4	0	0	4
PRACTICAL						
BEC3L1	PC	Microprocessor Lab	0	0	3	2
BEI3L2	PC	Electrical & Electronic Measurement Lab	0	0	3	2
BBM3L2	PC	Anatomy and Physiology Lab	0	0	3	2

Total No. of Contact Hours: 31 **Total No. of Credits: 27**

SEMESTER IV

THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BMA403	PC	Biostatistics	4	0	0	4
BBM402	PC	Clinical Biochemistry	3	0	0	3
BBM403	PC	Biomedical Instrumentation I	4	0	0	4
BBM404	PC	Medical Electronics	3	0	0	3
BEC404	PC	Basic Principles of Communication and Circuit	4	0	0	4
BBM405	PC	Biosensors and Transducer	3	0	0	3
PRACTICAL						
BBM4L1	PC	Biosensors and Transducer Lab	0	0	3	2
BBT4L2	PC	Biochemistry lab	0	0	3	2

Total No. of Contact Hours: 27 **Total No. of Credits: 25**

SEMESTER V

THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BBM501	PC	Linear and Digital Integrated Circuits	3	0	0	3
BEI502	PC	Digital Signal Processing	4	0	0	4
BBM503	PC	Biomedical Instrumentation II	4	0	0	4
BBM505	PC	Biomaterials & Implantable Devices	3	0	0	3
BBM506	PC	Physiology Control System	4	0	0	4
	PE	Core Elective I	3	0	0	3
PRACTICAL						
BBM5L1	PC	Biomedical Instrumentation Lab	0	0	3	2
BBM5L2	PC	Linear and Digital Integrated Circuits lab	0	0	3	2
BBM5C1	PR	Comprehension I	0	0	0	1

Total No. of Contact Hours: 27 **Total No. of Credits: 26**

SEMESTER VI

THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BBM602	PC	Radiological Equipment	4	0	0	4
BSS601	HS	Value education & Professional Ethics	3	0	0	3
BBM603	PC	Pathology and Microbiology	3	0	0	3
BBM605	PC	Bio-Signal Processing	4	0	0	4
	PE	Core Elective II	3	0	0	3
	NE	Non Major Elective I	3	0	0	3
PRACTICAL						
BBM6L1	PC	Bio Signal Processing Lab	0	0	3	2
BBM6L2	PC	Pathology and Microbiology Lab	0	0	3	2
BBM6P1	PR	Mini-Project	0	0	4	1

Total No. of Contact Hours: 30 **Total No. of Credits: 25**

SEMESTER VII

THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BBM701	PC	Digital and Medical Image Processing	4	0	0	4
BBM702	PC	Neural Networks and Pattern Recognition	4	0	0	4
BBM703	PC	Health, Hospital & Equipment Management	3	0	0	3
	PE	Core Elective III	3	0	0	3
	PE	Non Major Elective II	3	0	0	3
	OE	Open Elective I	3	0	0	3
PRACTICAL						
BBM7L1	PC	Image Processing Lab	0	0	3	2
BBM7L2	PC	Inplant Training in Hospital	0	0	1	1
BBM7P1	PR	Term Paper	0	0	3	2

Total No. of Contact Hours: 27 **Total No. of Credits: 25**

SEMESTER VIII

THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
	NE	Non Major Elective III	3	0	0	3
	OE	Open Elective II	3	0	0	3
PRACTICAL						
BBM8C1	PR	Comprehension II	0	0	0	1
BBM8P1	PR	Project Work	0	0	18	9

Total No. of Contact Hours: 24 **Total No. of Credits: 16**

TOTAL NO. OF CREDITS : 196

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No.	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	7	8	3	-	-	3	-	-	21	10.71
2	Basic Sciences (BS)	9	10	4	-	-	-	-	-	23	11.73
3	Engineering Sciences (ES)	10	8	-	-	-	-	-	-	18	9.18
4	Professional Core (PC)	-	-	20	25	22	15	14	-	96	48.98
5	Professional Electives (PE)	-	-	-	-	3	3	3	-	9	4.60
6	Non major Electives (NE)	-	-	-	-	-	3	3	3	9	4.60
7	Open Electives (OE)	-	-	-	-	-	-	3	3	6	3.06
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	-	-	1	1	2	10	14	7.14
	Total Credit	26	26	27	25	26	25	25	16	196	100%
	Total Contact Hour	32	33	31	27	27	30	27	24	231 Hrs	

LIST OF ELECTIVES

SUB.CODE	SUBJECT NAME	L	T	P	C
CORE ELECTIVE (PE) - I					
BBM504	Medical Physics	3	0	0	3
BBM502	Biofluid and Biomechanics	3	0	0	3
BBM056	Bioprocess Technology	3	0	0	3
CORE ELECTIVE (PE) –II					
BBM083	Troubleshooting of Medical Instruments	3	0	0	3
BBM055	Telemedicine	3	0	0	3
BBM058	Clinical Engineering	3	0	0	3
CORE ELECTIVE (PE) - III					
BBM084	Real Time Processor and Bio MEMS	3	0	0	3
BBM704	Modeling of Physiological Systems	3	0	0	3
BBM051	Tissue Engineering and Artificial Organs	3	0	0	3

NON MAJOR ELECTIVE (NE) - I					
BBM701	Medical Informatics	3	0	0	3
BEI010	VLSI Design	3	0	0	3
BEI011	Microcontroller based System Design	3	0	0	3
NON MAJOR ELECTIVE(NE) - II					
BBM060	Medical Imaging Techniques	3	0	0	3
BBM057	Robotics and Nanotechnology	3	0	0	3
BBM075	Virtual Instrumentation	3	0	0	3
NON MAJOR ELECTIVE(NE) - III					
BBM052	Biological Effects of Radiation	3	0	0	3
BBM081	Digital System Design	3	0	0	3
BBA008	Total Quality Management	3	0	0	3

SUB.CODE	SUBJECT NAME	L	T	P	C
OPEN ELECTIVE (OE) –I					
BBA001	Principles of Management and Organization Behavior	3	0	0	3
BBM076	Regulatory Aspects in Biosciences	3	0	0	3
BBM801	Rehabilitation Engineering	3	0	0	3
OPEN ELECTIVE (OE) –II					
BBA009	Intellectual Property Rights	3	0	0	3
BBA002	Entrepreneurship Development	3	0	0	3
BBM089	Design & Development of Medical Devices	3	0	0	3

BMA301	MATHEMATICS – III	L	T	P	C
	Total Contact Hours - 60	3	2	0	4
	Prerequisite – Engineering Mathematics-I, Engineering Mathematics -II,				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To understands the concepts of Fourier series analysis, Fourier transform techniques and Z transform techniques

COURSE OUTCOMES (COs)

CO1	To learn the problem solving methods in linear differential equations
CO2	To learn Dirichlet‟s condition and operations using Fourier series
CO3	To have a clear understanding about 2nd order equations and wave equations
CO4	Properties of Laplace transform and problem solving using it
CO5	Properties of Fourier transform and problem solving using it
CO6	To understand the concepts of various transform and partial differential equation technique

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 12

Formation-solutions of standard types of first order equations-LaGrange‟s equation-linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 12

Dirichlet‟s condition-General Fourier series-half range sine and cosine series-Parseval‟s identity. Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 12

Classification of second order linear partial differential equations-Solutions of one- Dimensional wave equations, one-dimensional heat equations.

UNIT IV LAPLACE TRANSFORMS 12

Transforms of simple functions-basic operational properties-transforms of derivatives and integrals-Initial and Final value theorems-Inverse transforms-Convolution theorem. Periodic functions. Applications of Laplace Transforms for solving linear ordinary differential equations up to second order with constant coefficients and integral equations.

UNIT V FOURIER TRANSFORMS 12

Statement of Fourier integral theory-Fourier transforms pairs-Fourier Sine Cosine transforms-Properties-Transforms of simple functions-Convolution theory-Parseval‟s identity.

TEXTBOOKS:

1. Kreyszig, E.”Advanced Engineering Mathematics”8th Edition, John Wiley and Sons, (Asia) Pvt., Ltd, Singapore, 2006.
2. Grewal, B.S.,”Higher Engineering Mathematics” (35thEdition), Khanna Publishers, Delhi2000.

REFERENCE:

1. Kandasamy, P., Thilakavathy, K., and Gunavathy, Kk. ”Engineering Mathematics”, Volumes 1 and 3(4th Edition) S Chand and Co., New.
2. Narayanan, S.ManicavachangamPillay, T.K.Ramanaiah, G.”Advanced mathematics for Engineering Students”, Volume2 and 3(2nd Edition), S.Viswanathan (printers & publishers Pte, Ltd.,) 1992.
3. Venkataraman, M.K”Engineering Mathematics”Volumes3-A&B, 13th Edition National Publishing Company, Chennai, 1998.
4. Shanmugam,T.N.:http:.www.annauniv.edu/shan/trans.html.

BBM301	ANATOMY AND PHYSIOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biology (Class X-XII)				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

To provide the students the exposure to the fundamentals in human anatomy and physiology.

COURSE OUTCOMES (COs)

CO1	Learn the basic terminologies, structural and functional elements of human body
CO2	Understand the physiological aspects of respiratory and cardiac system
CO3	Learn the structure and function of nervous tissue, visual and auditory pathways
CO4	Analyze the process of temperature regulation; understand the process of GI reflex
CO5	To understand the structure and location of every organ system
CO6	To understand the physiology of various biosystems

UNIT I INTRODUCTION: HUMAN BODY AND CELL PHYSIOLOGY 9

Define Anatomy, Terms of Location, Position and Planes, Cell structure, Cell membrane Transport, Resting membrane potential and ionic basis of potentials, Action potential in nerve, Muscle and Heart.

UNIT II RESPIRATORY AND CARDIAC SYSTEM 9

Cardiac Cycle – ECG – Blood Pressure – Feedback Control for Blood Pressure – Nervous control of Heart. Cardiac output – Coronary and Peripheral Circulation, Physiological aspects of respiration. Exchange of gases – Regulation of Respiration. Disturbance of respirating function. Pulmonary function test.

UNIT III NERVOUS SYSTEM ANDSPECIAL SENSES 9

Structure and function of Nervous tissue – Reflex action – Peripheral Nervous System– Autonomic Nervous System, Structure of Sense Organs (Eye, Ear, Nose and Skin), Visual and Auditory Pathway.

UNIT IV DIGESTIVE AND EXCRETORY SYSTEM 9

Organization of GI system, Digestion and absorption – Movement of GI tract – Structure of Nephron – Mechanism of Urine formation – Urine Reflex – Temperature regulation and Sweat Gland.

UNIT V ENDOCRINE AND REPRODUCTIVE SYSTEM 9

Mention of Endocrine glands general hormonal action (Pituitary, Thyroid, Parathyroid, Adrenal, Pancrease), Second messengers, testis, ovaries, Fallopian tube, Uterus.

TEXTBOOKS:

1. Arthur C, Guyton, John Hall.E “Textbook of Medical Physiology”, W.B. Saunders Company, Twelfth edition, 2006

REFERENCES:

1. Guyton „Text book of Medical Physiology – WB Jaunder company Philadelphia - 10 edition 2002
2. Cyrul A Keele and Eric Neil – Samsons Wrights Applied physiology – Oxford University press New Delhi – 1991
3. Ranganathan T S,Text Book of human Anatomy S. Chand and company New Delhi – 1994
4. Best and Taylor, The livery Body – BC publication New Delhi 1980
5. http://vet.uokufa.edu.iq/staff/falah/Textbook%20of%20Medical%20Physiology.pdf

BBM302	Electrical Measurements and Instrumentation	L	T	P	C
	Total Contact Hours - 45	4	0	0	4
	Prerequisite – Basic Electrical				
	Course Designed by – Dept of E&I				

OBJECTIVES

The student will be made to understand:

- Magnetic circuits, principle and application of transformers
- Principle of operation of DC motors and AC Machines
- Principle of fractional-kW motors and their applications.

COURSE OUTCOMES (COs)

CO1	Describe principles and applications of different ammeters and voltmeters
CO2	Explain the types and working of watt meters and energy meters
CO3	Learn the types, construction, and working of different types of potentiometers
CO4	Describe in detail the different methods of resistance measurements
CO5	Describe in detail the different methods of impedance measurements

UNIT – 1 **9**

DIFFERENT TYPES OF AMMETERS AND VOLTMETERS

Galvanometers – Principle of operation, Construction and sources of errors and compensation in PMMC and Moving iron Instruments – Dynamometer and Rectifier type Ammeter and Voltmeters

UNIT –II **9**

WATTMETERS AND ENERGY METERS

Electrodynamics type wattmeter – Theory and its errors – methods of correction – LPF Wattmeter – Phantom loading – Induction type Kwh meter – theory and adjustments – calibration of wattmeter‟s and energy meters

UNIT – III **9**

POTENTIOMETERS AND INSTRUMENT TRANSFORMERS

Student type potentiometer & L and N type potentiometer – precision potentiometer – polar and co – ordinate type – A.C. potentiometers – their applications – construction and theory of operation C.T. and V.T. phasor diagrams – Characteristics- applications.

UNIT IV **9**

RESISTANCE MEASUREMENT

Measurement of low , medium & High resistances ammeter Voltmeter method – Wheatstone Bridge – Precision form wheat stone Bridge – Kelvin Double Bridge – Ductor Ohmmeter – Series Shunt type ohmmeters – High Resistance measurement – Megger – Direct deflection methods – price‟s Gauard wire method – Megohm Bridges – loss of charge method – earth resistance measurement.

UNIT – V **9**

IMPEDANCE MEASUREMENT

A.C.Bridges – Measurement of inductance , capacitance – Q of coil – Maxwell‟s Bridge – Maxwell‟s Wien Bridge – Hay‟s Bridge Schering Bridge - Anderson Bridge – Cambell Bridge to measure mutual inductance – errors in A.C Bridge method and their compensation – Detectors and exited field A.C Galvanometer – Vibration Galvanometer

L:45

L = 45 TOTAL: 45 PERIODS

TEXT BOOKS:

1.Sawhney A.K., A. Course in Electrical and Electronics Measurements and Instrumentation, Dhanpat Raiand Sons, New Delhi, 1995.

BCE406	ENVIRONMENTAL STUDIES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Physical Sciences				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To study the nature and facts about environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth‟s interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context
CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

UNIT I THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance, Need for public awareness.

Natural Resources : Renewable And Non – Renewable Resources

Natural resources and associated problems

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.
c) Mineral resources : Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing , effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.
f) Land resources : Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 8

Concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-

Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III BIODIVERSITY AND ITS CONSERVATION 7

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega-diversity nation, Hot-spots of biodiversity -Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution 7

Definition, Causes, effects and control measures of ;- Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management : floods earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8

From Unsustainable to Sustainable development, Urban problems related to energy, nuclear accident and holocaust, case studies, wasteland reclamation, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection Act, Forest Conservation Act, Issues involved in enforcement of environmental Legislation, public awareness –

Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel –oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes – Noise produced by fire crackers – Noise pollution – Noise level standards for fire crackers – Intensity of sound – Impact on hearing – Safety measures.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations, population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXTBOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.

REFERENCES:

1. Bharucha Erach, "The Biodiversity of India", Mapin Publishing Pvt. Ltd., Ahmedabad India.2002
2. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, EnviroMedia 2009
3. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
4. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
5. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno Science Publications 2013

	MICROPROCESSORS AND ITS APPLICATIONS	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3

BBM303	Prerequisite – Digital Electronics
	Course Designed by – Department of Electronics and Communication Engineering.

OBJECTIVES

1. Study the Architecture of 8086 microprocessor.
2. Learn the design aspects of I/O and Memory Interfacing circuits.
3. Study about communication and bus interfacing.
4. Study the Architecture of 8051 microcontroller.

COURSE OUTCOMES (COs)

CO1	Design and implement programs on 8086 microprocessor.
CO2	Design I/O circuits.
CO3	Design Memory Interfacing circuits.
CO4	Design and implement 8051 microcontroller based systems.
CO5	Learn the instruction sets and interfacing
CO6	To learn the instruction sets and programming for microprocessor

UNIT-I ARCHITECTURE 9

General 8 bit microprocessor and its architecture – 8085 functional block diagram architecture – functions of different sections architecture of 8086 CPU.

UNIT-II INSTRUCTION SETS 9

Instruction format – addressing modes – instruction set of 8085 CPU – instruction cycle – timing diagram – different machine cycles – Fetch and execute operations – estimation of execution time.

UNIT-III ASSEMBLY LANGUAGE PROGRAMMING 9

assembly format of 8085 – assembly directions multiple precision arithmetic operations – binary to BCD and BCD to binary code conversion – ALU Programming using look up table – stack and subroutines.

UNIT-IV DATA TRANSFER AND INTERFACING 9

Data Schemes Program I/O and interrupt structure of 8085, interrupt drives I/O – DMA serial I/O – I/O ports – latches and buffers – peripheral interface IC‟s 8212, 8255, 8279, 9239 – interfacing of A/D and D/A converters – RAM and ROM – memory devices – display devices – applications.

UNIT-V MICRO CONTROLLERS 9

Architecture of 8 – bit microcontroller (8051) bus configuration – reset circuitry – power down considerations – instruction sets – programming exercises – development and troubleshooting tools – applications.

TEXT BOOKS:

1. Gaonkar R.S .,”Microprocessor Archicture programming and application “ Wiley Eastern Ltd, New Delhi.
2. Kenneth. J .Ayala, The 8051 Microcontroller. Archicture and Programming applications.

REFERENCE:

1. Mature . A “Introduction of microprocessor “ Tata McGraw Hill Publishing, Co Ltd., New Delhi 1989.
2. Theagarajan “Microprocessor and Microcontroller - 2ndEdn”. SCITECH Publications chennai.2003.
3. http://nptel.ac.in/courses/108107029/

BBM304	**INTRODUCTION TO ELECTRONIC DEVICES AND CIRCUITS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4

	Prerequisite – Basic Electronics
	Course Designed by – Department of Electronics and Communication Engineering.

OBJECTIVES

1. To introduce electric circuits and its analysis.
2. To impart knowledge on solving circuits using network theorems.
3. To introduce the phenomenon of resonance in coupled circuits.
4. To educate on obtaining the transient response of circuits.

COURSE OUTCOMES (COs)

CO1	Understand and design electric circuits and do various tests on it
CO2	Gain knowledge on solving circuits using network theorems.
CO3	Attain in-depth knowledge on the phenomenon of resonance in coupled circuits.
CO4	Work on obtaining the transient response of circuits.
CO5	Plot the phase or diagrams and analysis of three phase circuits.
CO6	To solve problems on circuit analysis

UNIT I PN JUNCTION 12

Analysis of PN junction diode equation, transition and diffusion capacitance, break down characteristics. Charge control model and switching characteristics, tunnel diode, light emitting diode, bipolar junction transistor, Ebers moll‟s equation, JFET – theory of operation and current equation.

UNIT II SPECIAL SEMICONDUCTOR DEVICES AND DEVICES TECHNOLOGY 12

Charge transfer device, UJT, SCR, Diac, Triac, GTO and introduction to gallium arsenide devices, N MOS, C MOS integrated circuits.

UNIT III AMPLIFIERS 12

Biasing circuits for transistors-FET and their analysis –CE, CC and CB amplifiers –PET amplifiers

Differential amplifiers- common mode and difference mode analysis- Drift compensation FET inputs stages- introduction to tuned amplifiers.

UNIT IV RECTIFIERS 12

Half and full wave, ripple factor calculations for C, L, L-C.

UNIT V POWER SUPPLIES 12

SMPS, linear electronic voltage regulators, power control using SCR.

TEXT BOOK :

1. Albert Paul Malvino, “Electronic Principles “ Tata McGraw Hill, 6th edition 2005

REFERNCES:

1. http://nptel.ac.in/courses/122104013/main1.html

	MICROPROCESSOR LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2

BEC 3L1	Prerequisite – Digital Electronics
	Course Designed by – Department of Electronics and Communication Engineering.

OBJECTIVES

1. Study the Architecture of 8085 microprocessor.
2. Learn the design aspects of I/O and Memory Interfacing circuits.
3. Study about communication and bus interfacing.
4. Study the Architecture of 8051 microcontroller.

COURSE OUTCOMES (COs)

CO1	Design and implement programs on 8085 microprocessor.
CO2	Design I/O circuits.
CO3	Design Memory Interfacing circuits.
CO4	Design and implement 8051 microcontroller based systems.
CO5	Design the instruction sets and interfacing
CO6	Design the instruction sets and programming for microprocessor

1. Familiarization of 8085 microprocessor kit.
2. Familiarization of 8051 microcontroller kit
3. 8085 and 8051 assembly language programming exercises
4. Interfacing of switches and display devices
5. Interfacing of D/A and A/D converters
6. Interface of key board and display using programming controllers
7. Interface of programmable timer
8. Stepper motor control using microprocessor
9. Interface of printer using UART

	ELECTRICAL AND ELECTRONIC MEASUREMENT LAB	**L**	**T**	**P**	**C**

BEI3L2	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic Electronics				
	Course Designed by – Department of Electronics and Communication Engineering.				

OBJECTIVES

1. To introduce electric circuits and its analysis.
2. To impart knowledge on solving circuits using network theorems.
3. To introduce the phenomenon of resonance in coupled circuits.
4. To educate on obtaining the transient response of circuits.

COURSE OUTCOMES (COs)	
CO1	Design electric circuits and do various tests on it
CO2	Gain knowledge on solving circuits using network theorems.
CO3	Attain in-depth knowledge on the phenomenon of resonance in coupled circuits.
CO4	Work on obtaining the transient response of circuits.
CO5	Plot the phase or diagrams and analysis of three phase circuits.
CO6	To Study of feedback in amplifiers.

LIST OF EXPERIMENTS:

1. Use of Wheat Stone bridge as resistance to voltage converter and to determine its Sensitivity for various ratios.
2. Kelvin double bridge.
3. Determination of critical damping resistance of a D‟Arsonval Galvanometer.
4. Tests on a single - phase energy meter.
5. Calibration of wattmeter at different power factors.
6. Testing of current transformers.
7. Calibration of ammeter, voltmeter and wattmeter using student type potentiometer.
8. Design construction and calibration of series and shunt type ohmmeters.
9. Operational amplifier applications.
10. Regulated power supply using fixed voltage IC regulators and LM 723.
11. Frequency response characteristics of CE and CB amplifiers.
12. Study of feedback in amplifiers.
13. RC phase shift and Wien Bridge Oscillator.

BBM3L2	ANATOMY AND PHYSIOLOGY LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Biology (Class X-XII)				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

To provide the students the exposure to the fundamentals in human anatomy and physiology.

COURSE OUTCOMES (COs)

CO1	Study on bone
CO2	Study of Electrocardiogram
CO3	Analyze the Total count and Hemoglobin estimation.
CO4	Analyze the process of blood Pressure Monitoring
CO5	To understand the structure and location of every organ system
CO6	To understand the physiology of tests.

LIST OF EXPERIMENTS:

1. Study on Upper Extremity bone.
2. Study in Lower Extremity bone.
   -Identification of Bone
   -Side identification
   -Identification of Important feature
3. Study of ECG.
4. Blood Pressure Monitoring.
5. Blood Cell Count – Total count and Hemoglobin estimation.
6. ESR estimation.
7. Blood group identification and differential count of differential WBC"' Count.
8. Auscultation for Heart Sounds
9. Weber"'s and Kinnee"'s test too auditory conduction.

BBM401	BIOSTATISTICS	L	T	P	C

	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Numerical Methods				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
To acquaint the student with Fourier transform techniques used in wide variety of situations.
To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes
To develop Z transform techniques for discrete time systems.

COURSE OUTCOMES (COs)

CO1	To learn the basics of statics in biomedicine
CO2	To learn basic concepts of various probability distributions
CO3	To have a clear understanding about various hypotheses and testing
CO4	To analyze any given model in terms of variance
CO5	To understand the basics of Statistical Quality Control
CO6	To know the probability based problems

UNIT I - INTRODUCTION TO BIO-STATISTICS (numerical problems only) 9+3

Handling univariate and bivariate data – Measures of central tendency – Measures of dispersion –Skewness & Kurtosis – Correlation and Regression .

UNIT II – PROBABILITY & THEORETICAL DISTRIBUTIONS 9+3

Probability concepts – conditional probability – Baye‟s theorem – one – dimensional random variables – expectation, variance, moments. Theoretical distributions : Binomial, Poisson, Normal (Problems only).

UNIT III - TESTING OF HYPOTHESIS 9+3

Introduction – Large sample tests based on normal distribution - Test for single mean, difference between means, proportion, difference between proportion, standard deviation, difference between standard deviation. Chi-square test for goodness of fit, independence of attributes.

UNIT IV - ANALYSIS OF VARIANCE 9+3

Small sample tests based on t and F distribution - Test for, single mean, difference between means, Paired t-test, test for equality of variances. ANOVA– one –way classification, Two-way classification.

UNIT V - STATISTICAL QUALITY CONTROL 9+3

Introduction – Process control – control charts for variables - X and R, X and s charts control charts for attributes : p chart, np chart, c chart.

TEXT BOOKS

1. S.C.Gupta & V.K.Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi , 2003.
2. W.Ewans & G.Grant, Statistical Methods in Bio informatics – An Introduction.
3. https://medschool.vanderbilt.edu/biostatistics/content/what-biostatistics

	CLINICAL BIOCHEMISRTY	L	T	P	C

BBM402	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Biology				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

1. Introduced to the basics of biochemistry, i.e, synthesis and carbohydrates, lipids etc
2. Familiarized with the Classification, structure and properties of carbohydrates, Lipids, Protein and Enzyme

COURSE OUTCOMES (COs)

CO1	Classification, properties, metabolism and synthesis of carbohydrates, glucose.
CO2	Classification of amino acids, proteins, metabolism of urea etc
CO3	Types and properties of lipids, metabolic disorders etc
CO4	Chemical nature and properties of Enzymes, hormones and nucleic acids and related disorders
CO5	Basic functional tests, measurement of electrolytes etc.
CO6	To understand the metabolism based problems

UNIT-I CARBOHYDRATE 9

Carbohydrate classification, structure and Properties of Mono-di and Polysaccharides with its clinical importance and its uses Biological importance of carbohydrates metabolism – glycolysis, TCA cycle, Glyes, resgenesis, Pentose phosphate pathway, Uronic acid pathway, metabolism of fructose, Sorbitol pathway, metabolism of gelatos and its dysfunction

UNIT-II PROTEIN 9

Classification of amino acids – characteristics of amino acids – Zwitterions, Iso-electric point. Protein classification. Structure of proteins, primary, secondary, tertiary and quaternary structure. Biological importance of polypeptides. Metabolism of ammonia, Urea cycle Metabolic disorders of glacier, Phenyl alumina, tyrosine, Tryptophan. Metabolic defects of branched chain amino acids maple syrup urine disease.

UNIT-III LIPIDS 9

Classification of lipids. Compound lipids. Structure and properties of compound lipids, glycolipids, glycerophosphatides, Phospoinositides. Derived lipids – cholesterol – Biosynthesis of cholesterol Bile acids and its importance. B oxidation of fatty acids. Disorder sol lipid metabolism. Arthosclerosis, hypercholesterolemia, hyperlipoproteinemias and fatty, liver diseases.

UNIT-IV ENZYMES, HARMONES AND NUCLEIC ACID 9

Enzymes – chemical nature. Hormones – chemical nature, properties of hormones and hormonal disorders. Nucleic acid. Composition and function of nucleic acid. Structure of DNA, RNA, Synthesis and degeneration of Purine and Pyramidine metabolism.

UNIT-V BIOCHEMISTRY OF BLOOD AND BODY FLUIDS 9

Liver function test. Renal function test. Acid base balance and imbalance measurements of electrolytes, their abnormal and normal values and conditions. Biochemistry of urine testing, uses of isotopes in Biochemistry.

TEXT BOOKS:

1. Text book of medical biochemistry – Rana shine, MN Chatterje 3rd edition.
2. Sathyanarayana, Textbook of Biochemistry, 2003.

REFERENCES:

1. Saini A.S "Clinical Biochemistry in Diagnosis and Management" CBS Publishers. Chennai 2005
2. Varley / Harold "Practical Clinical Biochemistry" CBS Publishers. Chennai 2005
3. http://as.wiley.com/WileyCDA/WileyTitle/productCd-EHEP002746.html

BBM403	BIO MEDICAL INSTRUMENTATION - I	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Fundamentals of Electronics and Instrumentation				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

The students will be exposed to electrical and non-electrical physiological measurements and bioamplifiers

COURSE OUTCOMES (COs)

CO1	Understand the purpose of measurement, the methods of measurements, errors associated with measurements.
CO2	Know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications.
CO3	Know the different display and recording devices for various biosignals
CO4	Know the measurement techniques for blood flow measurement and cell counting
CO5	Learn the uses of pH, spectrometers and auto-analyzer
CO6	To learn about the characteristics of various biopotentials

UNIT-I INTRODUCTION TO MEDICAL INSTRUMENTS 12

Design of medical instruments – components of biomedical instrument system, Electrodes & Transducers.

UNIT-II BIOSIGNAL ACQUISITION 12

Physiological signal amplifiers. Biosignal analysis signal recovery and data acquisition. Pattern recognition.

UNIT-III BIOPOTENTIAL RECORDS 12

ECG, EMO, EEG, ERO, EOG, Echo cardiography – characteristics of the recording systems – lead systems and recording methods – waveforms.

UNIT-IV BLOOD FLOWMETERS AND BLOOD CELL COUNTING 12

EM and Ultrasonic blood flow meters. Indicator dilution method, thermo dilution method, Manual and automatic counting of RBC, WBC and platelets.

UNIT-V BIOCHEMICAL MEASUREMENTS 12

Ph, pco_2, po_2, - calorimeter, spectrophotometer, flame photometer. Autoanalyser.

TEXT BOOKS:

1. Arumugam.M, Textbook of Biomedical Instrumentation,2003.
2. Richard A. Norman “Principles of Biomedical Instrumentation” John Wiley and sons. New York.1988.

REFERENCE:.

1. Khanpur R.R., Handbook of Biomedical Instrumentation, Tata McGraw hill publishing company. New Delhi 1999.
2. Scott / Mathur "Textbook of Biomedical Instrumentation" CBS Publishers. Chennai 2007.
3. http://www.eeeuniversity.com/2013/08/ei2311-biomedical-instrumentation.html

BBM404	MEDICAL ELECTRONICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic knowledge of electronic devices, and physiological system				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

1. To provide practice on recording and analysis of different Bio potentials
2. Study the function of different Therapeutic equipments.

COURSE OUTCOMES (COs)

CO1	IC circuits, Op-amps, rectifiers and its applications
CO2	Safety concerns in hospitals
CO3	Use of filters in biomedical applications
CO4	Different types of read-out devices used
CO5	Use of timers and counters
CO6	To know the protection and over voltage protection circuits

UNIT-I LINER INTEGRATED CIRCUITS 9

Introduction to liner integrated circuits, operational amplifiers, characteristics, application, Op amp circuits, Bio medical applications. Rectifiers op amp circuits using diodes, SMPS basic ECG amp, was form generation using Op amps.

UNIT-II SAFETY INSTRUMENTATION 9

interference and instability of biomedical signals. Electrical and magnetic components – leads as path of resistance – minimizing interference. Introduction – Physiological effects micro shock. Macro shock – electrical accidents in hospitals – Electrical Hazards – Safety Measures.

UNIT-III FILTERS 9

Carrier current and line noise HP,BP, BR – radio frequency interference, RF power, measurement – base line shift.

UNIT-IV READ OUT DEVICES 9

Recorders – types –Strip chart – XY Recorders, Magnetic tape Recorders – UV recorders – direct recording – other types.

UNIT-V TIMERS AND COUNTERS 9

Delay timer, interval timer, design of ADC and DAC circuits, frequency counters, multivibrator, flip flop.

TEXT BOOKS:

1. Ramakant A. Gayakwad, op Amps and Linear Integrated circuits "Prentice Hall of India, New Delhi, 3rd Edition , 1997.
2. Roy choudhury and Shah Jain, „Linear Integrated circuits", 1995.

REFERENCES:

1. Milam‟s and Halkias, “Electronic devices and circuits” Tata McGraw Hill publishing Co. Ltd., Delhi, 1996.
2. Joseph Dubay, Introduction to Bio medical electronics, McGrew Hill book Co., 2008.
3. Terra behilla “Bio medical and clinical Engineering” Brent ice hall inc., 2001
4. Geddas I.A and Baker I.JF. Principles of applied biopmedical instrumentation” , John Wiley and Sons,1992.
5. http://www.academia.edu/6243100/EC2021-_Medical_Electronics_notes_for_all_five_units

BEC404	BASIC PRINCIPLES OF COMMUNICATION AND CIRCUITS	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Basic knowledge of electronic devices				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

1. Understand analog and digital communication techniques
2. Learn data and pulse communication techniques
3. Be familiarized with source and Error control coding
4. Gain knowledge on multi-user radio communication

COURSE OUTCOMES (COs)	
CO1	Apply analog and digital communication techniques
CO2	Use data and pulse communication techniques
CO3	Analyze Source and Error control coding
CO4	Utilize multi-user radio communication
CO5	Modulate and demodulate a signal.
CO6	To understand the principles of both digital and analog communication

UNIT I BASIC OF CIRCUIT ANALYSIS 12

Kirchoffs law, DC and AC excitation, series and parallel circuit, sinusoidal steady state analysis. Mesh current and nods voltage method of analysis ,matrix method of analysis. Thevenins and Norton theorems, super position theorem , compensation theorem, Reciprocity theorem, maximum power transfer theorem and parallel resonance ,quality factor and bandwidth.

UNIT II STATICS ELECTRIC FIELD 12

Coulomb‟s law. Electric field intensity. Gaussi law and its applications, permittivity, polarization, Boundary relation, capacitance, Dielectric strength. Energy and Energy density. Poisson‟s and Laplace equations and applications. Electric current Density. Ohm‟s law at a point. Resistance and conductance , continuity relations for current problems.

UNIT III STEADY MAGNETIC FIELD 12

The Biot stevart law. Gauss‟s law for magnetic fields. Torque on a loop. Ampere‟s law and magnetic field intensity, magnetic materials. Magnetic dipoles .Loops and solenoids. Magnetization, Inductance, Energy in an inductor and Energy density ,boundary relation, Ferromagnetism, Hysterical, Reluctance and presence problem.

UNIT IV ANALOG MODULATION SYSTEM 12

Basic principle of AM, FM and PM spectra power consideration .Receivers characteristic and deduction of AM, FM and system performance Threshold effect reduction.

UNIT V BASE BAND DATA COMMUNICATION AND DIGITAL MODULATION12

Sampling and quantization PCM, ADPCM,DM, ADM, Base and pulse shaping binary data formats. Base band transmission ISI Correlative coding .Optimum SNR matched filter detection. Digital modulation, coherent binary modulation techniques , non coherent binary modulation.

TEXTBOOK:

1. Taub and Schilling, „Principles of Communication", Tata McGraw Hill Publication, 1990.
2. Joseph Ediminister and Mahmood Nahri, "Electric Circuits", Third Edition, Tata McGraw Hill, New Delhi, 1999.

REFERENCE:

1. John D. Krauss, "Electromagnetics", McGraw Hill, 1999.
2. http://www.nptel.ac.in/courses/117106090/

BBM405	BIOSENSORS AND TRANSDUCERS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic knowledge of electronic devices and sensors				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

1. Understand the purpose of measurement, the methods of measurements, errors associated with measurements.
2. Know the principle of transduction, classifications and the characteristics of different transducers and study its Biomedical applications.
3. Know the different display and recording devices.

COURSE OUTCOMES (COs)

CO1	Describe the purpose and methods of measurements
CO2	Explain different display and recording devices for various applications.
CO3	Know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications
CO4	Remember and understand the concepts, types, working and practical applications of important biosensors.
CO5	Know some of the commonly used biomedical transducers
CO6	To learn the different types of transducers and its applications

UNIT - I SCIENCE OF MEASUREMENT 9

Units and Standards - calibration methods - statics calibration - classification of errors, error analysis - statistical methods - odds and uncertainty.

UNIT - II CHARACTERISTICS OF TRANSDUCERS 9

Static characteristics - accuracy, precision, sensitivity, linearity etc - mathematical model of transducers - zero first - order and second - order transducers - response to impulse step, ramp and sinsoidal inputs.

UNIT - III VARIABLE RESISTANCE TRANSDUCERS 9

Principle of operation, construction details, characteristics and applications of resistance potentiometers, strain gauges, resistance thermometers, thermistors, hot-wire aneometer, piezoresistive sensors and humidity sensors.

UNIT - IV BIOSENSORS - PHYSIOLOGICAL RECEPTORS - J RECEPTORS 9

Chemo receptors, Baroreceptors, Touch receptors, Biosensors - Working Principle and Types, Applications.

UNIT - V OTHER TRANSDUCERS 9

Piezoelectric tranducers, magnetostrictive transducer, IC sensor digital transducers - smart sensor - fibre optic transducers.

TEXT BOOKS:

1. Doeblin. E. O, Measurment Systems, McGraw Hill Book Co. 1998
2. Renganathan S, Transducer Engineering, Allied Publishers, Chennai,2000.

REFERENCE:

1. http://www.scribd.com/doc/178415581/Transducer-Engineering-Dr-s-Renganathan#scribd

BBM4L1	BIOSENSORS AND TRANSDUCERs LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic knowledge of electronic devices and sensors				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

4. Understand the purpose of measurement, the methods of measurements, errors associated with measurements.

5. Know the principle of transduction, classifications and the characteristics of different transducers and study its Biomedical applications.

6. Know the different display and recording devices.

COURSE OUTCOMES (COs)	
CO1	Design the purpose and methods of measurements
CO2	Design different Strain Gauge characteristics. for various applications.
CO3	Learn and Design Hall Effect transducer
CO4	Design Ramp response characteristic of filled in system thermometer.
CO5	Know Load cell characteristics
CO6	To learn the Characteristics of LVDT.

LIST OF EXPERIMENTS:

1. Displacement versus output voltage characteristics of a potentiometric transducer.
2. Strain Gauge characteristics.
3. Load cell characteristics.
4. Photoelectric tachometer.
5. Hall Effect transducer.
6. Characteristics of LVDT.
7. Characteristics of LDR, thermistor and thermocouple.
8. Ramp response characteristic of filled in system thermometer.
9. Step response characteristics of RTD and thermocouple.

BBT4L2	BIOCHEMISRTY LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic Biology				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

3. Introduced to the basics of biochemistry, i.e, synthesis and carbohydrates, lipids etc
4. Familiarized with the Classification, structure and properties of carbohydrates, Lipids, Protein and Enzyme

COURSE OUTCOMES (COs)

CO1	Qualitative analysis .
CO2	Estimation of different methods
CO3	Isolation of Starch
CO4	Estimation of DNA
CO5	Abnormal Urine analysis
CO6	Estimation of Creatinine by Jafe‟s method.

LIST OF EXPERIMENTS:

1. Qualitative analysis of Glucose.
2. Qualitative analysis of Fructose.
3. Qualitative analysis of Maltose.
4. Qualitative analysis of Sucrose.
5. Qualitative analysis of Lactose.
6. Estimation of Glucose by Benedict‟s Method.
7. Estimation of Glucose by Lowry‟s Method.
8. Estimation of Protein by Biuret‟s Method.
9. Estimation of DNA by Diphenyl amine method.
10. Estimation of Glucose present in Urine Sample.
11. Isolation of Starch from Potato.
12. Estimation of Amino acid by Ninhydrin method.
13. Estimation of Creatinine by Jafe‟s method.
14. Abnormal Urine analysis (Glucose, Protein, Acetone, etc.).

BBM501	LINEAR AND DIGITAL INTEGRATED CIRCUITS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basics of electronic circuits				
	Course Designed by – Department of E & I				

OBJECTIVES

To study the application of analog ICs in the designing circuit.

To study the applications of these Digital ICs.

To understand the basic of the Digital systems.

To study the design of the various functional circuits using these ICs.

COURSE OUTCOMES (COs)

CO1	Basics of number systems, conversion and filters
CO2	Basics of Logic gates and Boolean algebra
CO3	Full adder and Half adder and its implementation using ICs
CO4	Different types of ICs and sequential circuits
CO5	Details about RAM, ROM, EPROM and types of memories
CO6	To understand the basic of the Digital systems.

Unit 1: NUMBER SYSTEMS, CODES AND OPERATIONAL AMPLIFIERS 9

Number systems-Decimal, binary, Octal, Hexadecimal, conversion from one to another, complement arithmetic. Codes – Gray code, Excess-3 code, alphanumeric code. Error detection and correction. Characteristics of ideal op amp, Virtual Short, differential amplifier, offset currents and voltages, Slew rate, 741 IC Specifications, inverting an non-inverting amplifiers, differential dc amplifier, bridge amplifier, integrator, differentiator, active low pass, high pass and band pass active filters, precision diode and clamp, half wave rectifier, average detector, peak detector, log – antilog amplifiers, monostable and triangular wave generators.

UNIT II: BOOLEAN ALGEBRA AND LOGIC GATES 9

Basic theorems and properties of Boolean Algebra-De Morgan‟s Theorem, simplification using Boolean algebra, sum of product and product of sum, Karnaugh map. Tabulation methods, Logic gates – Truth tables, Realization of Boolean functions using Gates, Universal Gates. Logic gates-AND, OR, NOT, NAND, NOR, EX-OR GATES. Universal property of NAND AND NOR gates.

UNIT III: COMBINATIONAL CIRCUITS 9

Basic adder – half adder, full adder, comparator, decoder, encoder, multiplexer, demultiplexer, Parity generator or checker. Boolean _Expression Implementation using these IC‟s.

UNIT IV: SEQUENTIAL CIRCUITS 9

Flip-flop – SR, JK, T, D, Master-slave flip-flop, shift registers, ripple counter, Excitation Tables, Design of counters using Excitation tables, synchronous counters and Asynchronous Counters,

7490, 74161 Counter IC specifications, Ring and Johnson Counters, Shift Register and IC Specifications

UNIT V: MEMORY AND STORAGE 9

Basics of semiconductor memory, RAM-static and dynamic, ROM-EPROM, special types of memories.

TEXT BOOKS

1. Roy Choudhury and ShailJain, *Linear Integrated circui*ts , Wiley Eastern Ltd., 1995.
2. Coughlin & Driscull, *Operational Amplifiers & Linear Integrated Circuits* , 6th ed., Prentice Hall Of India, 2003.

REFERENCE BOOKS

1. Gayakwad A.R. , Op-Amp and Linear Integrated circuits ,4th ed. Prentice Hall of India, 2003.
2. Sergio Franco,, Design with Operational Amplifier and Analog Integrated Circuits , McGraw Hill, 1997.
3. http://nptel.ac.in/video.php?subjectId=108106069

BEI502	DIGITAL SIGNAL PROCESSING	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Basics of electronics and C++ programming				
	Course Designed by – Department of E & I				

OBJECTIVES

1. To learn discrete Fourier transform and its properties
2. To know the characteristics of IIR and FIR filters learn the design of infinite and finite impulse
3. response filters for filtering undesired signals
4. To understand Finite word length effects
5. To study the concept of Multi-rate and adaptive filters

COURSE OUTCOMES (COs)

CO1	Apply DFT for the analysis of Digital Signals & Systems
CO2	Design IIR and FIR Filters
CO3	Characterize finite word length effect on filters
CO4	Design the Multi-Rate Filters
CO5	Apply Adaptive Filters to equalization
CO6	To learn the mathematical way of designing the filters

UNIT-1 DISCRETE TIME SIGNALS AND SYSTEMS 9+3

Periodic and Pulse signals-eg.‟s for sequences-Pulse,Step,Impulse,Ramp,Sine and exponential-Differential equations-Linear time invariant-Stability,casuality-DT systems-Time domain analysis.

UNIT-2 DISCRETE TIME SYSTEMS - Z TRANSFORM 9+3

Z transform and its properties-Convolution, Inverse.Z transform-Discrete Fourier series Properties-Sampling the Z transform-Discrete Fourier transform-Properties for frequency domain analysis-Linear Convolution using discrete Fourier transform-Overlap save method.

UNIT-3 FREQUENCY ANALYSIS OF SIGNALS - FAST FOURIER TRANSFORMS 9+3

Introduction to Radix to FFT‟s-decimation in the FFT Algorithm-Decimation in frequency FFT Algorithm-Computing inverse DFT using FFT-mixed radix FFT algorithm, Periodogram Techniques.

UNIT-4 IIR FILTER DESIGN 9+3

Classification-Reliability constraints-IIR design-Butterworth and Chebyshev Filters, Bilinear Transform Method-Impulse Invariant Method-Step Invariance Method.

UNIT-5 FIR FILTER DESIGN 9+3

FIR design-Fourier Series Method –Window function Method, triangular window, rectangular window, Hamming window, Hanning window functions, Kaiser window. Applications of Signal Processing in Biomedical Engineering.

TEXTBOOKS:

1. Openheim.A.V & Shaefer.R.S. " Discrete Time Signal Processing " Prentice Hall , N.J , 1980.
2. Proakis .J.G & Manolakis.D.G " Introduction to Digital Signal Processing " Maxwell Mc.Williams International Edition London 1989.

REFERENCES :

1. Antonla.A "Digital Filter Analysis and Design", TataMcGraw Hill publishing Co., NewDelhi, 1998.\
2. Stranneby "Digital Signal Processing & Applications" CBS Publishers. Chennai 2006
3. Biomedical Digital Signal Processing by Tompkins.
4. http://www.ece.wisc.edu/~cobb/courses/431Notes.pdf

BBM503	BIOMEDICAL INSTRUMENTATION II	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Biomedical instrumentation- 1				
	Course Designed by – Department of Biomedical engineering				

OBJECTIVES

The student should be made to:

1. Gather basic knowledge about measurements of parameters related to respiratory system
2. Learn measurement techniques of sensory responses
3. Understand different types and uses of diathermy units.
4. Know ultrasound imaging technique and its use in diagnosis
5. Know the importance of patient safety against electrical hazard

COURSE OUTCOMES (COs)	
CO1	Explain about measurements of parameters related to respiratory system
CO2	Describe the measurement techniques of sensory responses
CO3	Analyze different types and uses of diathermy units
CO4	Discuss ultrasound imaging techniques and its usefulness in diagnosis
CO5	Outline the importance of patient safety against electrical hazard
CO6	Know the instrumentation for various biomedical systems

UNIT-I HEART LUNG MACHINE 9+3

Condition to be satisfied by the H/L system, different type of Oxygenators, pumps- Blood handling system.

UNIT-II CARDIAC ASSIST DEVICES 9+3

Synchronous counter pulsation, right ventricular bypass pump, left ventricular bypass pump, Intra aortic balloon pumping and veno arterial pumping.

UNIT-III ARTIFICIAL KIDNEY 9+3

Indication and Principle of Haemodialysis, different types of dialysis, monitoring systems, artificial kidney.

UNIT-IV PROSTHETIC AND ORTHODIC DEVICES 9+3

Hand and arm replacement- different types of models, externally powered Prosthesis feed back in orthodic system, materials for prosthetic and orthodic devices

UNIT-V RESPIRATORY AND HEARING AIDS 9+3

Intermittent positive pressure breathing apparatus, operating sequence, audiograms, types of deafness hearing aids, impedance matching -BERA Test.

TEXTBOOKS:

1. Albert-N. Cook & Webster. J. G. Therapeutical medical devices, Prentice hall INC, New Jersey, 1982.

REFERENCES:

1. Khanpur, R.S., Handbook of Bio medical instruments and measurements, Tata Mc-Graw Hill, 1987.
2. Scott / Mathur "Textbook of Biomedical Instrumentation" CBS Publishers. Chennai 2007.
3. http://www.eeeuniversity.com/2013/08/ei2311-biomedical-instrumentation.html

BBM505	BIOMATERIALS AND IMPLANTABLE DEVICE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic knowledge of material science				
	Course Designed by – Department of Biomedical engineering				

OBJECTIVES

The student should be made to:

1. Learn characteristics and classification of Biomaterials
2. Understand different metals and ceramics used as biomaterials
3. Learn polymeric materials and combinations that could be used as a tissue replacement implants
4. Know the various artificial organs developed using these materials

COURSE OUTCOMES (COs)

CO1	Analyze different types of Biomaterials and its classification**.**
CO2	Perform combinations of materials that could be used as a tissue replacement implant.
CO3	Know about the various polymeric materials used for medical applications
CO4	About bio-ceramics and its applications in medicine
CO5	Applications and properties of materials in orthopedics
CO6	To know the various fatigue test that could be done on biomaterials

UNIT 1 BIOCOMPATIBILITY 9

Biocompatibility and hemo-compatibility, Overview of Biomaterials used as medical devices, Classification of biomaterials, Impact and future of biomaterials, performance of implants, Interfacial phenomena and tissue response to biomaterials, Metals and alloys for orthopaedic implants- Stainless steel, Cobalt chromium alloy, Titanium and its alloys. Electro kinetic factors. Types of orthopaedic fixation devices- pins, screws and plates, IM nails and spinal.

UNIT 2 ARTIFICIAL JOINTS 9

Bioelectric effect, Wolff‟s law. Interface problems with artificial joints and various fixation methods. Failure of implantation materials- metallic corrosion, wear, metallic implant fractures and their impact on biological systems. Hard tissue replacements- total hip and knee joint replacements

UNIT 3 CLASSES OF BIOMATERIALS 9

Polymers in biomedical use, Hydrogels, silicone rubber, biodegradable polymers, microorganisms in polymeric implants and polymer sterilization. Biopolymers, Synthetic polymers. Composites- Types and Applications. Contraceptive devices.

UNIT 4 MATERIAL RESPONSE 9

Orthopaedic implants. Ophthalmology – introduction, contact lenses, eye shields and artificial tears. Biological Tests. Material surface characterization. Corrosion. Standards on biomaterials.

UNIT 5 IMPLANTATION BIOMATERIAL 9

Bioceramics, types – bioactive, restorable, non-resorbable. Stoichiomety and Ca/P ratio of various forms calcium phosphates, bioceramic coatings on metallic implants and bone bonding reactions on implantation. Hydroxyapatite –properties and applications. Bone cements and bio glasses. Dental implants- materials, types and designs.

TEXTBOOKS :

1. Joon Bu Park, Roderic S, Lakes, "Biomaterials", Springer-Verlag, New York Inc., 2010.
2. Ratner A, and S.Hoffman, B. D. "Biomaterials Science: An Introduction to Materials in Medicine", Academic Press; 3 edition,November 8, 2012.

REFERENCES:

1. "Biomaterials", Sujata V Bhat., Narosa Publishing House, New Delhi, 2002.
2. A.F. Von Recum, "Handbook of Biomaterials Evaluation - Scientific, Technical and Clinical Testing of Implant Materials", 2nd Edn., Taylor & Francis, Philadelphia, 1999.
3. F. Silver and C. Dillon, " Biocompatibility: Interactions of Biological and Implantable Materials" Vol.1, VCH Publishers, New York, 1989.
4. Park. J.B. "Biomaterials: An Introduction", CBS Publishers, 2007.
5. L.L. Hench and E.C. Ethridge "Biomaterials: An Interfacial Approach", Academic press, New York, 1982.
6. F.H. Silver, "Biomaterials, Medical Devices and Tissue Engineering: An Intergrated Approach" 1st Edn., Chapman & Hall, London, 1994.
7. Buddy Ratner *etal.,* " Biomaterials Science – An Introduction to Materials in Medicine", Academic Press, San Diego, 2004.
8. http://ocw.mit.edu/courses/mechanical-engineering/2-782j-design-of-medical-devices-and-implants-spring-2006/lecture-notes/

BBM506	PHYSIOLOGICAL CONTROL SYSTEMS	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – NIL				
	Course Designed by – Department of Biomedical engineering				

OBJECTIVES

1. To study the concept and different mathematical techniques applied in analyzing any given system
2. To learn the analysis of given system in time domain and frequency domain
3. To study the stability analysis of the given system
4. To study the concept of physiological control system

COURSE OUTCOMES (COs)

CO1	Analyze the time and frequency domains of the given system using different mathematical techniques
CO2	Learn the basics of control systems
CO3	Time and frequency response analysis
CO4	Bio-control system definition and modeling
CO5	Study the model of eye, respiratory system, etc
CO6	To learn to workout numerical problems based on control systems

UNIT 1. CONTROL SYSTEM MODELLING **9+3**

System concept, Differential Equations, Transfer functions, Modelling of electrical systems, Translational and rotational mechanical systems, Electro-mechanical systems, physiological systems, block diagram modelling, signal flow graphs.

UNIT 2. TIME RESPONSE ANALYSIS **9+3**

Time domain specifications, step and Impulse response analysis of first order and second order systems, steady state errors, stability, Routh-Hurwitz criteria, Root locus techniques, construction of root locus, stability, dominant poles, applications of Root locus diagram.

UNIT 3. FREQUENCY RESPONSE ANALYSIS **9+3**

Frequency response, Bode plot-Nyquist plots, Nyquist stability criterion, Relative stability, Gain margin, phase margin, bandwidth magnitude plots, constant circles, Nichol's chart

UNIT 4. PHYSIOLOGICAL CONTROL SYSTEMS **9+3**

Introduction to physiological control systems, modelling of human movements, parameter estimation, linearizing

UNIT 5. STUDY OF BIOLOGICAL SYSTEMS **9+3**

Human Thermal system, Neuro muscular system, Respiratory system, occulomotor system.

TEXTBOOKS:

1. Michael C K, Khoo, “Physiological Control Systems – Analysis, Simulation and Estimation”, Prentice Hall of India Private Ltd., New Delhi, 2001.
2. Joseph D, Bronzino, “The Biomedical Engineering Handbook”, CRC Press, 3 rdedition, 2006

REFERENCES :

1. M.Gopal, “Control Systems”, Principles and Design, Tata McGraw-Hill, 1997.
2. Benjamin. C.Kuo, ' Automatic Control Systems', Prentice Hall of India, 1995.
3. Manfreclyner and John H.Milsum, Bio Medical engineering system, McGraw-Hill and Co., New York, 1970.
4. http://www.eee.metu.edu.tr/~ngencer/ee518/Lecture%20Notes/2013/Chapter%201/Chapter%201.pdf

	BIOMEDICAL INSTRUMENTATION LAB	L	T	P	C
BBM5L1	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Biomedical instrumentation- 1				
	Course Designed by – Department of Biomedical engineering				

OBJECTIVES

The student should be made to:

- Gather basic knowledge about measurements of parameters related to respiratory system
- Learn measurement techniques of sensory responses
- Understand different types and uses of diathermy units.
- Know ultrasound imaging technique and its use in diagnosis
- Know the importance of patient safety against electrical hazard

COURSE OUTCOMES (COs)

CO1	Design ECG recording and Analysis.
CO2	Study of ESU
CO3	Analyze different types and uses of diathermy units
CO4	Design of Blood Pressure Measurement System
CO5	Outline the importance of patient safety against electrical hazard
CO6	Study about Electrical safety measurements.

LIST OF EXPERIMENTS:

1. ECG recording and Analysis.
2. EEG recording and analysis.
3. Respiratory Analysis.
4. Blood Pressure Measurement System.
5. Nerve Conduction Study.
6. Digital Heart Monitor.
7. EOG system
8. Study of ESU – cutting and coagulation modes
9. pH Measurement and conductivity test.
10. Spectrophotometer.
11. Flame photometer.
12. ELIZA.
13. Plotting of human auditory response using audiometer
14. Analysis of bio signals using FFT Spectrum Analyser
15. Ultra Sound Dopplers.
16. Defibrillators and Pacemakers (Demo)
17. Ventilators and Humidifiers
18. Nebuliser
19. Pacemaker(Demo)
20. Physiotherapy equipment - Digi laser, Indsonic, Indotherm – 500W
21. Electrical safety measurements.
22. Mini project.

BBM5L2	LINEAR AND DIGITAL INTEGRATED CIRCUITS	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basics of electronic circuits				
	Course Designed by – Department of E & I				

OBJECTIVES

To study the application of analog and digital ICs in the designing circuit.

COURSE OUTCOMES (COs)

CO1	Design of number systems, conversion and filters
CO2	Basics of Logic gates and Boolean algebra
CO3	Design Full adder and Half adder and its implementation using ICs
CO4	Design the Different types Operational amplifier
CO5	Details about RAM, ROM, EPROM and types of memories
CO6	To understand the basic of the Digital systems.

LIST OF EXPERIMENTS:

1. Inverting, non-inverting amplifier and comparator
2. Active filter – first order LPF and HPF
3. Schmitt trigger using IC741
4. Instrumentation amplifier using IC741
5. Wein bridge oscillator
6. Multivibrator using IC555 Timer
7. Study of logic gates, Half adder and Full adder
8. Encoder and BCD to 7 segment decoder
9. Multiplexer and demultiplexer using digital ICs
10. Universal shift register using flipflops
11. Design of mod-N counter
12. Study of operational amplifier IC 741.
13. Characteristics of operational amplifier IC 741.
14. Inverting and non inverting mode of operation.
15. Operational amplifier as summer and subtractor.
16. Operational amplifier as integrator and differentiator.
17. Active high pass filter(second order)
18. Active low pass filter(second order)
19. Narrow band pass filter.
20. RC phase shift oscillator.
21. Comparator.
22. Squaring circuit.
23. Halfwave rectifier.
24. Current to voltage converter.
25. Voltage to current converter

BBM601	RADIOLOGICAL EQUIPMENT	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Biomedical instrumentation – 1&2				
	Course Designed by – Department of Biomedical engineering				

OBJECTIVES

The aim of the courses to show the introduction to radiological equipments.

COURSE OUTCOMES (COs)

CO1	Have a fundamental knowledge of basic physics of medical imaging
CO2	Acquire knowledge about treatment planning.
CO3	Have fundamental knowledge on effects of radiotherapy.
CO4	Have knowledge about devices used in radiotherapy.
CO5	Understand advanced applications of radiology.
CO6	To understand the fundamentals of X Ray imaging and principles

UNIT I - RADIOTHERAPY PHYSICS & PRE-TREATMENT IMAGING (9+3 hours)

Atoms, nuclei and radioactivity- Radiation interactions with matter- Radiation measurement and detection- Imaging with X-ray, MRI and ultrasound-Imaging with radio nuclides- Therapy with unsealed radio nuclides-Radiotherapy beam production

UNIT II - RADIATION TREATMENT PLANNING (9+3 hours)

Immobilization, localization and verification techniques- Principles and practice of radiation treatment planning- Brachytherapy-Networking, data and image handling and computing in radiotherapy- Quality management in radiotherapy.

UNIT III - RADIOTHERAPYEFFECTS (9+3 hours)

Epidemiology of cancer-screening- Biological and pathological introduction- Molecular, cellular and tissue effects of radiotherapy- Principles and management of patients with cancer-Chemotherapy and hormones- Skin and lip cancer-head and neck cancer.

UNIT IV - RADIOTHERAPY ASSISTING DEVICES (9+3 hours)

Features of conventional simulator and modern simulator – Immobilization equipment for head, neck, pelvic and extremities

UNIT V - ADVANCED APPLICATIONS (9+3 hours)

Cobalt units, Gamma knife, Linear accelerators, helical tomotheraphy, Ancillary equipment – Superficial and ortho voltage equipment

TEXTBOOKS

1. Symonds, Deehan, Meredith & Mills Walter and Miller, "*Textbook of Radiotherapy: Radiation Physics, Therapy and Oncology",* Churchill Livingstone, Seventh Edition, 2012**.**
2. Pam Cherry, Angela Duxbury, "*Practical Radiotherapy-Physics and Equipment",* John Wiley & Sons, Second Edition, 2009

REFERENCES

1. Todd Powliki, Peter Dunscombe B, Arno J, Mundt, Pierre Scalliet, "Quality *and safety in radiotherapy",* CRC Press, First Edition, 2010
2. Subramania Jayaraman, Lawrence Lanzl H, "*Clinical Radiotherapy Physics",* CRC Press, Second Edition, 1996
3. http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1564webNew-74666420.pdf

BSS601	**VALUE EDUCATION AND PROFESSIONAL ETHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basics of management and bio-ethics				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
- To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)

CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing
CO4	To learn more of Engineer as Responsible Experimenter.
CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To know the case study with needs the understanding of medical ethics

UNIT I : PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II : SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE) 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People‟s Responsibility / duties of the community, World peace.

UNIT III: MIND CULTURE & TENDING PERSONAL HEALTH 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelising the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV: ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS'S RESPONSIBILITIES FOR SAFETY 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Chalenger, case study. Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies.

UNIT V: ENGINEERS'S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership

TEXT BOOKS:

1. Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata Mcgraw Hill, Newyork 2005 (Units IV & V)

REFERENCE:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004 (for Units IV-V)
5. http://www.gktoday.in/blog/importance-and-need-of-value-education/

BBM603	PATHOLOGY AND MICROBIOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic biology				
	Course Designed by – Dept of Biomedical engineering				

OBJECTIVES

- To learn about the cell structure and its disorders
- To gain knowledge about the fundamental structure of virus, bacteria and its causes

COURSE OUTCOMES (COs)

CO1	Have a Fundamental Knowledge about the cell and concepts of tumor.
CO2	Have to learn about the fluid present in the body and hemodynamic derangement
CO3	Have a fundamental knowledge of real time imaging with basic hardware architecture, algorithms and transform techniques
CO4	Have knowledge about basic concepts of infection and immunity of the human body
CO5	Acquire the fundamental knowledge of structure of Bacteria, virus and its causes.
CO6	To know the uses of various microbiology based techniques

UNIT-I NORMAL CELL STRUCTURE 9

Introduction. Cell Degeneration and Regeneration- apoptosis, Neoplasia, Classification- Difference between benign and malignant- Etiology of tumors-Spread of tumors.

UNIT-II FLUID AND HAEMODYNAMIC DELANGEMENT 9

Edema, Shock, Hemorrhage- Thrombus- Embolism- Disseminated intravascular coagulation- Hematological disorders- Bleeding disorders- Leukemia lymphoma

UNIT-III INFECTION AND IMMUNITY 9

Normal Flora of the body- Host and Parasite relationship- Types of immunity-Innate and adaptive immunity- Important Bacterial, Viral, Protozoan and Helminthic Diseases.

UNIT-IV MICROORGANISMS 9

Structure of Bacteria and Virus – Methods of Isolation of Bacteria viz Streak Plate, Pour plate and Spread plate methods, viral cell- Growth and cultivation of bacteria.

Microscopy- Light microscopy- Dark field microscopy- Phase contrast microscopy- Electron microscopy.

UNIT-V STRAINING TECHNIQUES 9

Identification of disease producing organism simple, gram, AFB stain, fluorescent techniques, Ag-Ab techniques like Double diffusion, electro immune diffusion and agglutination techniques.

Text Book:

1. Pillai / Qadry "Biochemistry and Clinical Pathology" CBS Publishers. Chennai. 2008.
2. Sharma "Biochemical Engineering, Biochemistry, Biotechnology & Microbiology" CBS Publishers. Chennai 2007

3. Jain P.C “Microbiology & Biotechnology for Sustainable Development” CBS Publishers. Chennai 2004.
4. Paul “Soil Microbiology, Ecology & Biochemistry” CBS Publishers. Chennai 2009.
5. https://www.vidyarthiplus.com/vp/Thread-BM2252-Pathology-And-Microbiology-Lecture-Notes#.Vuo6XuJ97IU

BBM605	BIO SIGNAL PROCESSING	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Basics of signals and systems				
	Course Designed by – Dept of Biomedical engineering				

OBJECTIVES

The aim of the courses to show the introduction to biomedical signal, data acquiring system, Filtering and event detection in the biomedical signals.

COURSE OUTCOMES (COs)

CO1	Have a fundamental knowledge of biomedical signal.
CO2	Acquire knowledge about the filtering the biomedical signal.
CO3	Have fundamental knowledge event detection, ECG, EEG, EMG and the detection of waveform
CO4	Have knowledge about Biosignal processing using Fourier transformation.
CO5	Acquire the skills Pattern classification and diagnostic Decision.
CO6	To learn the various filtering techniques for biosignals

Unit – 1 INTRODUCTION TO BIOMEDICAL SIGNALS 9+3

The nature of biomedical signals, Examples of Biomedical signals-The action potential, The Electroneurogram(ENG), The Electromyogram (EMG), The Electro Cardiogram (ECG), Event related potentials (ERPs), The Electroencephalogram (EGG), The Phonocardiogram (PCG), The speech signal.

Unit-2 FILTERING FOR REMOVAL OF ARTIFACTS 9+3

Time –domain Filters-synchronized averaging. Moving Average Filters, Derivative-based operators to remove low frequency artifacts. Frequency- domain filters-Removal of High Frequency noise; Butterworth, Low pass filters. Removal of low frequency noise; Butterworth, high pass filters. Removal of periodic artifacts: Notch and comb Filters.

Unit-3 EVENT DETECTION 9+3

Detection of Events and waves: Derivative-based methods for QRS detection, The Pan-Topkins algorithm for QRS detection. Correlation Analysis of EEG channels: Detection of EEG rhythms , Template matching for EEG spike and- Wave detection. Cross Spectral Techniques-Coherence analysis of EEG channels. The matched Filters- Detection of EEG spike and wave Complexes. Homomorphic Filtering-Generalized linear filtering, Homomorphic deconvolution.

Unit 4 ANALYSIS OF NON STATIONARY SIGNALS 9+3

Time variant system-characterization of non stationary signals and dynamic systems. Fixed Segmentation- The short time Fourier transforms. Adaptive segmentation-Spectral error measure, ACF distance. Application- Adaptive segmentation of EEG signals, Time Varying analysis of Heart –rate Variability.

Unit-5 PATTERN CLASSIFICATION AND DIAGNOSTIC DECISION 9+3

Pattern classification: supervised pattern classification-Discriminate and decision functions, distance functions. Unsupervised Pattern classification: cluster seeking methods. Logistic Regression analysis. Neural networks.

TEXT BOOKS

1. John G. Proakis and Dimitris G.Manolakis, Digital *Signal Processing, Algorithms and App*lications, PHI of India Ltd., New Delhi, 3rd Edition, 2000.
2. Rangaraj.M.Rangayyan , *Biomedical signal processing, IEEE Press, 2003.*

REFERENCES

1. Sanjit K.Mitra „Digital Signal Processing", A Computer Based Approach, Tata McGraw-Hill, NewDelhi, 1998.

http://ocw.mit.edu/courses/health-sciences-and-technology/hst-582j-biomedical-signal-and-image-processing-spring-2007/lecture-notes/

BBM6L1	BIO SIGNAL PROCESSING LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basics of signals and systems				
	Course Designed by – Dept of Biomedical engineering				

OBJECTIVES

To gain the practical knowledge about the various bio signals and its characteristics

COURSE OUTCOMES (COs)	
CO1	To represent the basic discrete time signals and analyze it
CO2	To design the IIR and FIR filter
CO3	To analyze various types of bio signals and study its characteristics

LIST OF EXPERIMENTS

1. Generation of signals- Discrete and continuous.
2. Representation of time-series; computation of convolution.
3. Response of a difference equation to initial conditions; stability.
4. DFT computation.
5. Computational experiments with digital filtering.
6. Sampling and waveform generation.
7. FIR and IIR filters implementation.
8. Simulation of Biosignals and Analysis of ECG signals, EEG signals and EMG signals.
9. Properties of Fourier transform – zeros, FFT Discrete Fourier transform
10. Properties of Fourier transform- FFT SHIFT, IFFT SHIFT

BBM6L2	PATHOLOGY AND MICROBIOLOGY	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic biology				
	Course Designed by – Dept of Biomedical engineering				

OBJECTIVES

- To learn about the cell structure and its disorders
- To gain knowledge about the fundamental structure of virus, bacteria and its causes

COURSE OUTCOMES (COs)	
CO1	Have a Fundamental Knowledge about the cell and concepts of tumor.
CO2	Have to learn about the fluid present in the body and hemodynamic derangement
CO3	Have a fundamental knowledge of real time imaging with basic hardware architecture, algorithms and transform techniques
CO4	Have knowledge about basic concepts of infection and immunity of the human body
CO5	Acquire the fundamental knowledge of structure of Bacteria, virus and its causes.
CO6	To know the uses of various microbiology based techniques

LIST OF EXPERIMENTS:

1. Haemoglobin Estimation-Lyanmeth Haemoglobin method.
2. Peripheral smear study (i) Morphology.
   (ii) Different count,
   (iii) Total count.
3. Cross matching of Blood-ABO blood grouping.
4. Cytopathic effect.
5. Study on inclusion bodies.
6. Antigen-Antibody reaction Immuno electrophoresis.
7. Simple staining.
8. Gram staining.
9. Acid-fast staining.
10. IMVIC test.
11. Oxidase-Citrate.
12. Hydrogen sulphide test.
13. Cutting section and staining.

BBM701	DIGITAL AND MEDICAL IMAGE PROCESSING	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – basic of signal processing and Matlab				
	Course Designed by – Department of Biomedical Engineering				

OBJECTIVES

The aim of the courses to show how to extract, model, and analyze information from medical data and application in order to help diagnosis , treatment and monitoring of diseases through computer sciences.

COURSE OUTCOMES (COs)

CO1	Have a Fundamental Knowledge of digital image processing with Fourier transforms
CO2	Acquire knowledge about the image sampling, Modeling and quantization
CO03	Have a fundamental knowledge of image enhancement, its process and types of filters used in image processing
CO04	Have knowledge about image analysis, classification and reconstruction of act and MRI images
CO05	Acquire the skills in the transmission of biological images.
CO06	To learn image analysis using MATLAB

UNIT-I DIGITAL IMAGE FUNDAMENTAL 9+3

Elements of digital image processing systems, Elements of Visual perception, Image formation model, Image sampling and quantization, aliasing, zooming and shrinking of digital images. Monochrome Vision Model, Colour Vision Model. Image transforms –Discrete Fourier transform, Properties of Fourier transform, Fast Fourier transform and inverse fast Fourier transform

UNIT-II IMAGE FUNDAMENTALS 9+3

Image sampling and quantization, Matrix and Singular Value representation of discrete images. Image pre-processing, point operation, Histogram modeling, spatial operations, transform operations.

UNIT-III IMAGE ENHANCEMENT 9+3

Enhancement by point processing –Simple intensity transformation –Histogram processing – Image subtraction –Image averaging. Spatial filtering –Smoothing filters, sharpening filters. Enhancements in frequency domain-Low pass filtering –High pass filtering.

UNIT-IV IMAGE ANALYSIS, CLASSIFICATION AND RECONSTRUCTION OF ACT AND MRI IMAGES 9+3

lmage analysis, Spatial feature extraction, edge detection, Image segmentation. Image reconstruction from projections, Random transform, filter back projection algorithm, reconstruction of CT images, Imaging methods in MF images, fourier reconstruction of MRI.

UNIT-V TRANSMISSION OF MEDICAL IMAGES 9+3

Medical Image, data compression of transmission, transform coding, pixel Coding, predictive coding, Interference coding.

TEXT BOOK:

1. Kavyan Najarian and Robert Splerstor ”Biomedical Signals and Image Processing”, CRC – Taylor and Francisn, New York, 1991.
2. John L. Semmlow, “Biosignal and Biomedical Image Processing Matlab Based applications” Marcel Dekker Inc., New York, 2004.

REFERENCES:

1. **http://www.cs.uu.nl/docs/vakken/ibv/reader/readerINFOIBV.pdf**

BBM702	NEURAL NETWORKS AND PATTERN RECOGNITION	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Basic knowledge on signal and image processing				
	Course Designed by – Department of Biomedical Engineering				

OBJECTIVES

- To learn about the Neurophysiology and biological network
- To extract the model of network and its process

COURSE OUTCOMES (COs)	
CO1	Have to know about the process of neurophysiology.
CO2	Have to gain knowledge about the neural networking process such as back propagation
CO3	Have a fundamental knowledge of pattern recognition
CO4	Have skills about the manipulating, transforms using classifiers theorems.
CO5	Acquire the skills cluster analysis and feature extraction
CO6	To learn problem solving techniques in neural networks

UNIT I ADAPTIVE LINEAR COMBINER 9+3

Elementary neurophysiology and biological neural network-Artificial neural network, Adeline and Madeline.

UNIT II BACK PROPOGATION AND ASSOCIATE MEMORY 9+3

Back propogation network, generalized delta rule, Bidirectional associate memory, Hopefield memory architecture.

UNIT III PRINCIPLES OF PATTERN RECOGNITION 9+3

Patterns and features, training and learning in pattern recognition, pattern recognition approach, different types of pattern recognition.

UNIT IV DECISION MAKING 9+3

Bayer‟s theorem, multiple features, decision boundaries, estimation of error rates, histogram, kernels, window estimators, nearest neighbor classification, maximum distance pattern classifier, adaptive decision boundaries.

UNIT V CLUSTER ANALYSIS AND FEATURE EXTRACTION 9+3

Unsupervised learning, hierarchical clustering, Graph theories approach to pattern clustering, fuzzy pattern classifier, application of pattern recognition in medicine.

TEXT BOOK:

1. J.A. Freeman & David.M. Skapura, Neural networks, Algorithms applications and programming techniques, Addison Wesley, 1991. ISE Reprint, 1999.
2. Earl Gose, Richard Johnsonbaugh, Steve Jost, “Pattern Recognition and Image Analysis”, Prentice Hall of India Pvt. Ltd., New Delhi, 1999.

REFERENCES:

1. https://www.ii.uni.wroc.pl/~aba/teach/roadmap.pdf

BBM703	HEALTH, HOSPITAL AND EQUIPMENT MANAGEMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basics knowledge on equipment and management				
	Course Designed by – Department of Biomedical Engineering				

OBJECTIVES

To learn about the health, hospital and equipment management.

COURSE OUTCOMES (COs)

CO1	Have Knowledge about the health organization of the country.
CO2	Have a well-founded knowledge hospital organization and management
CO3	Have a fundamental knowledge of regulatory requirement and health care codes
CO4	Have a skills about the equipment maintenance management
CO5	Acquire the skills Function, role of Clinical Engineer.
CO6	To know the structure of the hospital management

UNIT-I HEALTH SYSTEM 9

Health organization of the country, the state, the cities and the region, Health Financing System, Organisation of Technical Section.

UNIT-II HOSPITAL ORGANISATION AND MANAGEMENT 9

Management of Hospital Organization. Nursing section Medical Sector, Central Services, Technical Department, Definition and Practice of Management by Objective, Transactional Analysis Human relation in Hospital. Importance to Team Work, Legal aspect in Hospital Management

UNIT-III REGULATORY REQUIREMENT AND HEALTH CARE CODES 9

FDA Regulation, joint commission of Accreditation for Hospitals, National Fire Protection Association Standard, IRPC.

UNIT-IV EQUIPMENT MAINTENANCE MANAGEMENT 9

Organizing Maintenance Operations, Paperwork Control, Maintenance Job, Planning Maintenance Work Measurement and Standards, Preventive Maintenance, Maintenance Budgeting and Foirecating, Maintenance Training, Contract Mainframe.

UNIT-V TRAINED TECHNICAL PERSONNEL 9

Function of Clinical Engineer, Role to be performed in Hospital, Man power Market, Professional Registration, Structure in Hospital.

TEXTBOOKS:

1. Kunders G D, “Biomechanics: Hospitals, facilities planning and management”, Tata Mcgraw Hill, 2008.
2. Sakharkar B M, “Principles of hospital administration and planning”, Jaypee Brothers Medical Publishers Pvt Limited, 2nd edition, 2009.

REFERENCES:

1. Cesar A. Caceres and Albert Zara, The Practice of Clinical Engineering. Academic Press, 1977.
2. Webster, J. G. and Albert M. Cook, Clinical Engineering Principles and Practices, Prentice Hall Inc. Eng/ewood Cliffs, 1979.
3. Antony Kelly, Maintenance planning and control, Butterworths London, 1984.
4. Hans Pfeiff Vera Dammann (Ed.) Hospital Engineering In Developing Countries, Z report Eschborn, 1986.
5. Jacob Kline, Handbook of Bio Medical Engineering, Academic Press. San Diego 1988.
6. R.C.Goyal. Handbook of Hospital Personal Management. Prentice Hall of India. 1993.
7. http://www.scribd.com/doc/18278414/Hospital-management#scribd

BBM7L1	IMAGE PROCESSING LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic of signal processing and Matlab				
	Course Designed by – Department of Biomedical Engineering				

OBJECTIVES

To learn about the health, hospital and equipment management.

COURSE OUTCOMES (COs)	
CO1	To understand the fundamentals of digital image and its properties
CO2	To enhance the medical images by applying various filters
CO3	To segment the region of interest using various image processing algorithms

LIST OF EXPERIMENTS:

1. Implement (a) Edge Detection (b) Line Detection
2. Implement a function in MATLAB for image segmentation.
3. Implement a function in MATLAB for Image Restoration
4. Display an image and its histogram
5. Image arithmetic operations – Addition, Subtraction, Multiplication and Division of 2 images.
6. Gray level transformation – Log transformation, Power law transformation and Histogram equalization.
7. Spatial Filters-Salt and pepper noise, speckle noise, Average Filter and Gaussian Filter
8. Properties of Fourier transform – zeros, FFT Discrete Fourier transform, Two dimensional Discrete Fourier transform.
9. Properties of Fourier transform- FFT SHIFT, IFFT SHIFT
10. Display an image and its histogram

BBM504	MEDICAL PHYSICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basics of physics				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

• To Study effects of sound and light in human body

• To study effects of radiation in matter and how isotopes are produced

COURSE OUTCOMES (COs)	
CO1	To learn about Ultrasound fundamentals.
CO2	To know about Natural radioactivity, type of radiation and their applications.
CO3	To get knowledge of Interaction of charged particles with matter.
CO4	To learn about Major components of cardiovascular system.
CO5	To learn about Photoelectric effect, Acute Radiation Effects.
CO6	To gain knowledge on physics behind medical imaging

UNIT I - ELECTROMAGNETIC SPECTRUM AND ITS MEDICAL APPLICATION 9

Light - Physics of light, Intensity of light, limits of Vision and color vision Sound – Physics of sound , Normal sound levels – Ultrasound fundamentals- Generation of ultrasound (Ultrasound Transducer) – Interaction of Ultrasound with Materials-Reflection and Refraction – Absorption and Scattering Non- ionizing Electromagnetic Radiation Tissue as a leaky dielectric – Relaxation Processes – Overview of non – ionizing radiation effects -Low Frequency Effect – Higher frequency effect.

UNIT II RADIOACTIVE DECAY 9

Radioactive Decay – Spontaneous Emission – Isometric Transition - Gamma ray emission, alpha, beta, positron decay, electron capture Principles of Nuclear Physics – Natural radioactivity, Decay series, Half life period, type of radiation and their applications. Production of radionuclides – Cyclotron produced Radionuclide - Reactor produced Radionuclide – fission and electron Capture reaction, Radionuclide Generator – Milking Process - Linear accelerator , Radionuclide used in Medicine and technology.

UNIT III - INTERACTION OF RADIATION WITH MATTER 9

Interaction of charged particles with matter – Specific ionization , linear energy Transfer Range, Bremsstrahlung , Annihilation Interaction of Gamma radiations with matter – Photoelectric effect, Compton Scattering , pair Production, Attenuation of Gamma Radiation, Interaction of neuron with matter

UNIT IV - PHYSICS OF CARDIOPULMONARY SYSTEM 9

The Airways, - blood and lung interaction – measurement of lung volume – pressure air flow volume relation ships of lungs – physics of alveoli – the breathing mechanism – Major components of cardiovascular system – O2 and CO2 exchange in the capillary system – Physical activity of heart – transmural pressure – Bernolli‟s principles applied to cardiovascular system - Blood flow – laminar and turbulent

UNIT V - RADIATION EFFECTS 9

Acute Radiation Effects - The concept of LD 50 – Radiation syndromes- Central nervous system syndrome - Gastro-intestinal syndrome –Bone Marrow syndrome Delayed Effects of Radiation - Stochastic and Deterministic effects – Late Deterministic effect in different organs and tissues.

TEXT BOOKS

1. B.H Brown , PV Law ford, R H Small wood , D R Hose , D C Barber , "Medical Physics and Biomedical Engineering", CRC Press, 1999.
2. Gopal B.Saha "Physics and Radiobiology of Nuclear Medicine" Springer, 3rd ed, 2006

REFERENCES:

1. John R. Cameron and James G. Skofronick, "Medical Physics", John–Wiley & Sons, 978.
2. RF Farr and PJ Allisy –Roberts, "Physics for Medical Imaging" Saunders, 1997.
3. P.Uma Devi, A. Nagarathnam, B S Satish Rao, "Introduction to Radiation Biology" B.I Churchill Livingstone pvt ltd, 2000.
4. S.Webb, "The Physics of Medical Imaging", Taylor and Francis, 1988.
5. https://www.iop.org/education/teacher/resources/teaching-medical-physics/page_54690.html

BBM502	BIOFLUID AND BIOMECHANICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic knowledge of human joint movement				
	Course Designed by – Department of Biomedical engineering.				

OBJECTIVES

To provide the students:

1. An understanding on the physiology and anatomy of studied systems,
2. A capability to analyze cardiac, respiratory, soft tissue and orthopedic mechanics

COURSE OUTCOMES (COs)

CO1	The fundamental concepts and definitions related to Biomechanics
CO2	Discuss on Cardiovascular and pulmonary system in human body
CO3	Explain blood properties, especially the anatomy and physiology of blood vessels.
CO4	Explain the laws concerning bio-fluid mechanics
CO5	Various mechanical properties of tissues, bone, ligaments and cartilage
CO6	To learn the applications of Biofluids and biomechanics

UNIT-I BIOMECHANICS **9**

Newton‟s law, Stress, Strain, Hookes-law, Elasticity, Shear, Tension, Compression, Bone – Cancellous and cortical bone,structure, Mechanical Properties and mechanical testing of bone, UTM, creep and Fatigue.

UNIT II BIOFLUID MECHANICS 9

Viscosity, Newtonian fluid, Non-Newtonian fluid, Viscoelastic, Vascular tree, Flow properties of Blood, Physical, Chemical and Rheological properties of blood, Apparent and Relative and Viscosity, Problems associated with extra corporeal blood flow

UNIT-III RESPIRATORY AND CARDIAC MECHANICS **9**

Alveoli mechanics, PV curve of lung, Breathing Mechanism, Airway resistance, Physics of Lung Diseases. Cardio vascular system, Mechanical properties of blood vessels – arteries, arterioles, capillaries, veins, blood flow: laminar and turbulent.

UNIT IV SOFT TISSUE MECHANICS **9**

Tissue Mechanics-Mechanical Properties of Tissues, Biological materials, Pseudo elasticity, nonlinear stress-strain relationship, viscoelasticity, structure, function and mechanical properties of skin, ligaments and tendons, Mechanical testing of Soft tissue.

UNIT V ORTHOPAEDIC MECHANICS **9**

Mechanical properties of cartilage, diffusion properties of articular cartilage, kinetics and kinematics of joints, lubrication of joints analysis of force in orthopaedic implants. Biomechanics of Elbow Shoulder hip and Knee.

TEXTBOOKS:

1. Fung Y C, Biomechanics: “Mechanical Properties of Living Tissues”, Springer, 2nd edition, 1993.
2. Susan J Hall, “basic biomechanics”, Tata Mcgraw hill, 4th edition, 2004.

REFERENCES:

1. Y.C.Fung, “Biomechanics: Mechanical properties of living tissues”, Springer, verlag, New York, 1981.
2. D.Dawson & Right, “Introduction to bio-mechanics of joints and joint replacement”, Mechanical Engineering Publication Ltd, 1989.
3. Jacob Kline, “Handbook of biomedical engineering”, Academic press Inc., Sandiego, 1988.
4. Basic Biomechanics by Susan J Hall
5. Jay D Humphrey and Sherry L. Delange, “An Introduction to Biomechanics” Springer
6. Donald R Pieterson and Joseph Bronzino“ Biomechanics – principles and applications” CRC Press, 2008.
7. http://www.maths.gla.ac.uk/~xl/Arasu-biofluid.pdf

BBM056	BIOPROCESS TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic knowledge on clinical chemistry				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

To introduce Bioprocess Technology and Enzyme based actions in Medical Applications.

COURSE OUTCOMES (COs)

CO1	To learn about basic principle of bioprocess
CO2	To learn about Bioreactor design. Batch, fed batch and continuous cultivation
CO3	To learn about Growth rate parameters
CO4	To learn about Kinetics and thermodynamics of enzyme-catalyzed reactions, techniques of enzyme immobilisation,
CO5	To learn about Methods of on-line and off-line biomass estimation
CO6	To learn about computer-based data acquisition, monitoring and control-LABVIEW Software.

UNIT I INTRODUCTION OF BIOPROCESS TECHNOLOGY 9

Introduction to bioprocess technology, Screening, preservation and improvement of industrially important microorganisms, Raw material and media formulation for fermentation process, Influence of environmental factors on growth and product formation.

UNIT II BIOREACTORS 9

Bioreactor design. Batch, fed batch and continuous cultivation. Solid state cultivation. Sterilization of media reactor and air. Agitation and aeration and mass transfer of oxygen. Inoculum development, addition and sampling.

UNIT III GROWTH RATE ANALYSIS 9

Growth rate parameters : Specific growth rate, doubling time, validity of exponential growth law, growth yield, metabolic quotient, Effect of substrate concentration, Monod Kinetics, Determination of Ks, Definition of lag period.

UNIT IV ENZYME TECHNOLOGY 9

Kinetics and thermodynamics of enzyme-catalyzed reactions, techniques of enzyme immobilisation, basic design and configuration of immobilised enzyme reactors, applications of immobilised enzyme technology.

UNIT V BIOPROCESS ESTIMATIONS 9

Methods of on-line and off-line biomass estimation; Flow injection analysis for measurement of substrates. Product and other metabolites; State and parameter estimation techniques for biochemical processes; Computer-based data acquisition, monitoring and control-LABVIEW Software.

Reference Books :

1. Principles of Fermentation Technology : Whitekar & Stanbury
2. Industrial Microbiology – Casida
3. Shule and Kargi, " Bioprocess Engineering ", Prentice Hall, 1992.
4. http://www.slideshare.net/yongkangbirdnest/lecture-5-bioprocess-technology-operation-mode-and-scale

BBM083	**TROUBLESHOOTING OF MEDICALINSTRUMENTS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3

	Prerequisite – Basic knowledge of circuit analysis &electronic devices
	Course Designed by – Department of Biomedical engineering.

OBJECTIVES

To provide the knowledge of planning ,designing and safety management in hospital services.

COURSE OUTCOMES (COs)

CO1	To learn about hospital planning and design .
CO2	To know about Radiology and imaging services .
CO3	To get knowledge of to Engineering department.
CO4	To learn about Admitting department .
CO5	To learn about the Importance of infection control .
CO6	To learn about the overview of department based services

UNIT I - PLANNING AND ORGANIZATION OF THE HOSPITALS 9

Roles of hospital in healthcare-hospital planning and design-outpatient servicesthe nursing unit-intensive care unit-nursing services-effective hospital management-directing and leading-controlling – financial management.

UNIT II - CLINICAL AND ADMINISTRATIVE SERVICES 9

Radiology and imaging services-laboratory services-operation theatre suite- pharmacy-central sterile supply department- hospital infection- materials management-evaluation of hospital services.

UNIT III - DESIGNING OF HOSPITAL SERVICES 9

Engineering department - maintenance management- clinical engineering- electrical system- air conditioning system- water supply and sanitary system- centralized medical gas system-communication system- solid waste management and transportation.

UNIT IV - DESIGNING SUPPORT SERVICES AND SAFETY MANAGEMENT 9

Admitting department- medical records department- food service department laundry and linen service-housekeeping- volunteer department- safety in hospital fire safety- Alarm system-disaster management.

UNIT V - HOSPITAL INFECTION CONTROL 9

Importance of infection control-hand hygiene-aseptic techniques-isolation precautions-disinfection and sterilization-clinical laboratory standards to infection control-health care workers safety.

TEXTBOOKS

1. Kunders G D, “Biomechanics: Hospitals, facilities planning and management”, Tata Mcgraw Hill, 2008.
2. Sakharkar B M, “Principles of hospital administration and planning”, Jaypee Brothers Medical Publishers Pvt Limited, 2nd edition, 2009.

REFERENCES

1. Sanjiv Singh, Sakthikumar Gupta, Sunil Kant, “Hospital infection control guidelines, principles and practice”, Jaypee Brothers Medical Publishers Pvt Limited, First edition, 2012.
2. https://www.ems1.com/ems-products/medical/equipment/services/articles/1109754-How-to-troubleshoot-any-medical-device/

BBM055	TELEMEDICINE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – biomedical instrumentation				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

- To introduce telemedicine advancements in telemedicine .Benefits of telemedicine , Functional Block of a telemedicine system,Tele healthcare and E-medicine.
- To study Communication infrastructure for telemedicine LAN and WAN technology Satellite communication Mobile hand held devices and mobile communication Internet technology and telemedicine using World Wide Web Video and audio conferencing.
- Introduction to Network Configuration , circuit and packet switching.
- Introduction Archives Electronic Documentation Business aspects Common Access to Biological Resources and Information (CABRI) Database indexing and search terms Nucleic and genome databases Molecular data base and servers.
- To learn Ethical and legal issues of Telemedicine - Confidentiality and the law - Patient rights and consent - Access to medical Records.

COURSE OUTCOMES (COs)

CO1	To learn about the telemedicine
CO2	Study about the communication and networking system in telemedicine
CO3	Have a knowledge about the standards of telemedicine and encryption
CO4	To get knowledge about uses of telemedicine
CO5	Aware about laws of telemedicine
CO6	To learn Ethical and legal issues of Telemedicine - Confidentiality and the law - Patient rights and consent - Access to medical Records.

UNIT I FUNDAMENTALS OF TELEMEDICINE 9

History and advancements in telemedicine - Benefits of telemedicine – Functional Block of a telemedicine system - Tele-healthcare and E-medicine - Use of computers in distance mode of healthcare delivery - Familiarizing with technology of telemedicine – scanner, electro stethoscope - data reception equipment - Scope for telemedicine - Cyber laws related to telemedicine - Telemedicine access to health care services - Limitations of telemedicine.

UNIT II COMMUNICATION SYSTEMS AND NETWORKS IN TELEMEDICINE 9

Communication infrastructure for telemedicine - LAN and WAN technology - Satellite communication - Mobile hand held devices and mobile communication - Internet technology and telemedicine using World Wide Web - Video and audio conferencing - Types of information - Audio, Video, Still images, Text and data, fax - Types of communication and network - PSTN, POTS, ANT, ISDN, Internet, Wireless communication - GSM satellite, and Microwave – Signal Modulation techniques - Data compression and transfer - Capturing Medical Signals - Types of antennas depending on requirements, Integration and operational issues - System integration, store –and - forward operation, Real-time Telemedicine – Remote Sensing.

UNIT III DATA EXCHANGE, MANAGEMENT, SECURITY AND STANDARDS IN TELEMEDICINE 9

Network Configuration - circuit and packet switching - H. 320 series (Video phone based ISBN) - T. 120, H.324 (Video phone based PSTN) - Encryption - Cryptography - Mechanisms of encryption - phases of Encryption - Protocols - TCP/IP, ISO-OSI Standard - DICOM, HL7 - Medical information storage and management for telemedicine - Patient information medical history - Test reports, medical images diagnosis and treatment - Hospital information - Doctors, paramedics, facilities available - Pharmaceutical information – Information Security and confidentially of medical records and access control

UNIT IV APPLICATIONS OF TELEMEDICINE 9

Introduction - Archives - Electronic Documentation - Business aspects - Common Access to Biological Resources and Information (CABRI) - Database indexing and search terms - Nucleic and genome databases - Molecular data base and servers - Array express - Gateway to archives - Sequential retrieval system - Protein Identification Resource(PIR) - Telemedicine in Neuroscience - Telecardiology – Teledermatology - Teleneurology - Teleophthalmology – Telepathology – Teleoncology - Telepediatrics – Telepharmacy – Telepsychiatry and mental health – Teleradiology – Telesurgery – Veterinary – Other specialties

UNIT V ETHICAL ASPECTS AND CASE STUDIES IN TELEMEDICINE 9

Ethical and legal issues of Telemedicine - Confidentiality and the law - Patient rights and consent - Access to medical Records - Consent treatment - Jurisdictional Issues - Intellectual property rights - Telemedicine technology and Health care delivery for rural population - Use of telemedicine technology for clinical diagnostic study - Conceptual frame work on home telemedicine.

TEXT BOOKS

1. Olga (EDT) Ferrer – Roca, M.Sosa (EDT) Iudicissa Hand book of Telemedicine IOS press 2002.
2. A.C. Norris, Essentials of Telemedicine and Telecare John Sons & Ltd, 2002.
3. Marilyn J. Field, "A Guide to Assessing Telecommunications in Health Care",NATIONAL ACADEMY PRESS,1996.
4. Bashshur , R. L. , Sanders, J. H and Shannon, G. W.,"Telemedicine: Theory and Practice", Volume 27, Number 2,Springer Netherlands,1999,

REFERENCES

1. Norris, A.C. Essentials of Telemedicine and Telecare. Wiley (ISBN 0-471 53151-0), 2002
2. Wootton, R., Craig, J., Patterson, V. (Eds.), Introduction to Telemedicine. Royal Society of Medicine Press Ltd (ISBN 1853156779), 2006
3. Ferrer-Roca, O., Sosa-Iudicissa, M. (editors), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54). (ISBN 90-5199 413-3), 2002.
4. Simpson, W. 2006. Video over IP. A practical guide to technology and applications. Focal Press (Elsevier). ISBN-10: 0-240-80557-7
5. Bemmel, J.H. van, Musen, M.A. (Eds.) (1997). Handbook of Medical Informatics. Heidelberg, Germany: Springer. (ISBN 3-540-63351-0)

BBM058	CLINICAL ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic knowledge of planning and designing of hospital services				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

To introduce Clinical Engineering-Management, Quality Assurance and Risk Factors.

COURSE OUTCOMES (COs)	
CO1	To learn basic of clinical engineering
CO2	Study about the assessments and risk factors of medical technology
CO3	Have a knowledge about quality of improvement ant tem work
CO4	To learn about the standards for clinical engineering and regulators agencies
CO5	To get knowledge about the uses of virtual instruments in health care
CO6	To understand the differences between the role of a clinical and biomedical engineer

UNIT – 1 CLINICAL ENGINEERING 9

Definition, Evolution of Clinical Engineering – interactions of a clinical engineer , Hospital Organization and the Role of Clinical Engineering, Clinical Engineering Programs

UNIT -2 MANAGEMENT AND ASSESSMENT OF MEDICAL TECHNOLOGY AND RISK FACTORS 9

The Health Care Delivery System, Strategic Technology Planning, Technology Assessment, Equipment Assets Management. Risk Management – Strategies, Risk Management: Application

UNIT -3 QUALITY OF IMPROVEMENT AND TEAM BUILDING 9

Deming‟s 14 Points, Zero Defects, TQM (Total Quality Management) and Tools Used for Quality Improvement, Standard Database, Measurement Indicators.

UNIT -4 STANDARDS 9

Standards Regulatory and Assessment Agencies, Standards for clinical Engineers, Regulatory Agnecies, Technology Assessment Agencies

UNIT -5 APPLICATIONS OFVIRTUAL INSTRUMENTS IN HEALTH CARE 9

Application with Examples , Trending, Relationships, and Interactive Alarms, Data Modeling,0 Medical Equipment Risk Criteria, Peer Performance Reviews

REFERENCES

1. Handbook of Biomedical Engineering-Joseph Bronzino, 2000
2. Principles of Biomedical Engineering-Joseph Bronzino
3. http://ocw.mit.edu/courses/health-sciences-and-technology/hst-590-biomedical-engineering-seminar-series-developing-professional-skills-fall-2006/lecture-notes/

BMM084	REAL TIME PROCESSOR AND BIOMEMS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – DSP and microprocessor				
	Course Designed by – Department of Biomedical engineering.				

OBJECTIVES

To learn about the Digital Signal Processing and BIOMEMS in the real time.

COURSE OUTCOMES (COs)

CO1	To learn about Architecture of TMS 320C54XX .
CO2	To know about applications of PSoC.
CO3	To get knowledge of Nonlinear Image Processing Algorithms.
CO4	To learn about Working principle of Microsystems.
CO5	To learn about the Importance Drug delivery.
CO6	To learn the different MEMS technologies and its techniques

UNIT-I INTRODUCTION TO DIGITAL SIGNAL PROCESSING DEVICES 9

Architecture of TMS 320C54XX Digital Signal Processor-18. Addressing Modes and Instruction sets of TMS 320C54XX DSP-19. TMS 320VC5416 Assembly Language Programming-. Interfacing and Real Time C Programming with TMS 320C54XX- TMS 320C6713 Floating Point Processor Architecture and Real Time C Programming

UNIT-II PROGRAMMABLE EMBEDDED SYSTEM-ON-CHIP (PSOC) PROCESSOR 9

Architecture- Designer- Developing tools- biomedical applications

UNIT-III INTRODUCTION TO REAL-TIME IMAGING 9

Basic Hardware Architecture.-Linear Image Processing Algorithms-Compression by Matrix Transforms-Nonlinear Image Processing Algorithms-Parallel Architectures-Programming Languages-Optimization Techniques

UNIT IV MEMS AND MICROSYSTEMS 9

Working principle of Microsystems, materials for MEMS and Microsystems, micromachining, System modeling and properties of materials

UNIT V BIOMEMS 9

Drug delivery, micro total analysis systems (MicroTAS) detection and measurement methods, microsystem approaches to polymerase chain reaction (PCR), DNA hybridization, Electronic nose, Bio chip.

REFERENCES

1. Udayashankara, V. ,Real time digital signal processing : fundamentals, algorithms and implementation using tms processor,phi 2007.
2. Technical Reference Manuals,Cyprus Semiconductors,USA 2008
3. Edward R. Dougherty, Phillip A. Laplante ,Introduction to Real-Time Imaging ISBN: 978-0-8194-1789-3,February 1995, Wiley-IEEE Press.

4. Tai Ran Hsu , “ MEMS and Microsystems design and manufacture”, Tata McGraw Hill Publishing Company, New Delhi, 2002.
5. https://nanohub.org/resources/992/download/2005.02.07-Bashir1.pdf

	MODELLING OF PHYSIOLOGICAL SYSTEMS	L	T	P	C
BBM704	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Physiological control systems				
	Course Designed by – Department of Biomedical Engineering				

OBJECTIVES

To design the physiological systems

COURSE OUTCOMES (COs)	
CO1	Have Knowledge about the physiological process in the biological system.
CO2	Have a skills to modeling of human thermal regulatory system
CO3	Have a fundamental basis for respiratory system
CO4	Have a skills to design the Ultra Filtration system
CO5	To design the Model of body dynamics
CO6	To understand the mechanical designing of bone

UNIT I CONTROL SYSTEM MODELLING 9

Physiological processes and principles of their control flow, gas exchange Ultra filtration, biochemical reactions, pneumatic transport, digestion, Energy utilization and waste disposal, linear and nonlinear control systems, principles of open loop and feedback systems techniques for system Response characterization.

UNIT II MODELING OF CONTROL SYSTEM 9

Modeling of human thermal regulatory system o. Parameters involved, control system model etc. biochemistry of digestion, types of heat loss from body, models of heat transfer between subsystems of human body like skin core, etc. and systems like within body, body environment etc.

UNIT III HUMAN SYSTEMS 9

Respiratory system: Modeling oxygen uptake by RBC and pulmonary capillaries, mass balancing by lungs, gas transport mechanism of lungs, oxygen and carbon dioxide transport in blood and tissues.

UNIT IV HUMAN EXCRETION 9

Ultra Filtration system Transport through cells and tubules, diffusion, factated diffusion and active transports, methods, of waste removal, counter current model of urine formation in nephron, moellir Henle's loop.

UNIT V PHYSIOLOGICAL CONTROL SYSTEM 9

Modeling body dynamics: Principles of mechanical modeling of bone, tissues etc.modeling stress were propagation in bones, hills, model of muscle mechanisms Current trends : Pharmacokinetic modeling with illustrated example like drug diffusion, computer aided modeling etc.

TEXT BOOKS:

1. Advanced Methods of Physiological System Modeling by V.Z. Marmarelis
2. Applied mathematical model in Human Physiology, by Johnny T. Ottesen, Mette S. Olufsen, Jesper K.Larsen

REFERENCE BOOKS:

1. Physiological basis of Ventilatory Support, By John. J. Marini, Arthur S. Slutsky
2. Pharmacokinetic and Pharmacodynamic Data Analysis: Concepts and Applications**,** By Daniel (Weiner, Johan Gabrielsson).
3. http://physiology.arizona.edu/people/secomb/472-572lecturenotes09

BBM051	TISSUE ENGINEERING AND ARTIFICIAL ORGANS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biomaterials and artificial organs				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

To learn about the basic mechanics of Tissue Engineering, model of artificial organs and it process.

COURSE OUTCOMES (COs)

CO1	To learn about Tissue Development, objectives of Tissue engineering
CO2	To learn about Cell growth and differentiation, Cell and tissue mechanism, cell adhesion
CO3	To learn about Cell delivery and recirculation, Delivery molecular agents in tissue engineering
CO4	To learn about tissue replacements
CO5	To learn about
CO6	To learn the practical applications in tissue engineering

UNIT I FUNDAMENTAL OF TISSUE ENGINEERING 9

Tissue Exchange and Tissue Development, objectives of Tissue engineering, Element of Tissue development.

UNIT II CELLULAR STUDIES 9

Cell growth and differentiation, Cell and tissue mechanism, cell adhesion, cell migration, cell aggregation and tissue equivalent.

UNIT III TISSUE BARRIERS TO MOLECULAR AND CELLULAR TRANSPORT 9

Cell delivery and recirculation, Delivery molecular agents in tissue engineering, control releaser agents in time and space.

UNIT IV TISSUE REPLACEMENT IMPLANTS 9

Soft-tissue replacements, sutures, surgical tapes, adhesive, percutaneous and skin implants, maxillofacial augmentation, blood interfacing implants, hard tissue replacement implants, internal fracture fixation devices, joint replacements.

UNIT V ARTIFICIAL ORGANS 9

Artificial Heart, Prosthetic Cardiac Valves, Limb prosthesis, Externally Powered limb Prosthesis, Dental Implants.

REFERENCES:

1. PARK J.B., "Biomaterials Science and Engineering", Plenum Press, 1984.
2. W Mark Saltzman Tissue Engineering – Engineering principles for design of replacement organs and tissue –- Oxford University Press Inc New York 2004.
3. Gray E Wnek, Gray L Browlin – Encyclopaedia of Biomaterials and Biomedical Engineering – Marcel Dekker Inc New York 2004.
4. http://www.sciencedirect.com/science/book/9781855737372

BBM701	MEDICAL INFORMATICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Fundamentals of Computer programming				
	Course Designed by – Department of Biomedical engineering.				

OBJECTIVES

To learn about the historical information of hospitality and recent trends in the Hospital information system.

COURSE OUTCOMES (COs)

CO1	To study about Historical Highlights of health care information system
CO2	To learn about Motherboard and its logic-Memory and I/O interfacing/memory
CO3	To learn about Concept of HIS its position in hospital-introduction
CO4	To learn about Visual Basic Principles and Programming-Design
CO5	To study about Integration of inter and intra hospital information system
CO6	To learn the importance of hospital information system

UNIT-I BIOMEDICAL INFORMATION SYSTEM 9

Historical Highlights of health care information system-Biomedical information system-problems and pitfalls-History and evolution of Electronic resources, Multimedia components.

UNIT-II OVERVIEW OF COMPUTER HARDWARE 9

Motherboard and its logic-Memory and I/O interfacing/memory and input output mapping-I/O peripherals and Add-on cards.

UNIT- III HOSPITAL INFORMATION SYSTEM 9

Concept of HIS its position in hospital-introduction of a computerized HIS Automation of medical record-cost and Benefits of HIS-Modems and Networking in Hospitals.

UNIT-IV VISUAL PROGRAMMING AND MULTIMEDIA INFORMATION 9

Visual Basic Principles and Programming-Design, Production and Testing of Multimedia based HIS.

UNIT-5 INTEGRATED MEDICAL INFORMATION SYSTEM 9

Integration of inter and intra hospital information system. Role of expert systems-web based Multimedia information system-Video-conferencing-PowerPoint Presentation.

Text book:

1. R.D.Lele „“Computer in Medicine” Tata McGraw Hill, Newyork, 1999.

References:

1. S.K.Chauhan “PC Organisation”, S.K.Kataria and Sons, Delhi 2000.
2. Harold Sackamn “Bio Medical Information Technology”, Academic Press, Newyork.
3. http://www.springer.com/series/684

BEI010	VLSI DESIGN	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic knowledge on design				
	Course Designed by – Dept. of E&I				

OBJECTIVES

To introduce NMOS, PMOS, CMOS devices and their characteristics. Design principles, design layout rules, construction of multiplexers

COURSE OUTCOMES (COs)

CO1	To introduce about NMOS, PMOS, CMOS devices characteristics,
CO2	To learn about CMOS inverter design principles, design layout rules
CO3	To study about Combinational logic and sequential logic circuits
CO4	To learn about Design concepts- design tools, simulators
CO5	To study about VHDL model for combinational networks
CO6	To be thorough with the fundamentals of VLSI design

UNIT-1: BASIC DEVICE CHARACTERISTICS 9

NMOS, PMOS, CMOS devices characteristics, linear saturating modes, bulk effect capacitances, device models for simulation CMOS device fabrication principles.

UNIT-2: BASIC CIRCUITS FOR DIGITAL SYSTEMS 9

CMOS inverter design principles, design layout rules, construction of multiplexers, transmission gates, latches, flip flops, timing and fan out considerations.

UNIT-3 : BUILDING BLOCKS OF DIGITAL SYSTEMS 9

Combinational logic and sequential logic circuits. Data path circuits. Adder multiplier architecture and accumulators.

UNIT-4: DIGITAL DESIGN USING VHDL 9

Design concepts- design tools, simulators, introduction to VHDL- sequential and concurrent descriptions- signal port and variable statements- case and other sequential statements- compilation and simulation of VHDL code- VHDI, functions- procedures - packages and libraries- introduction to verilog and brief comparison with VHDL

UNIT-5 : FPGA DESIGN 9

VHDL model for combinational networks- routing procedures in FPGA and CPLD programming, methods for FPGA and CPLD- simulation and synthesis issues- FPGA architecture - FPGA design flow for logic gates, ALU, multiplexer, flip flop, counter.

TEXT BOOK

1. Subbaram N.R. " Handbook of Indian Patent Law and Practice ", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.

REFERENCES

1. Eli Whitney, United States Patent Number : 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today : Volume 8, No. 5, May 2001, [www.iptoday.com].
3. https://www.wto.org/english/tratop_e/trips_e/intel1_e.html

BEI011	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Microprocessor and its applications				
	Course Designed by – Department of Biomedical engineering.				

OBJECTIVES

1. To introduce microcontroller, the role of microcontrollers **.**Types and selection,its application and examples.
2. To study the microcontroller resources and Family members, bus widths program and data memory parallel ports. D/A and A/D convertors, reset circuitry, watchdog timers, power down considerations
3. To study Interrupt structures programmable timers, real time clock, latency, interrupt, density and interval constraints.
4. To study CPU register- structure- addressing modes- instruction sets- assembly languages- assemblers.
5. To study Queues, tables and strings, program organisation, microcontroller expansion methods, I/O hardware alternatives, development tools, RTOS.

COURSE OUTCOMES (COs)

CO1	To learn about the role of microcontrollers
CO2	Study about the microcontroller resources
CO3	Have a knowledge about real time control
CO4	To learn about the programming and framework for 8051 and PC16F877
CO5	To get knowledge about the software building blocks
CO6	To learn about the applications of microcontroller in diagnosis

UNIT 1: THE ROLE OF MICROCONTROLLERS **9**

Types and selection- application example

UNIT 2 : MICROCONTROLLER RESOURCES **9**

Family members, bus widths program and data memory parallel ports. D/A and A/D convertors, reset circuitry, watchdog timers, power down considerations.

UNIT 3 : REAL TIME CONTROL **9**

Interrupt structures programmable timers, real time clock, latency, interrupt, density and interval constraints.

UNIT 4 : PROGRAMMING FRAMEWORK FOR 8051 AND PC16F877 **9**

CPU register- structure- addressing modes- instruction sets- assembly languages- assemblers.

UNIT 5 : SOFTWARE BUILDING BLOCKS **9**

Queues, tables and strings, program organisation, microcontroller expansion methods, I/O hardware alternatives, development tools, RTOS, motorola MC68HC11 and intel 8051.

Textbooks:

1. S Ghoshal, “Microprocessor Based System Design”, MacMillan Publisher, 1996.
https://engineering.purdue.edu/ece362/Refs/prelim_text_copyright_2001_dgm.pdf

BBM060	MEDICAL IMAGING TECHNIQUES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Digital image processing				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

To study about medical image techniques, NMR, mathematical process.

COURSE OUTCOMES (COs)

CO1	To learn about the different modes of medical records
CO2	Study about the radioisotopic images
CO3	Have a knowledge about nuclear magnetic resonance imaging
CO4	To learn about the image formation and image processing
CO5	To get knowledge about the computer requirements for image system
CO6	To understand the theorems formulated on CT images

UNIT I DIFFERENT MODES OF MEDICAL RECORDING

Quality assurance and image improvement in diagnostic radiology with X-Rays, specific Quality assurance tests for X-rays, need for sectional images, principles of sectional images recording, computer tomography with different trajectories.

UNIT II RADIOISOTOPIC IMAGES 9

Radio isotopic imaging equipments, radiation detectors, radionuclide for imaging, static and dynamic planar scintillography.

UNIT III NUCLEAR MAGNETIC RESONANCE IMAGING 9

Development of NMR, relaxation processes and their measurements, MRI-Image acquisition and reconstruction, MRI safety.

UNIT IV MATHEMATICS OF IMAGE FORMATION AND IMAGE PROCESSING 9

Concept of object and image, general image processing problem, discrete fourier representation and models for imaging, image restoration, image sampling, perception of moving images.

UNIT V COMPUTER REQUIREMENT FOR IMAGING SYSTEM 9

Single / multi user system, transferring of images, processing speed, display of medical images, 3-D image display and its clinical applications.

TEXT BOOK

Steve Webb, “The physics of medical imaging”, Adam Hilger, Bristol, England, Philadelphia, USA, 1988.

REFERENCES:

1. http://ocw.mit.edu/courses/nuclear-engineering/22-058-principles-of-medical-imaging-fall-2002/lecture-notes/

BBM057	ROBOTICS AND NANOTECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Nil				
	Course Designed by – Department of Biomedical engineering.				

OBJECTIVES

To introduce about basic principle of robotics and nanotechnology

COURSE OUTCOMES (COs)

CO1	To study about Definition and origin of robotics
CO2	To learn about Hydraulic, pneumatic and electric drives determination
CO3	To introduce about Construction of manipulators – manipulator dynamics
CO4	To learn about basic concepts of Nano science and technology
CO5	To study about material processing by Sol – Gel method
CO6	To know the applications of nanotechnology in various medical fields

UNIT – I BASIC CONCEPTS 9

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov‟s laws of robotics – dynamic stabilization of robots.

UNIT – II POWER SOURCES AND SENSORS 9

Hydraulic, pneumatic and electric drives determination of HP of motor and gearing ratio variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fiber optic and tactile sensors.

UNIT – III MANIPULATORS, ACTUATORS AND GRIPPERS 9

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations.

UNIT IV NANO MATERIALS AND NANOTECHNOLOGY 9

Basic concepts of Nano science and technology – Quantum wire – Quantum well – Quantum dot – Properties and technological advantages of Nanomaterials – Carbon Nanotubes and applications

UNIT V MATERIALS PROCESSING AND CHRARCTERISATION: **9**

Material processing by Sol – Gel method, Chemical Vapor deposition and Physical Vapor deposition – Microwave Synthesis of materials – Principles of SEM, TEM and AFM - Fluorescence Microscopy and Imaging.

TEXT BOOK

1. Niku Saeed B, Introduction to Robotics: Analysis, System, Applications, PHI Publishers.
2. Tony Hyland, Scientific and Medical Robotics, Smart Apple Media Publishers, 2007.
3. Hari Singh Nalwa, "*Nanostructured Materials and Nanotechnology*", Academic Press, 2002.

REFERENCES:

https://books.google.co.in/books?id=VT8jgh81zycC&pg=PA233&lpg=PA233&dq=ROBOTICS+AND+NANOTECHNOLOGY+lecture+notes&source=bl&ots=fVFAVc80qK&sig=uKi7jtpHw1yMWDl-YeS0cjeQJcc&hl=en&sa=X&ved=0ahUKEwik2NX8gsfLAhVMvRQKHaRABBwQ6AEINjAE#v=onepage&q=ROBOTICS%20AND%20NANOTECHNOLOGY%20lecture%20notes&f=false

BBM075	VIRTUAL INSTRUMENTATION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Medical instrumentation				
	Course Designed by – Department of Biomedical engineering.				

OBJECTIVES

1. To introduce Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data flow techniques.
2. To study CAN bus characteristics. Bus interface for R8422 and RS485.
3. To study Principles of PAL‟s PLD‟s GAL‟s CPLD and their design considerations.
4. To study Principles and design considerations of specific PROM, EPROM, SRAM, SDRAM. Dual ported memories, FIFO‟s flash memories
5. To study Multiphase clock generators, LCD display controller.

COURSE OUTCOMES (COs)

CO1	To learn about the review of virtual instrumentation
CO2	Study about the programming techniques for virtual instrumentation
CO3	Have a knowledge about basic of data acquisition
CO4	To learn about the interfaces of common instruments
CO5	To get knowledge about the use of analysis tools
CO6	To study Multiphase clock generators, LCD display controller.

UNIT-1: REVIEW OF VIRTUAL INSTRUMENTATION 9

Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data flow techniques. Graphical programming in data flow, comparison with conventional programming.

UNIT-2 : VIRTUAL INSTRUMENTATION PROGRAMMING TECHNIQUES 9

VIS and subVIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.

UNIT-3: DATA ACQUISITION BASICS 9

ADC, DAC, DIO, counters and timers. PC hardware structure, timing, interrupts, DMA, software and hardware installation.

UNIT-4: COMMON INSTRUMENT INTERFACES 9

Current loop, RS232C/RS485, GPIB, system buses, interface buses: USB, PCMCIA, VXI, SCXI, PXI etc., networkign basics for office and industrial applications, visa and IVI, image acquisition and processing, motion control.

UNIT-5: USE OF ANALYSIS TOOLS 9

Fourier transforms, power spectrum correlation methods, windowing utttering, VI application in various fields.

TEXTBOOKS:

1. Anand M M S, Electronic Instruments and Instrumentation Technology, PHI Publishers, 2007.
2. Stephen Bennett, Emagic Logic Virtual Instruments, PC Publishing, 2003.

REFERENCES:

1. **http://ocw.njit.edu/csla/opse/opse-310/index.php**

BBM081	DIGITAL SYSTEM DESIGN	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – BioMEMS				
	Course Designed by – Department of Computer Science Engineering				

OBJECTIVES

1. To introduce Circuit diagram of Til, CMOS, NMOS, ECL, GaAs building blocks, operating conditions, interfacing between different families.

COURSE OUTCOMES (COs)

CO1	To learn about Til, CMOS, NMOS, ECL etc.
CO2	To know about Bus interface for R8422 and RS485.
CO3	To get knowledge of Principles of PAL‟s , etc.
CO4	To learn about Admitting department .
CO5	To learn about the Importance of LCD display controller .
CO6	To understand the various interfacing circuits

UNIT-1: DIGITAL LOGIC FAMILIES **9**

Circuit diagram of Til, CMOS, NMOS, ECL, GaAs building blocks, operating conditions, interfacing between different families- interpreting data sheet of 74 series, CD 4000 series, ECL 10000 series- power supply considerations for digital IC.

UNIT-2: DIGITAL SYSTEM BUS CHARACTERISTICS **9**

RS-232, RS-485, R8422, ISA, PCL, HC, SPI, CAN bus characteristics. Bus interface for R8422 and RS485

UNIT-3 : PROGRAMMABLE LOGIC DEVICES **9**

Principles of PAL‟s PLD‟s GAL‟s CPLD and their design considerations

UNIT-4: DIGITAL MEMORIES **9**

Principles and design considerations of specific PROM, EPROM, SRAM, SDRAM. Dual ported memories, FIFO‟s flash memories.

UNIT-5: DIGITAL SYSTEM DESIGN CASE STUDIES **9**

Multiphase clock generators, LCD display controller, PRBS generator, watch dog timer, interfacing with SPI bus, interfacing with flash memory.

TEXTBOOKS:

1. Balakrishnan, “Digital System Design”, Oxford University Press, USA 2007.
2. Mark Zwolinski, “Digital System Design with VHDL”, Prentice Hall, 2003.

REFERENCES:

http://www.ece.uic.edu/~dutt/courses/ece465/lect-notes.html

BBM052	BIOLOGICAL EFFECTS OF RADIATION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – The student should know Medical physics				
	Course Designed by – Department of Biomedical Engineering.				

OBJECTIVES

To learn about effects of radiation in the biological system.

COURSE OUTCOMES (COs)	
CO1	To learn about DNA and chromosomal damages.
CO2	To know about LD50/30 effective radiation on skin,etc.
CO3	To get knowledge of to Threshold and linear dose, gene control hereditary diseases effect of dose.
CO4	To learn about Effects of various human organs.
CO5	To learn about Classification of sources, measurement of different radiations.
CO6	To know the harmful effects of radiation and how to minimize it

UNIT – I ACTION OF RADIATION IN LIVING CELLS 9

Various theories related to radiation at cellular level. DNA and chromosomal damages.

UNIT – II SOMATIC APPLICATION OF RADIATION 9

Radio sensitivity protocols of different tissues of human. LD50/30 effective radiation on skin. Bone marrow, eye, endocrine glands, and basis of radio therapy.

UNIT – III GENETIC EFFECTS OF RADIATION 9

Threshold and linear dose, gene control hereditary diseases effect of dose.

UNIT – IV EFFECT OF MICROWAVE AND RF WITH MATTERS 9

Effects of various human organs and systems, Wavelength in tissue, non thermal interaction. Standards of protection, national, and international standards and precautions.

UNIT – V UV RADIATION 9

Classification of sources, measurement, photo medicine, UV radiation, safety visible and infrared Radiation.

REFERENCE:

1. Paul Fryer, Duncan Ward, Radiatiom, White Cube Publishers (2008).
2. Steve Forshier, Essential of Radiation Biology and Protection, Delmar Publishers (2008).
3. http://www.slideshare.net/erletshaqe1/lecture-4-30005235

BBA008	TOTAL QUALITY MANAGEMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic principles of Management				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To study about quality management, New management tools, , Quality auditing

COURSE OUTCOMES (COs)

CO1	To learn about - Need for quality ,- Basic concepts of TQM - Definition of TQM
CO2	To learn about – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement
CO3	To learn about The seven traditional tools of quality – New management tools
CO4	To learn about Quality circles – Quality Function Deployment (QFD)
CO5	To learn about Need for ISO 9000- ISO 9000-2000 Quality System
CO6	To learn the need for management process and stages

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM – TQM Framework - Contributions of Deming, Juran and Crosby – Barriers to TQM.

UNIT II TQM PRINCIPLES 9

Leadership – Strategic quality planning, Quality statements - Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement – PDSA cycle, 5s, Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS & TECHNIQUES I 9

The seven traditional tools of quality – New management tools – Six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

UNIT IV TQM TOOLS & TECHNIQUES II 9

Quality circles – Quality Function Deployment (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Cost of Quality – Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000- ISO 9000-2000 Quality System – Elements, Documentation, Quality auditing- QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – Case studies of TQM implementation in manufacturing and service sectors including IT.

TEXT BOOK:

1. Dale H.Besterfiled, et at., “Total Quality Management”, Pearson Education Asia,3rd Edition, Indian Reprint (2006).

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 6th Edition, South-Western (Thomson Learning), 2005.
2. Oakland, J.S., "TQM – Text with Cases", Butterworth – Heinemann Ltd., Oxford, 3rd Edition, 200UNIT III
3. Suganthi,L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd.,2006.
4. Janakiraman, B and Gopal, R.K, "Total Quality Management – Text and Cases", Prentice Hall (India**)** Pvt. Ltd., 2006.

http://asq.org/learn-about-quality/total-quality-management/overview/overview.html

BBA001	PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic principles of Management				
	Course Designed by – Department of Management Studies				

OBJECTIVES

Familiarize the students with the fundamental concepts of Management and to highlight the approaches in organization behavior

COURSE OUTCOMES (COs)

CO1	Understanding the concepts of Management
CO2	Knowledge on Management Functions
CO3	Understanding the Organization Theory & Approach.
CO4	Knowledge on the Concepts of Motivation
CO5	Clear insight on the factors contributing to discipline
CO6	In-depth Understanding about the concepts of Group Behavior

UNIT I NATURE OF MANAGEMENT 9

Nature of management – definition – theory and practice – effective management – Management: Science of Art – Management in India. Development of Management thoughts – Taylor‟s – Henry Fayol – Hawthrone experiment – Barnard & Social system – Herbert Simon – Peter Drucker – Various approaches – Management thoughts.

UNIT MANAGEMENT 9

Management process and co-ordination – Functions of management – Managers and environment – External and internal Business Ethics – Planning – Fundamentals – Definitions & Features – Steps in planning – types of planning – Objectives – Concepts and features – Hierachy of objectives – role – Process of MBO – Policy & Strategy – Decision making process – Individual Vs Group Decisions.

UNIT III ORGANIZATION THEORY 9

Organizing – Theory & Approach – Organization Structure – Authority & Responsibility – Delegation – Centralization & Decentralization – Line & Staff Relationship – Staffing – Fundamentals – System approach – Manpower Planning – Recruitment & Selection – Training and development – Performance appraisal – Direction – Fundamentals Motivation – Theories of Motivation-Maslow‟s Hersberg‟s MaClelland‟s theory X,Y & Z leadership – Theories and Styles – Communication – Type – Controlling – System and Process.

UNIT IV ORGANIZATION BEHAVIOR 9

Organizational Behavior – Definition – Organization – Managerial Role and Functions – Organizational Approaches, Individual behavior – Causes – Environmental effect – Behavior and performance, perception – Organizational implications, Personality – Contributing factors –

Dimension, Motivation – Need Theories – Process Theories – Job satisfaction, Learning and Behavior – Learning Curves, Work Design and Approaches.

UNIT V GROUP 9

r – Groups – Contributing factors –Group Norms, types – Causes – Intergroup relations – Conflict and Resolution – Change Process –Resistance to change.

REFERENCES:

1. and Heinz weihrich, „Essentials of Management", McGraw Hill
3. publishing Company, Singapore International Edition, 2004.
4. Ties AF, Stoner and R. Edward Freeman, "Management" Prentice Hall of India Pvt. Ltd., New Delhi -110011, 1995.
5. Joseph I. Massie „Essentials of Management", Prentice Hall of India Pvt. Ltd., New Delhi - 110011, 2004.
5. L.M. Prasad "Principles and Practice of Management", Sultan Chand & Sons.2001
6. Uma Sekaran, "Organizational Behaviour", Tata McGraw Hill, 2007.
7. http://asq.org/learn-about-quality/total-quality-management/overview/overview.html

BBM076	REGULATORY ASPECTS IN BIOSCIENCES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic principles of Management and science				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To learn about regulatory aspects in biosciences.

COURSE OUTCOMES (COs)	
CO1	To learn about the food and drug administration.
CO2	To know about Data and safety monitoring.
CO3	To get knowledge of The Nurenberg code.
CO4	To learn about Working principle of Microsystems.
CO5	To learn about the Importance Drug delivery.
CO6	To get an overview on the regulatory aspects of pharmaceutical industry

UNIT I - INDIVIDUAL AND INSTITUTIONAL RESPONSIBILITY & REGULATION BY FDA **9**

Researching a bioethical question, Individual and institutional responsibility, Institutional review boards, Role of independent institutional review boards, The regulation of drugs and biological products by the food and drug administration.

UNIT II - LEGAL ISSUES AND HEALTH POLICY **9**

Data and safety monitoring, Legal issues, rules to prevent conflict of interest on human subjects, National institutes of health policy on the Inclusion of women and minorities as subjects, Role and importance of trial registries and results databases.

UNIT III - ETHICAL AND REGULATORY GUIDANCE **9**

Immobilization, The Nurenberg code, Declaration of Helsinki: Ethical principles of medical research involving human subjects, The Belmont report: Ethical principles and guidelines for the protection of human subjects, The common rule, Code of federal regulations.

UNIT IV - DISTINCTION BETWEEN RESEARCH AND TREATMENT & THE ETHICS OF RANDOMIZED CLINICAL TRIALS **9**

Research and Practice, Demarcating Research and Treatment: A Systematic Approach, The ethics of randomized clinical trials: Problems of the randomized clinical trial, Equipoise and the ethics of clinical research, Randomized controlled trials: Lessons from ECMO.

UNIT V - ROLE OF PLACEBOS IN CLINICAL RESEARCH & CHANGING LANDSCAPE OF HUMAN EXPERIMENTATION 9

The continuing unethical use of placebo controls, Placebo-controlled trials and the logic of clinical purpose, Active control trials in the evaluation of new treatments, The changing landscape of human experimentation.

TEXTBOOKS:

1. John I, Gallin, Frederick P, Ognibene “Principles and Practice of Clinical Research”, Academic Press, Third Edition, 2012.
2. Ezekiel J, Emanuel, Robert A Crouch, John D Arras, Jonathan D Moreno, Christine Grady, “Ethical and Regulatory Aspects of Clinical Research”, Johns Hopkins University Press, First Edition, 2003.

REFERENCES:

1. Michael A, Santoro, Thomas M. Gorrie, “Ethics and the Pharmaceutical Industry”, Cambridge University Press, First Edition, 2005.
2. Susan E, Lederer, “SubjectedToScience: Human Experimentation in America before the Second World War”, Johns Hopkins University Press, First Edition, 1995.
3. http://www.ucsc-extension.edu/content/biosciences-4

BBM801	REHABILITATION ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Artificial organs and allied health sciences				
	Course Designed by – Department of Biomedical engineering.				

OBJECTIVES

To learn about the rehabilitation engineering and its process.

COURSE OUTCOMES (COs)

CO1	To learn about the basic of rehabilitation
CO2	Study about the science and technology of rehabilitation engineering
CO3	Have a knowledge about the orthopedic prosthetic and orthotics technology in rehabilitation
CO4	To learn about the sensor rehabilitation system
CO5	To get knowledge about the principles and uses of rehabilitation technologies
CO6	To be equipped with the latest advancements in the applications of robotics

UNIT 1 INTRODUCTION TO REHABILITATION: 9

Principles involved in the study of Rehabilitation Engineering, HAAT – Human Activity Assistive Technology.

UNIT 2 REHABILITATION ENGINEERING SCIENCE & TECHNOLOGY: 9

Rehabilitation engineering concepts in motor rehabilitation engineering concepts in communication disorders.Wheel chairs: Categories of Wheelchairs, Wheelchair structure and Component design, Ergonomics of Wheelchair Propulsion, Power Wheelchair Electrical Systems. Personal Transportation for the Handicap: Vehicle Selection, Lift Mechanisms, Hand Controls, Wheelchair restraint Mechanisms.

UNIT 3 ORTHOPEDIC PROSTHETICS & ORTHOTICS IN REHABILITATION TECHNOLOGY: 9

Fundamentals, Function, Structure and Cosmesis of Orthotic or Prosthetic device. Computer-Aided engineering in customized component design, Example- Intelligent prosthetic knee, hierarchically controlled Prosthetic Hand, Myoelectric hand and arm prosthesis – block diagram, signal flow diagram and functions.

UNIT 4 SENSORY REHABILITATION SYSTEMS: 9

Engineering concepts in sensory rehabilitation, Sensory Augmentation & substitution: Visual System, Auditory system, Tactual system.

UNIT 5 RÉHABILITATION ENGINEERING TECHNOLOGIES: PRINCIPLES OF APPLICATION: 9

Conceptual frameworks, Education and Quality Assurance, Specific Impairments and Related technologies, Future Developments – Rehabilitation Robotics, and Brain computer interface systems.

TEXT BOOK:

1. Robinson C.J Rehabilitation Engineering, Handbook of Electrical Engineering, CRC Press, Bocaration 1993.

REFERENCE:

1. Reswick. J, What is Rehabilitation Engineering, Annual Reviews of Rehabilitaion – Volume.
2. Springer – veriag, New York, 1982.
3. Leon Goldman m.d.r James Rockwell. J.r. Lasers in medicine.
4. K.Wolbarsht M. L. Laser application in Medicine and biology, Plenum Press, New York.

http://www.sms.hest.ethz.ch/education/lectures/RehabilitationEngineering

BBA009	INTELLECTUAL PROPERTY RIGHTS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic principles of Management				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To introduce about Intellectual property rights

COURSE OUTCOMES (COs)

CO1	To learn about Importance – Protection of IPR – Basic types of property
CO2	To learn about Protection of Geographical Indications at national and International levels
CO3	To learn about International convention relating to Intellectual Property
CO4	To learn about Indian Position Vs WTO and Strategies
CO5	To learn about Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.)
CO6	Have a good knowledge about IP, copyrights and related issues

UNIT I INVENTION AND CREATIVITY

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i. Movable Property ii. Immovable Property and iii. Intellectual Property).

UNIT II PATENTS

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures.

UNIT III TRADE

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV WTO

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V CASE STUDIES

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TEXT BOOK

1. Subbaram N.R. " Handbook of Indian Patent Law and Practice ", S. Viswanathan (Printers and Publishers) Pvt. Ltd., 1998.

REFERENCES

1. Eli Whitney, United States Patent Number : 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today : Volume 8, No. 5, May 2001, [www.iptoday.com].
3.https://www.wto.org/english/tratop_e/trips_e/intel1_e.html

BBA002	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic principles of Management				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To enable the students to develop the achievement motivation and to develop entrepreneurial competency

COURSE OUTCOMES (COs)

CO1	To study about Qualities, nature types, traits, culture, Similarities and differences between entrepreneur and entrepreneur
CO2	To learn about Evolution of entrepreneurs
CO3	To introduce about Small Business
CO4	To learn about Project finance
CO5	To study about Setting MSMEs
CO6	To understand the requisites of entrepreneurial development

UNIT I ENTREPRENEURSHIP 9

Entrepreneur - meaning - importance - Qualities, nature types, traits, culture, Similarities and differences between entrepreneur and entrepreneur. Entrepreneurship and economic development - its importance - Role of entrepreneurship - entrepreneurial - environment.

UNIT II MOTIVATION 9

Evolution of entrepreneurs - entrepreneurial promotion: Training and developing motivation: factors - mobility of entrepreneurs - entrepreneurial change - occupational mobility - factors in mobility - Role of consultancy organizations in promoting entrepreneurs - Forms of business for - entrepreneurs.

UNIT III BUSINESS 9

Small Business : Concept & Definition, Role of Small Business in the modern Indian Economy, Small entrepreneur in International business; Steps for starting a small industry, registration as SSI, Role of SIDBI; advantages and problems of SSIs; Institutional Support mechanism in India; Incentives & Facilities, Govt. Policies for SSIs

UNIT IV FINANCING AND ACCOUNTING 9

Setting MSMEs‟- location of enterprise - steps in setting - Problems of entrepreneurs - Sickness in small industries - reasons and remedies - Incentives and subsidies - Evaluating entrepreneurial performance - Rural entrepreneurship - Women Entrepreneurship.

UNIT V SUPPORT TO ENTREPRENEURS 9

Project finance: Sources of finance – Institutional finance - Role of IFC, IDBI, ICICI, LIC, SFC, SIPCOT, and Commercial Bank - Appraisal of bank for loans. Institutional aids for entrepreneurship development - Role of DST, DICS, SIDCO, NSICS, IRCI, NIDC, SIDBI, SISI, SIPCOT, Entrepreneurial guidance bureau - Approaching Institutions for assistance.

REFERENCES:

1. Vasanth Desai “Dynamics of Entrepreneurial Development and Management” Himalaya Publishing House.
2. N.P.Srinivasan & G.P. Gupta “Entrepreneurial Development” Sultanchand & Sons.
3. P.Saravanavelu “Entrepreneurship Development” Eskapee publications.
4. S.S.Khanka “Entrepreneurial Development” S.Chand & Company Ltd.,
5. Satish Taneja, Entrepreneur Development ; New Venture Creation.
6. https://en.wikipedia.org/wiki/Entrepreneurship_Development_Institute_of_India

BBM089	DESIGN AND DEVELOPMENT OF MEDICAL DEVICES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Advanced Biomedical Instrumentation				
	Course Designed by – Department of Biomedical Engineering				

OBJECTIVES

To introduce Bio-Process Technology and Enzyme based actions in Medical Applications.

COURSE OUTCOMES (COs)

CO1	To learn about Define medical device, Classification of medical device, Medical device vs medical
CO2	To learn about Laparoscopic instrumentation, surgical instrumentation in ophthalmology
CO3	To learn about Patient monitoring system, ECG, EEG, Blood pressure monitor
CO4	To learn about Pacemaker, External cardio vector defibrillator, Implantable cardio vector
CO5	To learn about Total hip prosthesis, Joint replacement, Design of artificial pancreas
CO6	Get familiarized with latest technologies in rehabilitation based devices

UNIT I - INTRODUCTION TO MEDICAL DEVICE 9

Define medical device, Classification of medical device, Medical device vs medical instrumentation, Origin of bio-potential, Physiological signal, Human machine interface ,Input output and control signal, Data acquisition, Sensor, Amplification, Medical electrical stimulator.

UNIT II - MINIMALLY INVASIVE DEVICE AND TECHNIQUE 9

Laparosopic instrumentation, surgical instrumentation in ophthalmology - Phacoemulsification: Instrument and system - Vitrorectomy: Instrument and system- Human machine interface.

UNIT III - SYSTEM DESCRIPTION OF DIAGNOSTIC EQUIPMENT 9

Patient monitoring system, ECG, EEG, Blood pressure monitor, Digital stethoscope, Thermometer, System description and diagram of pulse oximeter, optical fiber optics for circulatory and respiratory system measurement.

UNIT IV - SYSTEM DESCRIPTION OF THERAPEUTIC EQUIPMENT 9

Pacemaker, External cardiovector defibrillator, Implantable cardiovector defibrillator, Deep brain stimulation, Functional electrical stimulator (FES), Hemodialysis delivery system, Mechanical ventilator.

UNIT V - SYSTEM DESCRIPTION OF VARIOUS IMPLANT AND PROSTHESIS 8

Total hip prosthesis, Joint replacement, Design of artificial pancreas, Drug eluting stent and its engineering design - Intraocular lens implant, Cochlear implants, Heart valves.

TEXTBOOKS:

1. Gail Baura, "Medical Device Technologies: A Systems Based Overview Using Engineering", Elsevier science, 2002.
2. Martin Culjat, Rahul Singh, Hua Lee,"Medical Devices: Surgical and Image- Guided Technologies", John Wiley & Sons, Reinaldo perez, "Design of medical electronic device", Elsevier science, 2002.

3. Richard C, Fries, “Handbook of Medical Device Design”, Marcel Dekker AG, 2 nd edition 2005.

REFERENCES:

1. Anthony Y. K, Chan, “Biomedical device technology: principles and design”, Charles Thomas, 2008.
2. Theodore R, Kucklick, “The Medical Device Ramp-D Handbook”,Taylor &Francis Group LLC, 3rd edition 2013.
3. David Prutchi, Michael Norris, “Design and Development of Medical Electronic Instrumentation: A Practical perspective of the design, construction and test of medical devices”, John Wiley & Sons, 2005
4. https://www.cranfield.ac.uk/Courses/training/Design-Development-and-Testing-of-Medical-Devices

BBM7P1 **MINI PROJECT** **L T P C**
0 0 4 1

Guidelines for Mini project:

To develop an ability to solve a specific Biomedical Engineering problem by identifying them, designing any hardware or software to achieve the goal.

Each student is expected to do a project and present along with the title which should be approved by the Head of the Department under the guidance of a faculty member. The improvement in the projects are been watched in every review conducted by the project coordinator under the Head of the Department. A comprehensive project report after completing the project work is written to the satisfaction of the supervisor. Based on the project work a paper should be written to be published in any appropriate journals. Project report is finally submitted at the end of the semester. The project evaluation is done based on the oral presentation and the work done by the students by the Project coordinator and Internal Guide.

OUTCOME:

On completion of the project work students will be in a position to take up any challenging practical problems and finding solution by formulation proper methodology in the field of Biomedical Engineering

BBM6P1	TERM PAPER	L T P C 0 0 4 2

Guidelines for Term Paper:

i. Students should register for the term paper in the VII semester either in the core area or interdisciplinary area

ii. Every student or in a group of four is expected to identify a topic with substantial literature survey and history of the topic has to be submitted at the end of the semester as a report.

iii. The term paper report submitted by the students will be evaluated by viva-voce examination comprising of both external and internal examiners.

iv. Students should prepare a research article based on the subject of the term paper and should submit the same for journal publication/conference presentation

v. The students shall carry out the course under the guidance/supervision of a faculty. Each faculty can guide four students/ groups.

BBM8P1	PROJECT WORK	L T P C 0 0 18 9

OBJECTIVE:

To develop an ability to solve a specific Biomedical Engineering problem by identifying them, designing any hardware or software to achieve the goal. The project done should be useful in some way to the society and which could be used in our practical life.

The students in a group of 3 to 4 are present in a project along with the title which should be approved by the Head of the Department under the guidance of a faculty member. The improvement in the projects are been watched in every review conducted by the project coordinator under the Head of the Department. A comprehensive project report after completing the project work is written to the satisfaction of the supervisor. Based on the project work a paper should be written to be published in any appropriate journals. Project report is finally submitted at the end of the semester. The project evaluation is done based on the oral presentation and the work done by the students jointly by both the internal and external examiners.

OUTCOME:

On completion of the project work students will be in a position to take up any challenging practical problems and finding solution by formulation proper methodology in the field of Biomedical Engineering.

.

CURRICULUM AND SYLLABUS (R 2015)
CHOICE BASED CREDIT SYSTEM
(Applicable to the batch admitted from July 2015)

B.TECH – CIVIL ENGINEERING
(FULL TIME)
I – VIII SEMESTERS

SEMESTER I

Code No.	Category	Course Title	L	T	P	C
THEORY						
BEN101	HS	English – I	3	1	0	3
BMA101	BS	Mathematics – I	3	1	0	3
BPH101	BS	Engineering Physics – I	3	0	0	3
BCH101	BS	Engineering Chemistry – I	3	0	0	3
BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
BBA101	HS	Personality Development	1	1	0	2
BBT 102	BS	Biology for Engineers	2	0	0	2
BME101	ES	Engineering Graphics – E	2	0	3	4
BME103	ES	Basic Mechanical Engineering	2	0	0	2
PRACTICAL						
BCM1L1	ES	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	3	1
BPC1L1/1L2 #	BS	Physics and Chemistry Laboratory	0	0	3	0
BSS1L4/ BSS1L5/ BSS1L6	HS	NCC/NSS/NSO to be conducted during week ends	0	1	2	1

Laboratory Classes on alternate weeks for Physics and Chemistry. The Lab examinations will be held only in the second semester (including the first semester experiments also).

Total No. of Contact Hours: 37 **Total No. of Credits: 27**

SEMESTER II

Code No.	Category	Course Title	L	T	P	C
THEORY						
BEN201	HS	English – II	3	1	0	3
BMA201	BS	Mathematics – II	3	1	0	3
BPH201	BS	Engineering Physics – II	3	0	0	3
BCH201	BS	Engineering Chemistry – II	3	0	0	3
BFI 201*	HS	Foreign / Indian Language	3	0	0	3
BME202	ES	Engineering Mechanics	3	1	0	3
BEE201	ES	Basics Electrical and Electronics Engineering	2	0	0	2
PRACTICAL						
BCS2L2	ES	Computer Practices Lab	0	0	3	1
BEE2L1	ES	Basics Electrical and Electronics Engineering Practices Laboratory	0	0	3	1
BPC2L1#	BS	Physics and Chemistry Laboratory	0	0	3/3	1
BSS1L7/BSS2L7	HS	Yoga	0	1	2	1

*Any one of the following courses: BFR201 – French, BGM201-German, BJP201 – Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 – Tamil.

Laboratory Classes on alternate weeks for Physics and Chemistry. The Lab examinations will be held only in the second semester (including the first semester experiments also).

Total No. of Contact Hours: 35 **Total No. of Credits: 24**

SEMESTER III						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BMA301	BS	Mathematics III	3	2	0	4
BCE301	PC	Applied Mechanics	4	0	0	4
BCE302	PC	Surveying I	3	0	0	3
BCE303	PC	Building Construction	3	0	0	3
BCE304	PC	Fluid Mechanics	3	0	0	3
BCE305	PC	Engineering Earth Science	3	0	0	3
PRACTICAL						
BCE3L1	PC	Surveying Practical – I	0	0	3	2
BCE3L2	PC	Strength Of Materials Lab	0	0	3	2
Total No. of Contact Hours: 27				**Total No. of Credits: 24**		

SEMESTER IV						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BMA402	BS	Numerical Methods	3	2	0	4
BCE401	PC	Theory of Structures	4	0	0	4
BCE402	PC	Surveying II	3	0	0	3
BCE403	PC	Soil Mechanics	3	0	0	3
BCE404	PC	Basic Structural Design	4	0	0	4
BCE405	PC	Transportation Engineering	3	0	0	3
BCE406	BS	Environmental Studies	3	0	0	3
PRACTICAL						
BCE4L1	PC	Surveying Practical II	0	0	3	2
BCE4L2	PC	Soil Mechanics Lab	0	0	3	2
Total No. of Contact Hours: 31				**Total No. of Credits: 28**		

SEMESTER V						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BCE501	PC	Structural Analysis – I	4	0	0	4
BCE502	PC	Applied Hydraulic Engineering	3	0	0	3
BCE503	PC	Foundation Engineering	3	0	0	3
BCE504	PC	Reinforced Concrete Structures - I	4	0	0	4
BCE505	PC	Environmental Engineering	3	0	0	3
BCE507	PC	Construction Technology	3	0	0	3
BCE5E1	CE	Core Elective – I	3	0	0	3
PRACTICAL						
BCE5L1	PC	Construction Engineering Lab	0	0	3	2
BCE5L2	PC	Fluid Mechanics and Machinery Lab	0	0	3	2
BCE5C1	PR	Comprehension I	0	0	0	1
Total No. of Contact Hours: 29			**Total No. of Credits: 28**			

SEMESTER VI						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BCE601	PC	Structural Analysis – II	4	0	0	4
BCE602	PC	Reinforced Concrete Structures - II	4	0	0	4
BCE603	PC	Irrigation Engineering- II	3	0	0	3
BSS601	HS	Value Education and Professional Ethics	3	0	0	3
BCE6E2	CE	Core Elective –II	3	0	0	3
BCE6E3	NE	Non Major Elective –I	3	0	0	3
Practical						
BCE6L1	PC	Computer Aided Building Drawing	0	0	3	2
BCE6L2	PC	Environmental Engineering Lab	0	0	3	2
BCE6P1	PR	Term Paper	0	0	4	2
Total No. of Contact Hours: 30			**Total No. of Credits: 26**			

SEMESTER VII						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
Theory						
BCE701	PC	Estimation & Costing	3	0	0	3
BCE702	PC	Computer Aided Design of Structures	4	0	0	4
BCE703	PC	Design of Steel Structures	4	0	0	4
BCE704	PC	Management Concepts For Civil Engineers	3	0	0	3
BCE7E4	CE	Core Elective – III	3	0	0	3
BCE7E5	OE	Open Elective – I	3	0	0	3
Practical						
BCE7L1	PC	Computer Aided Design Of Structures Laboratory	0	0	3	2
BCE7L2	PC	Computer Aided Design and Drafting Laboratory(R.C.C, Steel, Irrigation & Environment)	0	0	3	2
BCE7V1	PR	In-plant Training (End of 6th Semester -30days)	0	0	0	1
Total No. of Contact Hours: 26			**Total No. of Credits: 25**			

SEMESTER VIII						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
Theory						
BCE8E6	NE	Non Major Elective – II	3	0	0	3
BCE8E7	OE	Open Elective – II	3	0	0	3
Practical						
BCE8C1	PR	Comprehension I	0	0	0	1
BCE8P1	PR	Project Work and Viva Voce	0	0	18	9
Total No. of Contact Hours: 24			**Total No. of Credits: 16**			

OVERALL CREDITS FOR THE PROGRAMME: 198

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No	Sub Area	Credit as per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	6	7	-	-	-	3		-	16	08.08
2	Maths &Basic Sciences (BS)	11	10	4	7	-	-	-	-	32	16.16
3	Engineering Sciences (ES)	10	7	-	-	-	-	-	-	17	08.59
4	Professional Core (PC)	-	-	20	18	24	15	18	-	95	47.80
5	Core Electives (PE)	-	-	-	-	3	3	3		9	04.55
6	Non major Electives (NE)	-	-	-	-	-	-	3	3	6	03.03
7	Open Electives (OE)	-	-	-	-	-	-	3	3	6	03.03
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	-		1	2	1	10	14	07.07
	Total Credits	27	24	24	25	28	26	25	16	198	100
	Total Contact Hours	37	35	27	31	29	30	26	24	236	

LIST OF ELECTIVES

List of Core Elective (CE) -I:

Code No.	Course Title	L	T	P	C
BCE051	Concrete Technology	3	0	0	3
BCE052	Industrial Structures	3	0	0	3
BCE053	Advanced Construction Techniques	3	0	0	3
BCE054	Construction Planning, Scheduling and Control	3	0	0	3
BCE055	Industrial Waste Treatment and Disposal	3	0	0	3
BCE056	Solid and Hazardous Waste Management	3	0	0	3

List of Core Elective (CE) -II:

Code No.	Course Title	L	T	P	C
BCE057	Design of R.C. Framed Structures	3	0	0	3
BCE058	Tall Structures	3	0	0	3
BCE059	Safety Practices in Construction	3	0	0	3
BCE060	Modern Construction Materials	3	0	0	3
BCE061	Air and Noise Pollution	3	0	0	3
BCE062	Environmental Impact Assessment	3	0	0	3

List of Core Elective(CE) -III:

Code No.	Course Title	L	T	P	C
BCE063	Pre stressed Concrete Structures	3	0	0	3
BCE064	Advanced Concrete Design	3	0	0	3
BCE065	Construction Equipment	3	0	0	3
BCE066	Prefabrication and Construction Techniques	3	0	0	3
BCE067	Environmental Health Engineering	3	0	0	3
BCE068	Indoor Air Quality	3	0	0	3

List of Non Major Elective (NE) - I:

Code No.	Course Title	L	T	P	C
BCE069	Matrix Methods of Structural Analysis	3	0	0	3
BCE070	Concrete Structures	3	0	0	3
BCE071	Shoring, Scaffolding and Formwork	3	0	0	3
BCE072	Construction Project Management	3	0	0	3
BCE073	Ground Water Contamination and Transport Modeling	3	0	0	3
BCE074	Physical and Chemical Treatment of Water and Wastewater	3	0	0	3
BCE075	Ground Water Engineering	3	0	0	3
BCE076	Coastal Engineering	3	0	0	3

List of Non Major Elective (NE) -II:

Code No.	Course Title	L	T	P	C
BCE077	Finite Element Analysis	3	0	0	3
BCE078	Structures on Expansive Soil	3	0	0	3
BCE079	Quality Control and Assurance in Construction	3	0	0	3
BCE080	Construction Personnel Management	3	0	0	3
BCE081	Water and Sewage Conveyance	3	0	0	3
BCE082	Environmental Engineering Structures	3	0	0	3
BCE083	Soil Dynamics and Machine Foundation	3	0	0	3
BCE084	Hydrology	3	0	0	3

List of Non Major Elective (NE) -III:

Code No.	Course Title	L	T	P	C
BCE085	Concrete Bridges	3	0	0	3
BCE086	Maintenance and Rehabilitation of Structures	3	0	0	3
BCE087	Project Formulation and Appraisal	3	0	0	3
BCE088	GIS in Construction Engineering & Management	3	0	0	3
BCE089	Environmental Quality Modeling	3	0	0	3
BCE090	Marine Pollution Monitoring	3	0	0	3
BCE091	Operation and Management of Irrigation Systems	3	0	0	3
BCE092	Transportation Structures	3	0	0	3

List of Open Elective (OE) -I:

Code No.	Course Title	L	T	P	C
BCE093	Remote Sensing and GIS	3	0	0	3
BBA008	Total Quality Management	3	0	0	3
BCE094	Optimization Techniques	3	0	0	3
BBA009	Intellectual Property Rights	3	0	0	3
	NSS Paper I	2	0	2	3

List of Open Elective (OE) -II:

Code No.	Course Title	L	T	P	C
BCE095	Geographic Information System	3	0	0	3
BCE096	Engineering Economics	3	0	0	3
BCE097	Renewable Sources of Energy	3	0	0	3
	NSS Paper II	2	0	2	3
	Massive Open Online Course	3	0	0	3

BEN101	ENGLISH - I	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Dept of English				

OBJECTIVES

To make the students learn the basic modes of communication for fluency and attainment of confidence in speech, reading and writing.

COURSE OUTCOMES (COs)

CO1	Understand the importance of being responsible, logical, and thorough.
CO2	Respond to the situations where short reports and instructions are required.
CO3	Explain "how things work", and what to suggest when "things don't work
CO4	Develop our confidence and authority in the practical use of language.
CO5	Understand the importance of being responsible, logical, and thorough.
CO6	e to Face interviews and competitive examinations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	C	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H	H	M	L	L	H	H	H	H
	CO2							L					
	CO3	H						H		H			H
	CO4	H	M				M	L	H	H			H
	CO5							L					
	CO6	H		H	H	H	H	L		H	H	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I STRUCTURES12

Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT II TRANSCODING 12

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT III REPORTING **12**

Degrees of comparison – Positive, Comparative, Superlative - questions- SI units -Lab reports - Physics chemistry, workshop and Survey report for introducing new product in the market.

UNIT IV FORMAL DOCUMENTATION **12**

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT VMETHODOLOGY **12**

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives , prepositional relatives.

TEXT BOOK

1. Department Of Humanities and Social Sciences Division, Anna University, Oxford University Press, 2013.

REFERENCES:

1. S.P.Danavel, English and Communication for Students of Science and Engineering, Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007.
3. Murali Krishna and Sunitha Moishra, Communication Skills for Engineers . Pearson, New Delhi, 2011.

BMA101	**MATHEMATICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – + 2 Level Mathematics				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To make the students learn Mathematics in order to formulate and solve problems effectivel their respective fields of engineering.

COURSE OUTCOMES (COs)

CO1	Study the fundamentals of mathematics
CO2	Students learn multiple integral techniques
CO3	Students gain knowledge in application of variables
CO4	Find area and volume based on a function with one or more variables.
CO5	Apply matrix operations to solve relevant real life problems in engineering.
CO6	Formulate a mathematical model for three dimensional objects and solve

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	D	e	f	g	h	i	j	k	l
2	CO1												
	CO2			M		H							
	CO3		H				M						
	CO4								L				
	CO5							H			L		
	CO6											L	
3	Category	Humanities & Social Studies	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)				
			√										
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I MATRICES 12

Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes-Envelopes- Applications of Evolutes and Envelopes.

UNIT 1V FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives- Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobians- Taylor's expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates- Area as double integral- Volume as triple integral.

TEXT BOOK:

1. Ravish R.Singh and Mukkul Bhatt, "Engineering Mathematics-I" First Reprint, Tata McGraw Hill Pub Co., New Delhi. 2011.
2. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi.

2007.

REFERENCES:

1. Ramana.B.V. "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons, New York, 2003.
4. Murray R.Spiegel, "Advanced Calculus", Schaum's Outline Series, First Edn, McGraw Hill Intl Book Co.,New Delhi, 1981.

PH101	**ENGINEERING PHYSICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES:

To enhance the fundamental knowledge in Physics and its applications relevant to various stre of Engineering and Technology

COURSE OUTCOMES (COs)

CO1	Understand the Principles and Laws of Physics
CO2	To understand the impact of Crystal Physics
CO3	Learn the Properties of Elasticity and Heat transfer.
CO4	Acquire Knowledge on Quantum Physics.
CO5	Understand the concepts on Laser & Ultrasonic's and its Applications
CO6	Understand the Principle of Laser and its Applications in Engineering and Medicine.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	A	b	C	d	e	f	g	h	i	j	k	l
2	CO1	H						M			H		
	CO2		L	H		M				M		L	H
	CO3												
	CO4	H		M	L						L		M
	CO5		L	L								L	L
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative

treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity-Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress - strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion –Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO2, Semiconductor lasers (homo junction & hetero junction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TEXT BOOKS:

1. Jayaraman D Engineering Physics I. Global Publishing House, 2014.
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai Publishers, 2009.
4. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
4. http://ocw.mit.edu/courses/find-by-topic
5. http://nptel.ac.in/course.php?disciplineId=122
6. https://en.wikipedia.org/wiki/Engineering_physics

BCH101	ENGINEERING CHEMISTRY - I	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level Chemistry				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving the different applica oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Understand the principles of water characterization and treatment for portable industrial purposes.
CO2	To impart knowledge on the essential aspects of Principles of polymer chemistry engineering applications of polymers
CO3	Having a sound knowledge in the Field of the Conventional and non-Conventi energy
CO4	To impart knowledge on the essential aspects of electrochemical cells, emf applications of EMF measurements
CO5	To make the students understand the Principles of corrosion and corrosion control .
CO6	To impart knowledge about the Conventional and non-conventional energy sources energy storage devices

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	L
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I WATER TECHNOLOGY 9

Introduction-Characteristics : Hardness of water – types - temporary and permanent hardness - estimation by EDTA method Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –Domestic water treatment – disinfection methods (Chlorination, Ozonation , UV treatment) Boiler feed water – requirements – disadvantages of using hard water in boilers Internal conditioning (Calgon Conditioning method) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

UNIT IIPOLYMERS **9**

Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization– Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III ELECTRO CHEMISTRY **9**

Introduction CELLS: types of Electrochemical cells , Electrolytic cells – Reversible and irreversible cells EMF – measurement of EMF– Single electrode potential – Nernst equation Reference electrodes : Standard Hydrogen electrode -Calomel electrode Ion selective electrode :Glass electrode and measurement of pH using Glass electrode Electrochemical series – significance Titrations :Potentiometer titrations (redox - Fe^{2+}vs dichromate titrations) Conduct metric titrations (acid-base – HCI vs, NaOH titrations)

UNIT IV CORROSION AND CORROSION CONTROL **9**

Introduction: Chemical corrosion Definition - Chemical Corrosion - Electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion control – sacrificial anode and impressed cathodic current methods – Protective coatings :Paints– constituents of the paint and their functions Metallic coatings – electroplating of Gold and electro less plating of Nickel.

UNIT V NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Introduction : Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor Solar energy conversion – solar cells – wind energy Fuel cells – hydrogen – oxygen fuel cell Batteries :Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries :Lead–acid storage battery –working –uses Nickel–cadmium battery - working –uses Solid – state battery : Lithium battery

TEXT BOOKS:

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara “A text book of engineering chemistry” S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).

REFERENCES :

1. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Electrochemistry

BCS101	FUNDAMENTALS OF COMPUTING AND PROGRAMMING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES

Students will understand the basics of computers and solve computer oriented problems using various computing tools.

COURSE OUTCOMES (COs)

CO1	Learn the fundamental principles in computing.
CO2	Learn to write simple programs using computer language
CO3	To enable the student to learn the major components of a computer system.
CO4	Computing problems
CO5	To learn to use office automation tools.
CO6	To interpret and relate programs

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H					H						
	CO2		L	H		M							
	CO3		L		S								
	CO4	M		M	W		M						
	CO5		L	L									
	CO6	H					H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO COMPUTER 9

Introduction- Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers- Basic Computer Organization-Number system. Computer Software: Types of Software—System software-Application software-Software Development Steps

UNIT II PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program – Purpose – Algorithm – Flowcharts– Pseudo code Introduction to Office Packages: MS Word, Spread Sheet, Power Point, MS Access, Outlook.

UNIT III INTRODUCTION TO C 9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions. Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV ARRAYS AND STRUCTURES 9

Arrays - Handling of Character Strings - Pointers – Structures-Union -Functions – Recursion-Call by value and Call by reference.

UNIT V INTRODUCTION TO C++ 9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TEXT BOOKS:

1. Ashok, N.Kamthane,"Computer Programming", Pearson Education (2012).
2. Anita Goel and Ajay Mittal,"Computer Fundamentals and Programming in C", Dorling V Kindersley (India Pvt Ltd).,Pearson Education in South Asia,(2011).
3. Yashavant P. Kanetkar, "Let us C",13th Edition,BPB Publications(2013).
4. Yashavant P. Kanetkar,"Let us C++"10th Edition, BPB Publications (2013**).**

REFERENCES:

1. Pradeep K.Sinha, Priti Sinha "Foundations of Computing", BPB Publications (2013).
2. Byron Gottfried, "Programming with C", 2nd edition, (Indian Adapted Edition), TMH Publication.
3. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in 'C' First Edition, Oxford University Press(2009).
4. The C++ Programming Language , 4th Edition, Bjarne Stroustrop, Addison-Wesley Publishing Company (2013).

BSS101	**PERSONALITY DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	1	1	0	2
	Prerequisite – +2 Level Knowledge				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To make students groom their personality and prove themselves as good Samaritans of the societ

COURSE OUTCOMES (COs)

CO1	Individual or in-group class presentations pertaining to the applications of conce theories or issues in human development..
CO2	Scores obtained from essay and or objective tests.
CO3	Attendance, classroom participation, small group interactions.
CO4	Research and write about relevant topics.
CO5	Design and complete a research project that can take the form of a developme interview, an observation or assessment through service learning.

CO6	Develop and maintain a Reflection

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	I	J	k	l
2	CO1	L		H				M					
	CO2		H	H				M					
	CO3							M	H				
	CO4									H	H		
	CO5							M			H	H	
	CO6							M					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 6

The concept personality- Dimensions of theories of Freud & Erickson- personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analyses.

UNIT II ATTITUDE & MOTIVATION 6

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III SELF-ESTEEM 6

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV OTHER ASPECTS OF PERSONALITY DEVELOPMENT 6

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics –Good manners and etiquette.

UNIT V EMPLOYABILITY QUOTIENT 6

Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TEXT BOOKS:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition, Prentice Hall.

REFERENCE BOOKS:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

BBT102	**BIOLOGY FOR ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – Basic Science				
	Course Designed by – Department of Industrial Bio Technology				

OBJECTIVES

Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system**.**

COURSE OUTCOMES (COs)

CO1	Graduates within the first five years will be able to grasp and apply biological engineering principles, procedures needed to solve real-world problems.
CO2	To understand the fundamentals of living things, their classification, cell structure and biochemical constituents
CO3	To apply the concept of plant, animal and microbial systems and growth in real life situations
CO4	To comprehend genetics and the immune system
CO5	To know the cause, symptoms, diagnosis and treatment of common diseases
CO6	To give a basic knowledge of the applications of biological systems in relevant industries

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	I	j	k	l
2	CO1	H						M					
	CO2		H							H			
	CO3			H							M		
	CO4										H		
	CO5												
	CO6						H						M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO LIFE 6

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell-Introduction to biomolecules: definition-general classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome.

UNITII BIODIVERSITY 6

Plant System: basic concepts of plant growth-nutrition-photosynthesis and nitrogen fixation-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions-Microbial System: history-types of microbes-economic importance and control of microbes.

UNITIII GENETICS AND IMMUNE SYSTEM 6

Evolution: theories of evolution-**Mendel's** cell division–mitosis and meiosis-evidence of e **laws of inheritance**-variation and speciation- nucleic acids as a genetic material-central dogma immunity-antigens-antibody-immune response.

UNIT IV HUMAN DISEASES 6

Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis

UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION 6

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines-cloning-drug discovery-biological neural networks-bioremediation-biofertilizer-biocontrol-biofilters-biosensors-biopolymers-bioenergy-biomaterials-biochips-basic biomedical instrumentation.

TEXT BOOKS:

1. A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

REFERENCE BOOKS

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
3. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

BME 101	ENGINEERING GRAPHICS- E	L	T	P	C
	Total Contact Hours - 60	2	0	3	4
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES
To understand techniques of drawings in various fields of engineering

COURSE OUTCOMES (COs)

CO1	To know about different types of lines & use of different types of pencils in an Engineering Drawing
CO2	To know how to represents letters & numbers in drawing sheet
CO3	To know about different types of projection
CO4	To know projection of points ,straight lines, solids etc.
CO5	To know development of different types of surfaces.
CO6	To know about isometric projection.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	C	d	e	f	g	h	i	J	k	l
2	CO1	H											H
	CO2	M	H										M
	CO3			L									M
	CO4						L		H	H			L
	CO5			L						H			L
	CO6			L							H		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I BASIC CURVES, PROJECTION OF POINTS AND STRAIGHT LINES 6+6

Conics-construction of ellipse, parabola and hyperbola by eccentricity method-construction of cycloids- construction of involutes of square and circle-Drawing of tangent and normal to the above curves-Scales-Basic drawing conventions and standards-Orthographic projection principles- Principal planes-First angle projection- Projection of points. Projection of straight lines (only first angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces.

6+6

UNIT II PROJECTIONS OF PLANES AND SOLIDS

Projection of planes (Polygonal and circular surfaces) inclined to both the principal planes. Projection of simple solids like prisms, pyramids, cylinder, cone, tetrahedron and truncated solids when the axis is inclined to one of the principal planes/ both principal planes by rotating object method and auxiliary plane method.

UNIT III ORTHOGRAPHIC PROJECTIONS, ISOMETRIC PROJECTIONS & FREEHANDSKETCHING 6+6

Orthographic projection of Simple parts from 3D diagram-Principles of isometric projection and isometric view-isometric scale- Isometric projections of simple solids and truncated solids- Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems Free hand sketching of orthographic & Isometric projection

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+6

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other-obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids- Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

.

UNIT V PERSPECTIVE PROJECTION, BUILDING DRAWING AND COMPUTER AIDED DRAFTING 6+6

Perspective projection of simple solids-Prisms, Pyramids and cylinders by visual ray method. Introduction- components of simple residential or office building-specifications-plan and elevation of different types of Residential buildings and office buildings. Introduction to drafting packages and basic commands used in AUTO CAD. Demonstration of drafting packages.

TEXT BOOKS:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. K.V.Natarajan "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.

REFERENCES:

1. K.R.Gopalakrishna, "Engineering drawing",(Vol-I & II combined) Subhas stores, Bangalore,2007.
2. K.Venugopal and V. Prabhu Raja, "Engineering Graphics", New Age International Private limited,2008.
3. Luzzader, Warren.J., and Duff, John.M.,, "Fundamentals of Engineering Drawing with an introduction to Interactive computer graphics for design and production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi,2005.

Special points applicable to University Examinations on Engineering Graphics

1) There will be five questions, each of either or type covering all units of the syllabus.
2) All questions will carry equal marks of 20 each making a total of 100.

BME103	BASIC MECHANICAL ENGINEERING	L	T	P	C
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

- The program educational objectives (PEOs) for the mechanical-engineering program are to educate graduates who will be ethical, productive, and contributing members of society.
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- The ability to apply principles of engineering, basic science, and mathematics to design and realize physical systems, components, or processes

COURSE OUTCOMES (COs)

CO1	an ability to apply knowledge of mathematics
CO2	an ability to apply knowledge of science, and engineering
CO3	Ability to design and conduct experiments, as well as to analyze and interpret data.
CO4	an ability to function on multi-disciplinary teams
CO5	ToprovidebasicKnowledgeofbasicmanufacturingprocess.
CO6	ability to identify, formulate, and solve engineering problems

UNITI ENERGY RESOURCESANDPOWER GENERATION 6

RenewableandNon-renewableresources-solar,wind,geothermal,steam,nuclearandhidepowerplants-Layout, majorcomponentsandworking.ImportanceofEnergystorage,Environmentalconstraintsofpowergeneration usingfossil fuelsandnuclearenergy.

UNITII IC ENGINES 6

Classification,workingprinciplesof petrol anddiesel engines-twostroke andfourstroke cycles,functionsofmain componentsofI.Cengine.Alternatefuelsandemissioncontrol.

UNITIII REFRIGERATION AND AIR-CONDITIONINGSYSTEM 6

Terminologyof Refrigerationand Air-Conditioning,PrincipleofVaporCompression& Absorptionsystem- Layoutoftypicaldomesticrefrigerator-window&Splittyperoomairconditioner.

UNITIV MANUFACTURING PROCESSES 6

BriefdescriptionofMouldmakesandcastingprocess,Metalforming,Classification typesofforging, forging operations, Briefdescription ofextrusion,rolling,sheetforging,anddrawing.Briefdescription ofwelding,brazing andsoldering.Principalmetalcuttingprocessesandcuttingtools,Brief descriptionofCentrelatheandradial drillingmachine.

UNITV MECHANICALDESIGN 6

Mechanicalpropertiesofmaterial-Yieldstrength,ultimatestrength,endurancelimitetc.,Stress-Strain curvesof materials.Stresses inducedinsimpleelements.Factorofsafety-Design ofShaftsandbelts. Typesofbearingsand itsapplications.Introductionto CAD/CAM/CIM&Mechatronics.

TEXTBOOKS:

1. T.J.Prabhuetal, "BasicMechanicalEngineering", SciTechPublications(p)Ltd,2000

REFERENCES:

1. NAGPAL,G.R,"PowerplantEngineering",KhannaPublishers,2004.
2. RAO.P.N,"ManufacturingTechnology",TataMcGraw-HillEducation,2000.
3. Kalpakjian,"ManufacturingEngineeringandTechnology",AdissoWesley Publishers,1995.
4. Ganesan.V,"Internalcombustion Engines",TataMcGraw-HillEducation,2000.
5. C.P.Arora,"RefrigerationandAir Conditioning",TataMcGraw-HillEducation,2001.
6. V.B.Bhandari,"DesignofMachineelements",TataMcGraw-HillEducation,2010.

BCM1L1	**BASIC CIVIL & MECHANICALENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Department of Mechanical Engineering& Civil Engineering				

OBJECTIVES

To provide exposure to the students with hands on experience on various basic Civil & Mechanical Engineering practices.

COURSE OUTCOMES (COs)

CO1	Learn Basic concepts
CO2	Students will get exposure regarding pipe connection for pumps & turbines and to study the joint used in roofs, doors, windows and furniture's.
CO3	Students will get exposure regarding smithy, foundry operations and in latest welding operations such as TIG, MIG, CO2, spot welding etc.,
CO4	Students will get hands on experience on basic welding techniques, machining and sheet metal works.
CO5	Students will get hands on experience on basic machining techniques
CO6	Students will get hands on experience on basic sheet metal techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H	L										
	CO2				H								
	CO3					H	L	L					
	CO4		H				M		L			H	
	CO5		H				M		L			H	
	CO6		H				M		L			H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective	Project/Term Paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

LIST OF EXPERIMENTS

I. CIVILENGINEERINGPRACTICE

Buildings:

a) Studyofplumbingandcarpentrycomponentsofresidentialandindustrialbuildings.Safetyaspects.

PlumbingWorks:

a) Studyofpipelinejoints,itslocationandfunctions:valves,taps,couplings,unions,reducers,elbowsin householdfittings.

b) Studyofpipeconnectionsrequirementsforpumpsandturbines.

c) Preparationofplumbinglinesketchesforwatersupplyandsewageworks.

d) Hands-on-exercise:Basicpipeconnection ofPVCpipes&G.I.Pipes–Mixedpipematerialconnection–Pipe connectionswithdifferentjoiningcomponents.

e) Demonstrationofplumbingrequirementsofhigh-risebuildings.

CarpentryusingHandtoolsandPowertools:

a) Studyofthejointsinroofs,doors,windowsandfurniture.

b) Hands-on-exercise:Woodwork,jointsbysawing,planningandcutting.

c) Preparationofhalfjoints,MortiseandTenonjoints.

II MECHANICALENGINEERINGPRACTICE

Welding:

a) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

BasicMachining:

a) Simple Turning and Taper turning

b) Drilling Practice

SheetMetalWork:

a) Forming&Bending:

b) Modelmaking–Trays,funnels, etc.

c) Differenttypeofjoints

d) Preparationofair-conditioningducts

e) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

Machineassemblypractice:

a) Assembling,dismantlingand Studyofcentrifugalpump

b) Assembling,dismantlingand Studyofairconditioner

c) Assembling,dismantlingandStudyoflathe

Moulding:

a) Mouldingoperationslikemouldpreparationfor gearandstepconepulleyetc

Fitting:

a) FittingExercises–Preparationofsquarefittingandvee–fittingmodels.

Demonstration:

a) Smithyoperations,upsetting,swaging,settingdownandbending.Example–Exercise–Productionofhexagonalheaded bolt.

b) Gaswelding.

REFERENCES:

1. K. Jeyachandran, S. Nararajan& S, Balasubramanian, "A Primer on Engineering Practices Laboratory" ,Anuradha Publications, (2007).
2. T.Jeyapoovan, M. Saravanapandian& S. Pranitha, "Engineering Practices LabManual",Vikas Publishing House Pvt. Ltd. (2006)
3. H. S. Bawa, "Workshop Practice",Tata McGraw–Hill Publishing Company Limited,(2007).
4. A. Rajendra Prasad & P. M. M. S Sarma, "Workshop Practice", SreeSai Publication, (2002).
5. P. Kannaiah& K.L. Narayana, "Manual on Workshop Practice", Scitech Publication, (1999).

BPC 1L1/2L1	**PHYSICS AND CHEMISTRY LABORATORY**											**L**	**T**	**P**	**C**
	Total Contact Hours – 45											0	0	3	1
	Prerequisite – Physics and Chemistry														
	Course Designed by – Department of Physics & Chemistry														
OBJECTIVES: To impart knowledge to the students in practical physics and chemistry															
COURSE OUTCOMES (COs)															
CO1	Students will understand the concept of hall effect														
CO2	Students will understand the concept of semiconductors. .														
CO3	Student will understand the working of spectrometer.														
CO4	Student will able practically understand the chemical reactions.														
CO5	Students will Study the magnetic hysteresis and energy product														
CO6	Students understand the Determination of Band gap of a semiconductor														
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low															
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l		
2	CO1	M	H	M			L		L	L	M	H	M		
	CO2		H	M			L		L	L		H			
	CO3		H	M			L		L			H			
	CO4	M	H	M			L		L	L	M	H	M		
	CO6		H				L		L	H		H			
3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)						
			√												
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016													

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.

4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II- LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argentometry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BEN 201	**ENGLISH II**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – English I				
	Course Designed by – Department of English				

OBJECTIVES

Students will be able to actively participate in group discussions. Students will have Teleph Skills, Giving Directions and Information Transfer

COURSE OUTCOMES (COs)	
CO1	To make the students aware to different kinds of Learner-friendly modes of language variety of self- instructional learning (Computer based)
CO2	To make students comprehend the habit of intelligent Reading as well as Compu based competitive exams glob
CO3	To achieve a reasonably good level of competency in Report Writing.
CO4	To make the students aware to different kinds of Learner-friendly modes of language variety of self- instructional learning (Computer based)
CO5	To achieve a reasonably good level of competency in group discussions

CO6	To achieve a reasonably good level of competency in public speaking												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	M	L	H	L	M			H		M	L	
	CO2			H	L				H		M	L	
	CO3			H	L	M			H		H	L	
	CO4			H	L	M			H		M	L	
	CO5			H	L	M			H		M	L	
	CO6			H	L	M			H		M	L	
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√											
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I ORIENTATION 12

Numerical adjectives - Meanings in context - Same words used as different parts of speech - Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II ORAL SKILL 12

Listening to audio cassettes - C.Ds , News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - and Giving Instructions - Reading Comprehension answering questions. Inferring meaning.

UNIT III THINKING SKILL 12

Self- introduction describing –Group Discussion – Debate –Role play- Telephone- Things- etiquette- Recommendation and Sequencing jumbled sentences to make a suggestions- paragraph-advertisement and notice, Designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV WRITING SKILL 12

Definitions - Compound nouns - Abbreviations and acronyms – (a) business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) Letters to the editor (giving suggestions on an issue) .

UNIT V FORMAL INFORMATION 12

Editing – Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

TEXT BOOK:

1. Meenakshi Raman, Sangeetha Sharma , Technical English for Communication: Principle and Practice, OUP, 2009.

REFERENCE BOOKS:

1. Sumanth , English for Engineers, Vijay Nicole , Imprints Pvt Ltd.2013.
2. Meenakshi Raman and SangeethaSharma , Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binodmishra , Communication skills for engineers and scientists , PHI Learning Pvt Ltd, New Delhi, 2010.

BMA 201	**MATHEMATICS – II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – Mathematics I				
	Course Designed by – Department of Mathematics				

OBJECTIVES

Ability to apply these principles of mathematics in projects and research works.

COURSE OUTCOMES (COs)

CO1	Student shall be able to Solve differential equations, simultaneous linear equations, some special types of linear equations related to engineering.
CO2	Relate the use of mathematics in applications of various fields namely fluid flow, heat fl solid mechanics, electrostatics, etc.
CO3	Ability to test hypothesis
CO4	Find intensity of degree of relationship between two variables and also bring out regres equations.
CO5	Understand to solve matrix problems related to real life problems.
CO6	Formulate mathematical models

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		L									
	CO2		H				H		L	L		M	
	CO3		H				H		L	L		M	
	CO4					M						M	
	CO5										M	M	
	CO6										M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper//Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ORDINARY DIFFERENTIAL EQUATION 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – **Cauchy's** and L**egendre's linear equations** - simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient, divergence and curl –Directional derivatives –Irrotational and solenoidal vector fields – vector integration– **Green's theorem in a plane , Gauss divergence theorem and** S**toke's theorem (**without proofs) – simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) – Harmonic and orthogonal properties of analytic functions – Harmonic conjugate – construction of analytic functions – conformal mapping: W= Z+C, CZ, 1/Z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration – **Statement and application of Cauchy's integral theorem and Cauchy's integral formula** –Taylor and Laurent expansions – Singular points – Residues – Residue theorem –Application of Residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V STATISTICS 12

Mean, Median, Mode – Moments –Skewness and Kurtosis – Correlation – Rank Correlation – Regression –Chi square test for contingency tables.

TEXT BOOK:

1. R.M.Kannan and B.Vijayakumar" Engineering Mathematics–II "2nd Edition, SRB Publication, Chennai 2007.
2. Bali.N.P and Manish Goyal , "Engineering Mathematics", 3rd Edition, Laxmi Publications (P) Ltd, 2008 .
3. Grewal .B/S "Higher Engineering Mathematics", 40th Editon, Khanna Publications, Delhi, 2007

REFERENCES :

1. Ramana.B.V, "Higher Engineering Mathematic", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Gupta SC, and VK.Kapoor, "Fundamentals Mathematical Statistics", 11th Edition, Sultan Chand Sons, New Delhi, 2014.

BPH201	**ENGINEERING PHYSICS -II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING PHYSICS -I				
	Course Designed by – Department of Physics				

OBJECTIVES

- To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications
- To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

COURSE OUTCOMES (COs)

CO1	Understand about properties and advancements of conducting materials.
CO2	Understand the principle and properties semiconducting materials.
CO3	Acquire Knowledge on Magnetic and dielectric Materials.
CO4	To Know about the creation of new materials with novel properties
CO5	To Understand the impact of modern materials in technical uses.
CO6	Learn new engineering materials and its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	I	j	k	l
2	CO1	H											
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L								
	CO5		L	L									
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper//Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications.

TEXT BOOKS:

1. Jayaraman D Engineering Physics II. Global Publishing House, 2014.
2. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
3. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

REFERENCES:

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4 http://ocw.mit.edu/courses/find-by-topic
5 http://nptel.ac.in/course.php?disciplineId=122
6 https://en.wikipedia.org/wiki/Engineering_physics

BCH 201	**ENGINEERING CHEMISTRY-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING CHEMISTRY –I				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving application oriented to required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Students will understand the concepts and further industrial applications of sur chemistry
CO2	To impart knowledge about the Industrial importance of Phase rule and alloys

CO3	To make the students to be conversant with Analytical techniques of chemistry and their importance
CO4	To have an idea and knowledge about the Chemistry of Fuels and
CO5	Understanding of engineering materials
CO6	All about bonding and molecular structures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L		H		H				M	
	CO2		H			H		H					
	CO3	H		L		H		H				M	
	CO4			L		H		H					
	CO5			L		H		H					
	CO6			L		H		H		H		M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper//Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SURFACE CHEMISTRY 9

Introduction **:** Adsorption , absorption , desorption , adsorbent , adsorbate and sorption **–** (definition only) Differences between adsorption and absorption Adsorption of gases on solids **–** factors affecting adsorption of gases on solids **–** Adsorption isotherms **–**Frendlich adsorption isotherm and Langmuir adsorption isotherm Role of adsorbents in catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II PHASE RULE AND ALLOYS 9

Introduction **:**Statement of Phase Rule and explanation of terms involved **–** one component system **–** water system **–** Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) **–** eutectic temperature **–** eutectic composition **–** Pattinsons Process of desilverisation of Lead Alloys: Importance, ferrous alloys **–**nichrome and stainless steel **–** 18/8 stainless steel -heat treatment of steel **–** annealing **–** hardening **–** tempering normalizing **–** carburizing - nit riding . Non- ferrous alloys: Brass and Bronze

UNIT III ANALYTICAL TECHNIQUES 9

Introduction: Type of Spectroscopy - Atomic spectroscopy **–** molecular spectroscopy - Explanation IR spectroscopy **–** principles **–** instrumentation (block diagram only) **–** applications - finger print region UV-visible spectroscopy **—** principle **–** instrumentation (block diagram only) **–** Beer-**Lambert's law**- **–** estimation of iron by colorimetry**–** Atomic absorption spectroscopy- principle - instrumentation (block diagram only) - estimation of Nickel by Atomic absorption spectroscopy

Flame photometry– principles – instrumentation (block diagram only) - estimation of sodium ion by Flame photometry

UNIT IV FUELS 9

Introduction **:** Calorific value – types of Calorific value - gross calorific value – net calorific value Analysis of Coal –- Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only) Flue gas analysis – importance - Orsat apparatus

UNIT V ENGINEERING MATERIALS 9

Introduction: Refractory's – classification – acidic, basic and neutral refractory's – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Manufacture of Refractory's: alumina bricks and Magnesite bricks, Abrasives – natural and synthetic abrasives Natural type : Siliceous - quartz ; Non –siliceous – diamond Synthetic Abrasives : silicon carbide and boron carbide. Lubricants: Liquid lubricants - Properties – viscosity index, flash and fire points, cloud and pour points, oiliness) Solid lubricants – graphite and molybdenum sulphide

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub. Co.Ltd, New Delhi,(2008)
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Spectroscopy

BFR 201	**FRENCH**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

Language gives access and insights into another culture. It is a fundamental truth that cult define themselves through languages.

COURSE OUTCOMES (COs)

CO1	Introduce the basics of the language to beginners
CO2	Understand a dialogue and dialogue presentation
CO3	To develop their knowledge as well as their communicative skills so as to be abl respond in simple everyday contexts.

CO4	Synchronies I includes documents which initiate the learners to another world, ano culture and which acclimatize them to the authentic use of the French language thro the exploitation of written and iconographic documents. The Indian context has b used.
CO5	Grammatical and lexical notions as well as activities required for communication learnt by the students.
CO6	Interpreting skills and confidence in the language.
CO6	Interpreting skills and confidence in the language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper//Seminar/ Internship (PR)
		√							

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INTRODUCTION
8

At the airport: Savoir– faire: exchanging greetings, self introduction, introducing another, welcoming someone, identifying someone - Grammar: verbs ‘to be’, ‘to call oneself’, subject pronouns, interrogation

UNIT II GRAMMAR **8**

At the University: Savoir-faire: enquiring after one’s welfare, taking leave, expressing appreciation -Grammar: definite & indefinite articles, gender of nouns, adjectives, present tense of regular ‘er’ verbs, ‘to have’, ‘to learn’, negation, irregular verbs

UNIT IIICONVERSATION **8**

At the café: Savoir –faire: speaking about one’s likes, giving information, expressing admiration, asking information about someone - Grammar: Interrogative adjectives, irregular verbs, possessive and interrogative adjectives

UNIT IV PROPOSAL WRITING **7**

At the beach: Savoir faire: proposing an outing, accepting/ refusing the proposal - Grammar: singular & plural, indefinite pronoun, demonstrative adjectives, negation, irregular verbs

UNIT V FORMAL LETTERS **7**

A concert: Savoir –faire: inviting, accepting, expressing one's inability to accept an invitation

UNIT VI REGULAR & IRREGULAR VERBS **7**

Grammar: Present tense of more irregular verbs, contracted articles, future tense, interrogative adverbs, **At Nalli's** Savoir- faire: asking the price of an article, protesting against the price, Grammar: possessive adjectives, Exclamative adjectives, imperative tense

REFERENCES:

1. Course Material: Synchronie I –Méthode de Français
2. Madanagobalane -Samita Publications, Chennai, 2007

BGM 201	**GERMAN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

At the end of this course, students shall be able to obtain good knowledge of the language, to r write and speak German, whereby the emphasis is laid on speech.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand German lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper//Seminar Internship (PR)
		√							

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

Course structure:

A. German Language (speaking, reading, writing, grammar and test)
B. Life in Germany (shopping, restaurant, doctor, government, bank, post)
C. The German Way (introduction, doing business, conversation, meetings, dining)
D. Germany (Culture, Climate)

UNIT I PRONOUNCIATION 9

Welcome: Introduction to the Language, Spelling and Pronunciation (The alphabets and numbers) Greetings, ordering, requesting, saying thank you - Grammar **– the article "the", conjugation** of verbs

UNIT II SELF INTRODUCTION 9

Shopping - Grammar **–** adjectives, endings before nouns, practice. Self Introduction

UNIT III TRAINING 9

Addresses, Occupations, Studies - Grammar - **'to be', the definite/indefinite** articles, individual Training

UNIT IV ORAL 9

Leisure Time, Sports, Hobbies - Grammar **–** position of a verb in a main clause , oral practice

UNIT V NARRATION 9

At a Restaurant, Food and Drink - Grammar **–** the personal pronoun in the Nominative and Accusative, Narrating an event

RESOURCES:

1. Sprachkurs Deutsch 1 (Verlag Diesterweg), New Delhi Learning Centre

BJP 201	**JAPANESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Japanese language, Japanese culture and heritage
To impart knowledge Japanese lifestyle.
To give sufficient exposure to develop basic conversational skills.

COURSE OUTCOMES (COs)	
CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Japanese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper/ Seminar/ Internship	
		√											
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I CULTURAL HERITAGE 9

Introduction-history and origin of Japanese language-Japan and its cultural heritage-Self introduction-counting numbers (1-100)-time-conversation with the use of audio devices, grammar– usage of particles wa, no, mo and ka

UNIT II USAGE 9

Greetings, seasons, days of the week and months of the year-numbers (up to 99,999)-grammar–usage of kore, sore, are, kono, sono, ano, koko and kochira, arimasu and imasu-i-ending and na-ending adjectives-use of audio and drills for practice

UNIT III ORAL 9

Asking the price–associated vocabulary-usage of particles ni, ga and ne- use of audio and drills for practice-Introduction to basic Kanji characters- use of audio and drills for practice

UNIT IV ART AND CULTURE 9

Family relationships- colours-Kanji (numbers) and festivals of Japan-religion-Japanese art and culture-ikebana, origami-introduction to hiragana- use of audio and drills for practice

UNIT V DRILLS AND PRACTICE 9

Vocobulary associated with directions-asking way-particles – e, de, mo, koko, soko, asoko, doko, nani, mae, ushiro, ue, shita- use of audio and drills for practice-introduction to katakana

TEXT BOOKS

1. Japanese Hiragana and Katakana for beginners, Timothy G. Stout, 2011
2. Genki I: An integrated course in elementary Japanese, Eri Banno and Yuko Ikeda, 2011

REFERENCE BOOKS

1. Japanese Reader collection Volume I, Yumi Boutwell and Clay Boutwell, Kotoba books, 2013
2. Living Language Japanese Complete Edition beginners through advanced course, Living Language, 2012

BKR 201	KOREAN	L	T	P	C
	Total Contact Hours - 45	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Korean language, Korean culture and heritage

To impart knowledge on Korean lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Korean lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I PLANNING 9

Asking/giving reasons for studying Korean, making plans for the holiday, writing letters, describing past travel experiences and future travel plans, shopping in a grocery store, shopping in electronics store, storytelling Grammar: would like to (do), want to (do), construct future tense.

UNIT II MODIFIERS 9

Asking about feelings, asking about problems and giving advice, brief introductions - Grammar: Noun modifier, please try doing (something), irregular adjective/verb

UNIT III PLACING ORDERS 9

Asking about hobbies, asking about abilities (sports), job requirements, Ordering things for delivery, ordering a meal at a restaurant - Grammar: Sentence ending for the honorific form, please do something for me, have tried (something),

UNIT IV DESCRIPTIONS 9

Asking about evening plans, making plans with others, making preparations - Asking about rooms, describing your room to your classmates, describing your house. Grammar: to know/not know how to do something, must (do), have to (do), should,

UNIT V GRAMMAR 9

Describing your plans and giving reasons, cancelling appointments. Grammar: Shall we~? / Should we~?, with, and, irregular verbs/adjective, so, because, cannot, intend to, plan to, or hope to, (more) than, the most, tag question/is n't it? ,will (do)

COURSE MATERIAL:

Korean for Non-Native Speakers (Student Book 1B) Korean Language Education Center, Sogang University

BCN 201	**CHINESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Chinese language, Chinese culture and heritage

To impart knowledge on Chinese lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Chinese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							

	4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT 1 RISE OF DIALECTS 9

History, Origins, Old and middle Chinese, Rise of northern dialects

UNIT IIVARIETIES 9

Influences 3 Varieties of Chinese. 1.Classification 2.Standard Chinese and 3.Nomenclature

UNIT III CHARACTERS 9

Chinese characters, Homophones, Phonology

UNIT IV TRANSCRIPTIONS 9

Tones, Phonetic transcriptions, Romanization, Other phonetic transcriptions

UNIT V GRAMMAR 9

Grammar and morphology, Vocabulary, Loanwords, Modern borrowings and loanwords

REFERENCES:

1. Hannas, William C. (1997), Asia's Orthographic Dilemma, University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-1892-0" 978-0-8248- 1892-0.
2. Qiu, Xigui (2000), Chinese Writing, trans. Gilbert Louis Mattos and Jerry Norman, Society for the Study of Early China and Institute of East Asian Studies, University of California, Berkeley, ISBN HYPERLINK http://en.wikipedia.org/wiki/Special:BookSources/978-1-55729-071-7,978-1-55729-071-7.
3. Ramsey, S. Robert (1987), The Languages of China, Princeton University Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-691-01468-5" 978-0-691-01468-5.
4. Schuessler, Axel (2007), ABC Etymological Dictionary of Old Chinese, Honolulu: University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-2975-9"978-0-8248-2975-9.
5. R. L. G. " Language borrowing Why so little Chinese in English?" The Economist. June 6, 201

BME 202	**ENGINEERING MECHANICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – Engineering Mathematics I , II, Engg. Physics				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES:	To understand the concept of basic engineering mechanism
COURSE OUTCOMES (COs)	
CO1	Students will understand the concepts of engineering mechanics
CO2	Students will understand the vectorial representation of forces and moments
CO3	Students will gain knowledge regarding center of gravity and moment of inertia and apply them for practical problems.

CO4	Students will gain knowledge regarding various types of forces and reactions and tom draw free body diagram to quicker solutions for complicated problems.
CO5	Student will gain knowledge in solving problems involving work and energy
CO6	Student will gain knowledge on friction on equilibrium and its application.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	H		H		L		H	H	
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/Seminar// Internship (PR)
				√					

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I BASICS AND STATICS OF PARTICLES 12

Introduction - Units and Dimensions - Laws of Mechanics – **Lame's theorem, Parallelogram and triangular Law** of forces – Vectors –Vectorial representation of forces and moments – Vector operations on forces - Coplanar Forces – Resolution and Composition of forces – Resultant of several concurrent forces - Equilibrium of a forces – Forces in space - Equilibrium of particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples– Scalar components of a moment – **Varignon's theorem** - Equilibrium of Rigid bodies in two dimensions -Equilibrium of Rigid bodies in three dimensions.

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Determination of areas – First moment of area and the Centroid of standard sections – T section, I section, Composite figures, Hollow section – second moments of plane area – Rectangle, triangle, circle - T section, I section, Hollow section – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Basic concept of Mass moment of inertia.

UNIT IV FRICTION 12

Frictional force – Laws of Coloumb friction – Cone of friction – Angle of repose – Simple contact friction – Sliding of blocks – Wedge friction - Ladder friction – Screw Jack – Belt friction - Rolling resistance.

UNIT V DYNAMICS OF PARTICLES 12

Displacements, Velocity and acceleration, their relationship – Relative motion – Relative acceleration – Curvilinear motion of particles – **Newton's law** – work energy equation – impulse and Momentum – Impact of
elastic bodies.

TEXT BOOK:

1. Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers: Vol. 1 Statics and vol. 2 Dynamics**"**, McGraw-Hill International Edition, 2013.
2. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2011.

REFERENCES :

1. Kumar, K. L Kumar, V., Engineering Mechanics, Tata McGraw – Hill, New Delhi, 2010
2. Palanichamy, M.S., Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw - Hill, 2013.
3. Timoshenko, and Young, Engineering Mechanics, Tata McGraw-Hill, New Delhi, 2013.
4. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition – Pearson Education Asia Pvt., Ltd., 2006.

BEE 201	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Engineering Mathematics, Engineering Physics-I & II				
	Course Designed by – Department of Electrical & Electronics Engineering				
OBJECTIVES: To understand the laws of electrical engineering.					
COURSE OUTCOMES (COs)					
CO1	Students will gain knowledge regarding the various laws and principles associated with electrical systems.				
CO2	Students will gain knowledge regarding electrical machines and apply them for practical problems.				
CO3	Students will gain knowledge regarding various types semiconductors.				
CO4	Student will gain knowledge digital electronics.				
CO5	Student will gain knowledge on electronic systems.				
CO6	Students will acquire knowledge in using the concepts in the field of electrical engg. projects and research.				
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low					

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L			
	CO2		H	M			L		L	L			
	CO3		H	M			L		L				
	CO4	M	H	M			L		L	L			
	CO5	M	H	M			L		L				
	CO6		H				L		L	H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
				√					

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I ELECTRIC CIRCUITS 6

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem –Thevenin's and Norton's Theorem - Problems.

UNIT IIELECTRICAL MACHINES 6

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT III BASIC MEASUREMENT SYSTEMS 6

Introduction to Measurement Systems, Construction and Operating principles of PMMC, Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method **–** and Energy meter.

UNIT IV SEMICONDUCTOR DEVICES 6

Basic Concepts of semiconductor devices **–** PN Junction Diode Characteristics and its Applications **–** HWR, FWR **–**Zener Diode **–** BJT (CB, CE, CC) configuration & Characteristics.

UNIT V DIGITAL ELECTRONICS6

Number system **–** Logic Gates **–** Boolean Algebra**–** De-**Morgan's Theorem –** Half Adder & Full Adder **–** Flip Flops.

TEXT BOOKS:

1. N.Mittal "Basic Electrical Engineering". Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
3. Jacob Millman and Christos C-Halkias, "Electronic Devices and Circuits", Tata McGraw

Hill

REFERENCE BOOKS:

1. Edminister J.A. "Theory and Problems of Electric Circuits" Schaum's Outline Series. McGrawHill Book Compay, 2nd Edition, 1983.
2. Hyatt W.H and Kemmerlay J.E. "Engineering Circuit Analysis", McGraw Hill Internatinal Editions, 1993.
3. D. P. Kothari and I. J. Nagrath" Electric Machines"Tata McGraw-Hill Education, 2004
4. Millman and Halkias, "Integrated Electronics", Tata McGraw Hill Edition, 2004.

BCS 2L2	**COMPUTER PRACTICE LABORATORY**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									0	0	3	1
	Prerequisite – Fundamentals of Computer												
	Course Designed by – Department of Computer Science &Engineering												
OBJECTIVES: To impart basic computer knowledge													
COURSE OUTCOMES (COs)													
CO1	Demonstrate major algorithms and data												
CO2	Implementation of array operations												
CO3	Implementation of binary tree.												
CO4	Implementation of linked list												
CO5	Students will able to do analyse data using spread sheet												
CO6	Student will able to understand the basics of C programming.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	H		H		L		H	H	H
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
					√								
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

A) WORD PROCESSING **6**

Document creation, Text manipulation with Scientific Notations. Table creation, Tabl formatting and Conversion. Mail merge and Letter Preparation. Drawing-Flow Chart

B) SPREAD SHEET **9**

Chart-Line Xy Bar and Pie – Formula-Formula Editor-Spread sheet-Inclusion of Object, Picture and Graphics Protecting the document and sheet-Sorting and Import/Export features.

C) SIMPLE C PROGRAMMING* **15**

Data types, Expression Evaluation, Condition Statement. Arrays structures and Unions – Functions

D) SIMPLE C++PROGRAMMING **15**

-Classes and Objects
-Constructor and Destructor

***For Programming exercises Flow chart and Pseudo code are essential.**

BEE2L1	**BASIC ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Basic Electrical and Electronics Engineering				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To enhance the student with knowledge on electrical and electronic equipments

COURSE OUTCOMES (COs)

CO1	Students will able to handle basic electrical equipments.
CO2	Students will able to do staircase wiring.
CO3	Students will able to understand domestic wiring procedures practically.
CO4	Student will able to assemble electronic systems.
CO5	Students will understand all the fundamental concepts involving electrical engineering
CO6	Students will understand all the fundamental concepts involving electronics engineering

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	
	CO5	M	H	M			L		L		M	H	
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

I LIST OF EXPERIMENTS FOR ELECTRICAL ENGINEERING LAB

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

II LIST OF EXPERIMENTS FOR ELECTRONICS ENGINEERING LAB

1. Study of electronic components and equipments.
   a. Resistor colour coding using digital multi-meter.
   b. Assembling electronic components on bread board.
2. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

BPC 1L1/2L1	**PHYSICS AND CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				

OBJECTIVES: To impart knowledge to the students in practical physics and chemistry

COURSE OUTCOMES (COs)

CO1	Students will understand the concept of hall effect
CO2	Students will understand the concept of semiconductors. .
CO3	Student will understand the working of spectrometer.
CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M

	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II- LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argentometry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BMA301	MATHEMATICS – III	L	T	P	C
	Total Contact Hours –75	4	0	0	4
	Prerequisite – Mathematics II				

	Course Designed by – Dept of Civil Engineering

OBJECTIVES

1. To introduce Fourier series analysis this is central to many applications in engineering apart from its use in solving boundary value problems.
2. To acquaint the student with Fourier transform techniques used in wide variety of situations.
3. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes
4. To develop Z transform techniques for discrete time systems.

COURSE OUTCOMES (COs)

CO1	To learn the problem solving methods in linear differential equations
CO2	To learn Dirichlet's condition and operations using Fourier series
CO3	To have a clear understanding about 2nd order equations and wave equations
CO4	Properties of Laplace transform and problem solving using it
CO5	Properties of Fourier transform and problem solving using it

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M											
	CO2		M	H		H							
	CO3		M		H								
	CO4	H			M								
	CO5	H			M	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT 1 PARTIAL DIFFERENTIAL EQUATIONS 9+6

Formation – Solution of Standard types of first order equations – Lagrange's equation – Linear partial differential equations of second and higher order with constant coefficients

UNIT II FOURIER SERIES 9+6

Dirichlet's conditions – General Fourier series- Half range sine and cosine series – Parse Val's identity – Harmonic analysis

UNIT III BOUNDARY VALUE PROBLEMS 9+6

Classification of second order linear partial differential equations – solution of one – dimensional wave equations, one dimensional heat equations.

UNIT IV LAPLACE TRANSFORMS 9+6

Transforms of simple functions – basic operational properties – transforms of derivatives and integrals – initial and final value theorems – inverse transforms – convolution theorem – periodic functions – applications of Laplace transforms for solving linear ordinary differential equation up to second order with constant coefficients and simultaneous equations of first order with constant coefficients.

UNIT V FOURIER TRANSFORMS 9+6

Statement of Fourier integral theorem – Fourier transform pairs – Fourier sine and cosine transforms – properties – transforms of simple functions – convolution theorem – Parse Val's identity

TEXT BOOKS:

1. Kandasamy, P., Thilakavathy, K. and Gunavathy.K. "Engineering Mathematics ", Vol II& III (4^{th} revised edition) S Chand and co. , New Delhi, 2001.
2. Narayanan.S , Manicavachangam pillay ,.T.K., Ramanaiah, G. "Advanced Mathematicsfor Engineering Students " Vol II & III (2^{nd} Edition), S.Viswanathan (Printers and Publishers Pvt Ltd) 1992.
3. Venkatraman, M.K. "Engineering Mathematics" Vol III – A&B , 13^{th}Edition National Publishing Company , Chennai 2002

BCE301	APPLIED MECHANICS	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engineering Mechanics				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To learn fundamental concepts of Stress, Strain and deformation of solids with applications to bars, beams and thin cylinders.
2. To know the mechanism of load transfer in beams, the induced stress resultants and deformations.
3. To understand the effect of torsion on shafts and springs.
4. To analyze a complex two dimensional state of stress and plane trusses

COURSE OUTCOMES (COs)

CO1	Toapply the fundamental concepts of stress and strain in the design of various structural components and machines
CO2	Toanalyze and design shafts to transmit required power
CO3	To analyze about the force in member Truss with different methods
CO4	To determine the bending, shear stresses and deflection produced in a beam subjected to system of loads
CO5	To determine stresses due to impact and suddenly applied loads

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		M	M					L			
	CO2	H	M	M	M	H				L			
	CO3	H	M	M	M					L			
	CO4	H		M	M					L			
	CO5	H		M	M	H				L			

3	Category	Humanities & Social Studies	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SIMPLE STRESSES AND STRAINS 12

Tension, compression and shear stress - Hook's law - simple problems -compound bars - Relationship between elastic constants - Thermal stresses.

UNIT II PRINCIPAL STRESSES& TORSION 12

Combined stresses – Principles stress and principal planes – Mohr's circle - stresses in thin cylinders and shells. Theory of torsion – Strain energy in torsion – Torsion of circular shafts – shear stresses due to torsion of Closed and Open coiled helical springs.

UNIT III ANALYSIS OF PLANE TRUSSES 12

Stability and Equilibrium of plane frames, Perfect Frames, Types of trusses – Analysis of forces in truss members - Method of joints – Methods of sections – Tension coefficient method – Graphical method.

UNIT IV BEAMS & BENDING 12

Beams and support conditions - Types of supports - Shear force and bending moment – Dynamics for simply supported beams, cantilevers and overhanging beams with concentrated and / distributed loads. Theory of simple bending – bending stress distribution – shear stress distribution - leaf springs.

UNIT V STRAIN ENERGY 12

Strain energy due to axial force, bending moment, flexural and torsional shear – Resilience stresses due to impact and suddenly applied loads.

TEXT BOOKS:

1. Ramamurtham S & Narayanan R, Strength of Materials , Dhanpat Rai Publication 2008
2. Bansal R.K, Engineering Mechanics and Strength of Materials, Laxmi Publications (P) Ltd. New Delhi 2010

REFERENCE:

1. Egor P, Popov, Introduction of Mechanics of Solids,1998.
2. Ryder G.H. Strength of Materials, Macmillan India,2002.
3. Khurmi R.S, A Text Book of Engineering Mechanics S.Chand& Co, 2012.

4. Srinath L S, Advanced Mechanics of Solids, Tata McGraw Hill Co, 2009.
5. Jain O.P. &.Jain B.K, Theory and Analysis of Structures Vol I & II 2012,2011

BCE302	SURVEYING – I	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES: To introduce the principles of various surveying methods and applications to Civil Engineering projects.

COURSE OUTCOMES (COs)

CO1	Carry outpreliminary surveying in the field of civil engineering applications
CO2	Plan a survey, taking accurate measurements, field booking, plotting and adjustment of traverse using various conventional instruments
CO3	Plan a survey for applications such as road alignment and height of building.
CO4	Take horizontal and vertical angles precisely by an optical distance measurement using Theodolite.
CO5	Set out curves, buildings, culverts and tunnels

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M		M	H							M
	CO2		H			M							
	CO3	H				H							H
	CO4	H			M								
	CO5					M							H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INTRODUCTION AND CHAIN SURVEYING 9

Definition – Principles – classification-field & office work-scales-conventional signs – survey instruments – care & adjustment – ranging & chaining – Reciprocal Ranging – setting perpendiculars – well- conditioned triangles – traversing – plotting – enlarging & reducing figures.

UNIT II COMPASS & PLANE TABLE SURVEYING 9

Prismatic compass – Surveyors compass - bearing systems & conversions- local attraction-magnetic declination – Dip – Traversing – Plotting – adjustment – Plane table Surveying -

Methods of Radiation – intersection, Resection – traversing – Adjustments- Errors in plane tabling.

UNIT III LEVELING APPLICATION 9

Level line-Horizontal line-levels & Staves – sprit level – sensitiveness-bench marks – temporary and permanent adjustments– fly & check leveling – Booking – reduction – Curvature and refraction reciprocal leveling – longitudinal and cross sectioning – plotting – calculation of areas and volumes – contouring – methods – characteristics – and uses of contours – plotting-earth work volume – capacity of reservoirs.

UNIT IV THEODOLITE SURVEYS 9

Thedolite-vernier and microptic-description and uses – temporary and permanent adjustments of vernier transit – Horizontal angles – vertical angles – closing error and distribution – Gale's. table- Omitted measurement

UNIT V ENGINEERING SURVEYS 9

Reconnaissance-preliminary and location surveys for Engineering Projects – Layout – Setting out work- Route surveys for highways, railways and water ways – curve ranging – Horizontal and vertical curves – Simple Curves – setting with chain and tapes, tangential angles by theodolite, double theodolite-compound and reverse curves - Transition curves-functions and requirements-sight distances- mine surveying- instruments – tunnels correlation of underground and surface surveys .

TEXT BOOKS:

1. Punmia B.C."Surveying" Vols I and II & III Laxmi Publications, 1999.

REFERENCE:

1. Kanekar T.P."Surveying and Levelling" VOls. I and II, united book corporation, Pune, 1994.
2. Chandra A.M, "Plane Surveying and Higher Surveying", New Age International (P)
3. Limited, Publishers, Chennai, 2002.
4. Heribert Kahmen and wolfgang Faig "surveying" Walter de Gruyter, 1995
5. Bannister A and Raymonds. "Surveying" ELBS. Sixth Edition, 1992.

BCE303	BUILDING CONSTRUCTION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To introduce students to various materials and methods commonly used in civil engineering construction and their properties.
2. To give a detailed explanation of the tests performed on the fresh concrete and the harden concrete.
3. To give a vision of the basics to be followed in the construction site .

COURSE OUTCOMES (COs)													
CO1	To learn about the different manufacturing process of the cement												
CO2	To know the types of the paint, Plastering, GFRP and geotextile												
CO3	To have a clear understanding about foundation and its type, Plate load test												
CO4	About Water supplying, and drainage in the construction site												
CO5	To know about Thermal insulation, water proofing, sound acoustic treatments												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		M		H	M	M		M	M	M		
	CO2	H		M	H	M	M			M			
	CO3	H		H	M	M			M	H	M		
	CO4	L	M			L							
	CO5	M		H	L	M			L	L	L		
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I CEMENT & CONCRETE 9

Manufacture of cement – Hydration of cement – Test on coarse and fine aggregates tests on cement, types of cement, tests on fresh & hardened concrete.

UNIT II PRESERVATIVES & SPECIAL MATERIALS 9

Plastering - types – Paints – varnishes – distempers – wall cladding. Polymers (PVC Sheets, Pipes GFRP) ceramics & Clay Products - Refractory – Special Concrete - FRC, ferrocement& polymeric concrete – geotextiles.

UNIT III SUBSTRUCTURES & FOUNDATION 9

Soil Exploration - investigation report. Plate load test – Bearing Capacity of Soil – Improving the bearing Capacity – Types of Foundations – raft Foundation – pile, Pier & caisson- basements – diaphragm walls.

UNIT IV BUILDING SERVICES - I 9

Electric Wiring – Water Supply – Drainage- Air Conditioning – Ventilation – ramps, Escalators, Lifts, Stairs.

UNIT V BUILDING SERVICES II 9

Water Proofing - Thermal Insulation - Termite proofing - Acoustic Treatment (Sound Conditioning) - Fire Protection - Intelligent Buildings

TEXT BOOKS:

1. Arora S.P.and Bindra S.P. "Building Construction, Planning Techniques and Materials of Construction". DhanapatRai and Sons.

REFERENCE:

1. Chudley R "Construction Technology", (Vol.I,II,III,&IV) ELBS / Longman (2nd Edition).
2. Jha J and Sinha S.K. "Construction and Foundation Engineering" Khanna Publishers, 1993.

BCE304	FLUID MECHANICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engineering Mechanics				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To understand the basic properties of the fluid, fluid kinematics, fluid dynamics and to analyze and appreciate the complexities involved in solving the fluid flow problems.
2. To introduce the basics of hydrostatic forces involved in fluid mechanics and also to acquaint the students to learn about the theorems on Pascal's law and buoyancy
3. To understand the various types of fluid flow and to practice the problems based on Bernoullis equations and its applications
4. To provide basic ideas on the boundary layer theorem and its classification along with problems underlying the subjects.
5. To develops similitude and model studies for the basics of fluid mechanics with buckinghum pi theorem as the basic concept.

COURSE OUTCOMES (COs)

CO1	To learn about the basics of fluid mechanics and various properties of fluids
CO2	To learn about the various forces on plane and curved surfaces and the concepts of buoyancy
CO3	To have a clear understanding about fluid kinematics and dynamics
CO4	To study the basics of boundary layer flow and flow through pipes
CO5	To study about various models like distorted models and various dimensionless numbers

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M						L		
	CO2						H		L			M	
	CO3				H					M			
	CO4						M			H	L		
	CO5					M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I DEFINITIONS &FLUID PROPERTIES 9

Definitions – Fluid and Fluid Mechanics – Dimensions and units – Fluid properties continuum Concept of system and control volume.

UNIT II FLUID STATICS 9

Pascal's law and hydrostatic equation – Forces on plane and curved surfaces – Buoyancy-Pressure measurement.

UNIT III FLUID DYNAMICS & KINEMATICS 9

Fluid Kinematics - Stream, steak and path lines, Classification of flows-continuity equation, Stream and Potential functions, Flow nets, Velocity measurement. Euler and Bernoulli's equations- Application of Bernoulli's equation-Discharge measurement-laminar flows through pipes and between plates – Hagen Poisuille equation – Turbulent flow, DancyWeisbach formula - moody Diagram – Momentum Principle- Impact of jets on plane and curved plates.

UNIT IV BOUNDARY LAYER AND FLOW THROUGH PIPES 9

Definition of boundary layer – Thickness and classification - Displacement and momentum thickness. Development of laminar and Turbulent flows in circular pipes, Major and Minor losses of Flow in Pipes in series and in parallel pipe network.

UNIT V SIMILITUDE AND MODEL STUDY 9

Dimensional analysis – Rayleigh's method – Buckingham PI-Theorem- Similitude and Models – Scale effect and distorted models.

TEXT BOOKS:

1. Kumar K.L "Engineering Fluid Mechanics", Eurasia Publishing House (P) Ltd., New Delhi.

REFERENCES :

1. Streeter, Victor, L, and Benjamin., "Fluid Mechanics", McGraw-Hill Ltd., 1998
2. Natarajan M.K. "Principles of Fluid Mechanics", Agencies, Vidayal Karuppur, Kumbakonam, 1995.
3. Fox Robert W. and McDonald. Man T., Introduction Fluid Mechanics", John Wiley & Sons,1995.

BCE305	**ENGINEERING EARTH SCIENCE**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	**3**	**0**	**0**	**3**
	Prerequisite – +2 level science				

	Course Designed by – Dept of Civil Engineering

OBJECTIVES

1. To understand the importance of geological knowledge such as earth, earthquake and to apply this knowledge in projects such as dams, tunnels, bridges, roads, airport and harbor as well as to choose types of foundations.
2. An ability to function on multi-disciplinary teams.
3. Graduates will be capable of utilizing their backgrounds in engineering and earth science to provide solutions to engineering problems within the context of the natural world.
4. Areas of geological engineering practice might include fluid flow and contaminant transport in the subsurface; geo-mechanics (i.e., the behavior of earth materials), geo-engineering (i.e., design with earth materials); and discovery, development, and utilization of energy resources.

COURSE OUTCOMES (COs)

CO1	To understand the role of geology in the design and construction process of underground openings in rock
CO2	Be able to apply geologic concepts and approaches on rock engineering projects.
CO3	Be able to identify and classify rock using basic geologic classification systems.
CO4	Be able to use the geologic literature to establish the geotechnical framework needed to properly design and construct heavy civil works rock projects.
CO5	To assign projects which test student knowledge and application of intact rock and rock mass properties in geotechnical engineering

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			H		H	H		M			
	CO2	H			H		H	H		M			
	CO3	H			H		H	H		M			
	CO4	H			H		H	H		M			
	CO5	H			H		H	H		M			

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I GENERAL GEOLOGY 9

Geology in Civil Engineering - Branches of geology - Earth Structure and Composition - Elementary knowledge on continental drift and plate tectonics. Earth processes - Weathering - Work of rivers, wind and sea and their engineering importance – origin, occurrence of earthquake- Mode of occurrence - prospecting –Ground water - Importance in civil engineering.

UNIT II MINERALOGY 9

Elementary knowledge on symmetry elements of crystallographic systems - physical properties of minerals - study of the following rock forming minerals - Quartz family. Feldspar family, Augite, Hornblende, Biotite, Muscovite, Calcite, Garnet - properties, process of formation of all minerals - Coal and Petroleum - Their origin and occurence in India.

UNIT III PETROLOGY 9

Classification of rocks - Distinction between Igneous, Sedimentary and Metamorphic rocks. Description – occurrence, properties and distribution of following rocks. Igneous rocks - Granite, Syenite, Diorite, Gabbro, Pegmatite, Dolerite and Basalt. Sedimentary rocks - sandstone, Limestone, Shale, Conglomerate and breccia. Metamorphic rocks - Quartzite, Marble, Slate, Gniess and Schist.

UNIT IV STRUCTURAL GEOLOGY AND ROCK MECHANICS 9

Attitude of beds - Outcrops - Geological maps - study of structures - Folds, Faults and Joints - Their bearing on Engineering Construction -Rock mechanics - physical properties and mechanical properties of rocks – porosity – permeability - density – strength – hardness – elasticity – plasticity - dynamic property of rocks - types of wave theory – factors influencing wave velocity - static and dynamics moduli of elasticity – grouting.

UNIT V GEOLOGICAL AND GEOPHYSICAL INVESTIGATION IN CIVIL ENGINEERING 9

Site investigations - Geological methods - Exploration techniques - geophysical methods – Seismic and electrical methods – direct penetration – core boring – logging of cores – geological condition necessary for construction of dams – tunnels – building – Road cutting.

TEXT BOOKS:

1. Parbin Singh, “Engineering and General Geology ", Katson Publication House.
2. P. C. Varghese, “Engineering Geology for Civil Engineers”. PHI Learning Pvt. Ltd.,

REFERENCES:

1. Legeet, " Geology and Engineering ", McGraw Hill Book Company, 1998.
2. Blyth, " Geology for Engineers ", ELBS, 1995.

BCE3L1	SURVEYING PRACTICAL – 1	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Survey I				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES: To understand and posses the knowledge about field techniques in Surveying

COURSE OUTCOMES (COs)

CO1	To know how to do chain surveying, ranging and its importance
CO2	Study about types of compass, local attractions and its errors
CO3	To study plane table surveying and its various methods of finding inaccessible points
CO4	To study about leveling and its types, LS and CS sections of alignment

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M									
	CO2	M	H	M									
	CO3	M	H	M									
	CO4	M	H	M									
	CO5	M	H	M									
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

LIST OF EXPERIMENTS

1. a) Simple chain survey - problems involving instruments such as optical and prism Square - cross staff.
   b) Overcoming obstacles in chaining and ranging.
2. a) Measurement of bearing of survey lines by prismatic compass.
   b) Running closed and open compass traverse.
   c) Plotting and Adjustments of traverse.
3. a) Plane table survey of building or a park or a road by different methods.
   b) Field solution of two and three point problems.
4. Problems in leveling.

BCE3L1	**STRENGTH OF MATERIALS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**0**	**0**	**3**	**2**
	Prerequisite – Engineering Mechanics				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

To expose the students to the testing of different materials under the action of various forces and determination of their characteristics experimentally.

COURSE OUTCOMES (COs)

CO1	Tostudy the failure due to tensile force subjected to a material
CO2	Tostudy the failure due to shear force subjected to a material
CO3	To study hardness properties of materials and its types
CO4	To study impact intensity of materials and its properties
CO5	To study ductility properties of materials
CO6	To study fatigue properties of materials

CO7	To study the deflections in springs												
CO8	To study the behavior of different types of columns												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H			M							
	CO2	M	H			M							
	CO3	M	H			M							
	CO4	M	H			M							
	CO5	M	H			M							
	CO6	M	H			M							
	CO7	M	H			M							
	CO8	M	H			M							
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

LIST OF EXPERIMENTS

I.**TESTS ON STEEL**

1. Tension Test to find yield stress, ultimate stress, nominal and actual breaking stress and % age elongation and reduction in area of cross section, work done in breaking the specimen and calculation of Young's modulus using different extensometers (test on mild steel, High tensile steel Rods & flats).
2. Shear test: Double Shear
3. Hardness test Vicket, Brunell, and Rockwell.
4. Impact Test using Charpy and Izod Testing machines
5. Cold Bend Test
6. Ductility Test: sheet Ductility, Reverse bending on works.
7. Fatigue Test.

II **TESTS ON TIMBER**:

Compression test both parallel and perpendicular to the grains, deflection

III **OTHER TESTS:**

1. Springs: Leaf spring and helical spring
2. Columns: Long and short columns
3. Beams: Steel and timber beams with different cross sections of different and conditions(simply supported, cantilever, propped, continuous) Test under elastic and Ultimate stages.

REFERENCES:

1. Davis H.E. Trophell.G.E & Hanck, G.F.W. , The Testing Of Engineering Materials – McGrew Hill, International Book Co.

2. Timoshenko S.P, &Young, D.H. Strength of Materials – East West Press Ltd.
3. Relevant 813 code. Venon john, Engineering Materials, 3rt Edition, McMillan Co.Ltd.,

BMA402	NUMERICAL METHODS	L	T	P	C
	Total Contact Hours - 75	3	2	0	4
	Prerequisite – Maths I, II & III				
	Course Designed by – Dept of English				

OBJECTIVES

This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

COURSE OUTCOMES (COs)

CO1	Have a fundamental knowledge of the basic solutions of equations and eigen value problems
CO2	Have a well-founded knowledge of standard numerical differentiation and integration which can describe real life phenomena.
CO3	Acquire skills in handling situations involving first and second order differential equations
CO4	Understand boundary value problems on ordinary and partial differential equations
CO5	Be able to analyze the interpolation techniques.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		H			M		
	CO2												
	CO3	M			H						M		
	CO4	H				H		H					
	CO5	H			H						H		

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNITI SOLUTIONS OF EQUATIONS AND EIGEN VALUE PROBLEMS 9+6

Iterative method Newton - Raphson method for single variable. Solutions of Linear system by Gaussian Gauss – Jordan, Jacobi and Gauss – Seidel methods, Inverse of a matrix by Gauss – Jordan method. Eigen value of a matrix by power and Jacobi methods.

UNITII INTERPOLATION (FINITE DIFFERENCES) 9+6

Newton's Divided Difference Formula – Lagrange's Interpolation Newton forward and backward difference formulae – Stirling's Bessel's central difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+6

Numerical Differentiation with interpolation polynomials, Numerical integration by Trapezoidal Simpson's (Both 1/3" and 3/8") rules. Double Integrals using Trapezodial and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+6

Single step methods – Taylors series, Euler's and Modified Euler, Runge – Kutta method of first and second order differential equations. Multiple step methods – Milne and Adam's – Bashforth predict and Corrected Method.

UNIT V BOUNDARY VALUE PROBLEMS FOR ODE AND PDE 9+6

Finite difference for the second order ordinary differential equations. Finite difference solutions for one dimensional heat Equations. Finite difference solutions for one dimensional heat Equations(both implicit and Explicit) one dimensional wave equation and two dimensional Laplace and Poisson Equation.

REFERENCES:

1. Srinivasan, "Numerical Methods for Engineering" CBS Publishers.Chennai.1994.
2. Datta, "Numerical Methods for Linear Control Systems" CBS Publishers. Chennai 2005.
3. Yang, "Applied Numerical Methods Using MATLAB" CBS Publishers. Chennai 2005.

BCE401	**THEORY OF STRUCTURES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	**4**	**0**	**0**	**4**
	Prerequisite -Basic Structural Design				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To know the method of finding slope and deflection of beams and trusses using energy theorems and to know the concept of analysing indeterminate beam.
2. To estimate the load carrying capacity of columns, stresses due to unsymmetrical bending and various theories for failure of material.

COURSE OUTCOMES (COs)

CO1	To find the deflection in beams and frames using Energy theorems.
CO2	To analyze indeterminate beams like continuous beams and fixed beams
CO3	To analyze the long and short columns and determine the design loads
CO4	To assess the state of stress in three dimensions
CO5	To solve problems involving unsymmetrical bending structural members

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H	M								
	CO2	M		H	M								

	CO3	M		H	M								
	CO4	H		H	M								
	CO5	H		H	M								
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I ENERGY THEOREM 12

Conservative and non-conservative systems – Strain energy and complimentary energy – Principle of virtual displacement and virtual forces, castigliano's first theorem, Engesser's theorem, castigliano's second theorem, Maxwell's theorem

UNIT I IDEFLECTION OF BEAM 12

Determination of deflection and slope – Double integration method – Macaulay's method-Area moment method-conjugate beam method, strain energy and dummy unit load approaches.

UNIT III STATICALLY INDETERMINATE BEAMS 12

Axially load members - composite bars – Beams: Propped, fixed and continuous beams - Theorem of three moments-calculations of reactions, Bending Moment and Shear forces - shear force and bending moment diagrams.

UNIT IV THEORY OF COLUMNS 12

Axial load - combined bending and axial – Euler's formula for long struts-practical applications – Rankine's Gordon's formula – beam columns.

UNIT V THICK CYLINDERS 12

Lame's equation - shrink fit- compound cylinders – wire wound cylinders.

DEFLECTION OF TRUSSES

Castigliano's Theorem, dummy unit load method, Williotmohr's diagram.

TEXT BOOKS:

1. Gupta S.P, Pandit G.S, Gupta R. , Theory of Structures, Vol.I&II .Tata McGraw HillCo,1981

REFERENCES:

1. Kazimi S.M.A, "Solid Mechanics", Tata McGraw-Hill Publishing Co., New Delhi, 2003
2. Beer and Johnson. Mechanics of Materials, S.I Metric Edition, McGraw Hill Co, 2002
3. Punmia B.C.Theory of Structures (SMTS) Vol 1&II, Laxmi publishing Pvt Ltd, NewDelhi, 2004.
4. Jain O.P. and.Jain B.K., Theory and analysis of structures, Mechanics of Materials Nem Chand & Brothers, Roorkee, 2001

BCE402	SURVEYING – II	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Surveying I				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

This subject deals with geodetic measurements and Control Survey methodology and its adjustments. The student is also exposed to the Modern Surveying

COURSE OUTCOMES (COs)

CO1	Have the fundamental knowledge to measure both horizontal distance and elevations without the use of sophisticated instruments
CO2	Acquires knowledge aboutthe principle of control surveying
CO3	Have knowledge on the survey errors and its adjustments
CO4	Have knowledge in the advanced topics in astronomy.
CO5	Have knowledge to modern methods of surveying like Photogrammetry, Total station, Hydrographic survey and cartography

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M								
	CO2	H				M							
	CO3	H			M								
	CO4	H	M	M	M							M	
	CO5	H			M							H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I TACHEOMETRIC SURVEYING 6

Tacheometric systems - Tangential, stadia and subtense methods - Stadia systems - Horizontal and inclined sights - Vertical and normal staffing - Fixed and movable hairs - Stadia constants - Anellactic lens – Subtense bar.

UNIT II CONTROL SURVEYING 8

Working from whole to part - Horizontal and vertical control methods - Triangulation - Signals - Base line - Instruments and accessories - Corrections - Satellite station - Reduction to centre - Trigonometric leveling – Single and reciprocal observations - Modern trends

UNIT III SURVEY ADJUSTMENTS 8

Errors - Sources, precautions and corrections - Classification of errors - True and most probable values - weighted observations - Method of Equal shifts - Principle of least squares - Normal equation - Correlates - Level nets - Adjustment of simple triangulation networks

UNIT IV ASTRONOMICAL SURVEYING 11

Celestial sphere - Astronomical terms and definitions - Motion of sun and stars - Apparent altitude and corrections - Celestial co-ordinate systems - Different time systems - Nautical almanac - Star constellations -Practical astronomy - Field observations and calculations for azimuth

UNIT V MISCELLANEOUS 12

Photogrammetry - Introduction - Terrestial and aerial Photographs - Stereoscopy -Parallax – Electromagnetic distance measurement - Carrier waves - Principles - Instruments - Trilateration - Hydrographic Surveying – Tides - MSL - Location of soundings and methods - Three point problem - Study of Box - Sextants and station pointer - River surveys - Measurement of current and discharge - Cartography - Cartographic concepts and techniques - Cadastral surveying - Definition - Uses - Legal values -Scales and accuracies.

TEXT BOOKS:

1. Punmia B.C., " Surveying ", Vols. I, II and III, Laxmi Publications, 2005

REFERENCES:

1. Clark D., " Plane and Geodetic Surveying " , Vols. I and II, C.B.S. Publishers and Distributors, Delhi, sixth Edition, 1971.
2. James M. Anderson and Edward M. Mikhail, " Introduction to Surveying ", McGraw Hill Book Company, 1985.
3. Wolf P.R. " Elements of Photogrammetry", McGraw Hill Book Company, Second Edition, 1986.
4. Robinson A.H., Sale R.D. Morrison J.L.andMuehrche P.C., " Elements of Cartography ", John Wiley and Sons, New York, Fifth Edition, 1984.
5. HeribertKahmen and Wolfgang Faig, " Surverying " , Walter de Gruyter, 1995.
6. Kanetkar T.P., " Surveying and Levelling " , Vols. I and II, United Book Corporation, Pune, 1994.

BCE403	**SOIL MECHANICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – Engineering Mechanics				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To impart knowledge on behavior and the performance of saturated soil.
2. To understand and access both physical and engineering behavior of soils, mechanism of stress transfer in two-phase systems and stability analysis of slopes

COURSE OUTCOMES (COs)

CO1	To carry out soil classification
CO2	To solve three phase system problems

CO3	Tosolve any practical problems related to soil stresses estimation, permeability and seepage including flow net diagram.
CO4	To estimate the stresses under any system of foundation loads
CO5	To solve practical problems related to consolidation settlement and time rate of settlement.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	k	l
2	CO1		M		H								
	CO2	H			H	M							
	CO3				H								
	CO4	M			M								
	CO5		M		H								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 10

Nature of soil - Soil description and classification for engineering purposes - IS Classification system – Phase relationships - Soil compaction - Theory, comparison of laboratory and field compaction methods – Ground improvements by compaction.

UNIT II SOIL WATER AND WATER FLOW 8

Soil water - static pressure in water - Permeability measurement in the laboratory and field - Seepage - Introduction to flow nets - Simple problems.

UNIT III STRESS DISTRIBUTION AND SETTLEMENT 9

Effective stress concepts in solids - Stress distribution in soil media - Use of influence charts - Components of settlement - Immediate and consolidation settlement - Terzaghi's one dimensional consolidation theory.

UNIT IV SHEAR STRENGTH 9

Shear strength of cohesive and cohesion less soils - Mohr - Coulomb failure theory - saturated soil mass - Measurement of shear strength - direct shear - triaxial compression, UCC and Vane shear tests - Pore pressure parameters.

UNIT V SLOPE STABILITY 9

Slope failure mechanisms - Types - Infinite slopes - Finite slopes - Total stress analysis for saturated clay - Method of slices - friction circle method - Use of stability number - Slope protection measures.

TEXT BOOKS:

1. Punmia P.C., “Soil Mechanics and Foundations ", Laxmi Publications Pvt. Ltd., New Delhi 2005

REFERENCES:

1. Holtz R.D. and Kovacs W.D., “Introduction to Geotechnical Engineering ", Prentice-Hall, 1995.
2. McCarthy P.D.F., “Essentials of Soil Mechanics and Foundations ", Prentice-Hall, 1973.
3. Sutten B.H.C., “Solving Problems in Soil Mechanics", Longman Group Scientific and Technical, U.K.England, 1994.
4. Khan I.H., “A text book of Geotechnical Engineering ", Prentice Hall of India, New Delhi, 1999.
5. Arora K.R., “Soil Mechanics and Foundation Engineering ", Standard Publishers and Distributors, New Delhi, 1997.

BCE404	**BASIC STRUCTURAL DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	**4**	**0**	**0**	**4**
	Prerequisite – Basic Mechanical Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To introduce the students to limit state design of structural steel members subjected to compressive, tensile and bending loads, including connections.
2. Design of structural systems such as roof trusses, purlins as per provisions of current code (IS 800 - 2007) of practice

COURSE OUTCOMES (COs)

CO1	To study about different materials used in masonry
CO2	To analyse the steel structures.
CO3	To design of trusses and their members.
CO4	To carry out the analysis of simple beams
CO5	To study about different loading conditions on trusses

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	k	l
2	CO1	L		H	M								
	CO2	L		H	M								
	CO3	L		H	M								
	CO4	L		H	M								
	CO5	L		H	M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I MASONRY 12

Strength of bricks and masonry – Design of walls – Pillars and roofing as per the latest BIS codes. Timber Structures – Properties and strength of timber used in constructions – permissible stresses in timber – design of joints, using bolts, and metal connections – design of tension and compression members – beams in bending.

UNIT II STEEL STRUCTURES 12

Introduction – properties of Indian standard rolled steel sections – types of loads, permissible stresses in tension, compression and shear as per BIS Code - Riveted and Bolted connections – Permissible stresses for various types of rivets and bolts -Efficiency of a joint - types of failures of riveted Joint - design of riveted and bolted connections for members subjected to axial forces - design of eccentrically loaded connections.

UNIT III TENSION MEMBERS 12

Design of simple and compound steel sections subjected to tension- tension splice-Compression Members - Maximum slenderness ratio for different types of compression members – Design of simple and compound sections to resist compressive loads – design of battens and lacings – design of column base and connections – column splicings.

UNIT IV BEAMS 12

Design of simple beams- strength and stiffness criteria – design of built up beams – curtailment of flange plates – connections between flange and web- need for lateral support for compression flange and their design – web strength of beams in shear – design of grillage foundation

UNIT V ROOF TRUSSES 12

Types of roof trusses for different spans - design of pitched roof trusses for dead, live and wind loads - Design of joints, Design of supports and bearings – design of purlins.

TEXT BOOKS:

1. Ramachandra S. Design of steel Structures, Vol I & II, Standard Publications, New Delhi 1982

REFERENCES:

1. Arya.A.S. & Ajmani. IL "Design of Steel Structures". Nem Chand Bros., Roorkee (UP), 1992
2. Dayaratnam.P, “Design of Steel Structures”, Wheelers Publishing Co.Ltd, 2008
3. Duggal, Design of Steel Structures, Tata McGrew Hill Co.II Edition,1991
4. Vazirani V.N. and Ratwani M.M. : Steel Structures , Khanna Publications, New Delhi,1976

Note: The relevant BIS Codes for the design of masonry (I.S.1905) Timber (LS883) and Steel Structures (IS 800) are permitted in the University Examinations. Steel Tables are also permitted in the University Examinations

BCE405	TRANSPORTATION ENGINEERING	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Building Construction				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

To give an overview about the highway engineering with respect to, planning, design, construction and maintenance of highways as per IRC standards, specifications and methods.

COURSE OUTCOMES (COs)

CO1	To prepare the plan for highways as per IRC standards
CO2	To perform geometric design of urban and rural roads
CO3	Todesign flexible and rigid pavements using IRC methods
CO4	Tosuggests modern materials and methods of highway construction.
CO5	Toevaluate, carry out maintenance and strengthening of existing pavements.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	H								
	CO2			H	H								
	CO3			H	H								
	CO4			H	H								
	CO5			H	H								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I HIGHWAY PLANNING AND ALIGNMENT 9

Highway Development in India, Macadam's Method of Road Construction, Jayakar Committee Recommendations and Realizations, Twenty-year Road Development Plans, Concepts of On-going Highway Development Programmes at National Level, Institutions for Highway Development at National level - Indian Roads Congress, National Highway Authority of India, Ministry of Road Transport and Highways (MORTH) and Central Road Research Institute. Requirements of Ideal Alignment, Factors Controlling Highway Alignment Engineering Surveys for Alignment - Conventional Methods and Modern Methods (Remote Sensing, GIS and GPS techniques) Classification and Cross Section of Urban and Rural Roads (IRC), Highway Cross Sectional Elements – Right of Way, Carriage Way, Camber, Krebs, Shoulders and Footpaths [IRC Standards]

UNIT II GEOMETRIC DESIGN OF HIGHWAYS 9

Design of Horizontal Alignments – Super elevation, Widening of Pavements on Horizontal Curves and Transition Curves [Derivation of Formulae and Problems] Design of Vertical Alignments – Rolling, Limiting, Exceptional and Minimum Gradients, Summit and Valley Curves Sight Distances - Factors Affecting Sight Distances, PIEV Theory, Stopping Sight Distance (SSD), Overtaking Sight Distance (OSD), Sight Distance at Intersections, Intermediate Sight Distance and Illumination Sight Distance [Derivations and Problems in SSD and OSD] Geometric Design of Hill Roads [IRC Standards Only]

UNIT III DESIGN OF RIGID AND FLEXIBLE PAVEMENTS 9

Rigid and Flexible Pavements- Components and their Functions Design Principles of Flexible and Rigid Pavements, Factors Affecting the Design of Pavements - ESWL, Climate, Sub-grade Soil and Traffic Design Practice for Flexible Pavements [CBR method, IRC Recommendations-Problems] Design Practice for Rigid Pavements – [IRC Recommendations-Problems]

UNIT IV HIGHWAY MATERIALS AND CONSTRUCTION PRACTICE 9

Desirable Properties and Testing of Highway Materials: - (Tests have to be demonstrated in Highway Engineering Laboratory) Soil – California Bearing Ratio Test, Field Density Test, Aggregate - Crushing, Abrasion and Impact Tests Bitumen - Penetration, Ductility, Viscosity, Binder Content and Softening Point Tests. Construction Practice - Water Bound Macadam Road, Bituminous Road and Cement Concrete Road [as per IRC and MORTH specifications]
Highway Drainage [IRC Recommendations]

UNIT V HIGHWAY MAINTENANCE 9

Types of Defects in Flexible Pavements – Surface Defects, Cracks, Deformation, Disintegration – Symptoms, Causes and Treatments. Types of Pavement Failures in Rigid Pavements – Scaling, Shrinkage, Warping, Structural Cracks, Spalling of Joints and Mud Pumping – and Special Repairs Pavement Evaluation – Pavement Surface Conditions and Structural Evaluation Overlay Design by Benkleman Beam Method [Procedure only]

TEXT BOOKS:

1. Khanna K and Justo C E G, Highway Engineering, Khanna Publishers, Roorkee, 2001.

REFERENCES:

1. Indian Roads Congress (IRC) specifications: Guidelines and special publications on Traffic Planning and Management
2. Transportation Engineering – An Introduction, C.Jotin Khisty, B.Kent Lall, Prentice Hall of India Pvt Ltd, 2006
3. MORTH Guidelines for Highway Engineering.
4. Kadiyali L R, Principles and Practice of Highway Engineering, Khanna TechnicalPublications, Delhi, 2000

BCE406	ENVIRONMENTAL STUDIES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Physical Sciences				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To study the nature and facts about environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context
CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1						H	H					
	CO2						H	H					
	CO3							M					
	CO4						L	M	L				
	CO5						M	M					

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance, Need for public awareness.

Natural Resources : Renewable And Non – Renewable Resources

Natural resources and associated problems

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.
c) Mineral resources : Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes caused by agriculture and overgrazing , effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.
f) Land resources : Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 8

Concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-

Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III BIODIVERSITY AND ITS CONSERVATION 7

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega-diversity nation, Hot-spots of biodiversity -Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution 7

Definition, Causes, effects and control measures of ;- Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management : floods earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8

From Unsustainable to Sustainable development, Urban problems related to energy, nuclear accident and holocaust, case studies, wasteland reclamation, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection Act, Forest Conservation Act, Issues involved in enforcement of environmental Legislation, public awareness –

Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel –oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes – Noise produced by fire crackers – Noise pollution – Noise level standards for fire crackers – Intensity of sound – Impact on hearing – Safety measures.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations, population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXTBOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297 0277-0, 2004.
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
3. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, 1989.
4. Benny Joseph, "Environmental Studies"., TATA McGraw Hill, 2010

REFERENCES

1. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, EnviroMedia 2009
2. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
4. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno Science Publications 2013
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB),2001.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
8. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
9. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publish Co. Pvt. Ltd. 345p.
12. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut.
13. http://eng.mft.info/uploadedfiles/gfiles/c8e31c9e52d84c3.pdf

BCE4L1	SURVEYING PRACTICAL - II	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Survey practical-I				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

To understand field problems like tachometry, setting out for foundation marking etc.

COURSE OUTCOMES (COs)

CO1	Take angular and linear measurements using total station

CO2	Prepare contour maps for the given area
CO3	Field observation for the calculation of azimuth.
CO4	Determination of personal stereoscopic acuity in laboratory.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M			L							
	CO2		M			L							
	CO3		M										
	CO4												
	CO5	L				L							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I TACHEOMETRY **12**

Tangential system (using theodolite, leveling staff)
Stadia system (using theodolite, leveling staff)
Subtense system (using theodolite, tape, cross staff, leveling staff)

UNIT II SETTING OUT WORKS **12**

Foundation marking (using theodolite, tape, ranging rods)
Simple curve - right / left handed (using theodolite, tape, ranging rods)
Transition curve (using theodolite, tape, ranging rods)

UNIT III FIELD ASTRONOMY **9**

Field observation for the calculation of azimuth (using theodolite, tape)

UNIT IV ELECTRONICSURVEYING(USINGPHOTOGRAMMETRY ACCESSORIES/INSTRUMENTS) **12**

Practicing fusion of stereo pairs of charts and photographs to get 3D
Use of pocket stereoscope and parallax bars
Determination of personal stereoscopic acuity in laboratory
Work on stereo test charts to access stereoscopic ability

BCE4L2	SOIL MECHANICS LABORATORY	L	T	P	C
	Total Contact Hours - 45	**0**	**0**	**3**	**2**
	Prerequisite – Soil Mechanics				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

To understand and assess both Physical and Engineering behavior of soils through laboratory

testing procedures.	
COURSE OUTCOMES (COs)	
CO1	To learn about the different type of soil according to their classification and their size distribution
CO2	To determine the soil's property and their atterberg's limit.
CO3	To have a clear understanding about determining the optimum moisture
CO4	About the compressive strength of the soil which is obtain from the site.
CO5	To know about permeability of the soil, consolidate test on the soil.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	M	H	M	M	M							
	CO2	L	M	H									
	CO3			M	M								
	CO4	L											
	CO5			M	M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Grain size distribution - Sieve analysis
2. Grain size distribution - Hydrometer analysis
3. Atterberg limits test
4. Determination of moisture - Density relationship using standard proctor.
5. Permeability determination (constant head and falling head methods)
6. Determination of shear strength parameters.
   a) Direct shear test on cohesion less soil
   b) Unconfined compression test on cohesive soil
   c) Tri axial compression test on cohesion less soil
7. One dimensional consolidation test (Determination of co-efficient of consolidation only)

REFERENCES:

1. " Soil Engineering Laboratory Instruction Manual ", Published by the Engineering CollegeCo-operatiave Society, Chennai,
2. Lambe T.W., "Soil Testing for Engineers ", John Wiley and Sons, New York, 1990.
3. "I.S.Code of Practice (2720) Relevant Parts ", as amended from time to time.

BCE501	**STRUCTURAL ANALYSIS – I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Basic Structural Design				

	Course Designed by – Dept of Civil Engineering

OBJECTIVES

To introduce the students to basic theory and concepts of structural analysis and the classical methods for the analysis of structures.

COURSE OUTCOMES (COs)

CO1	Analyze the pin jointed plane frames using energy and consistent deformation method
CO2	Analyze indeterminate structures using various classical methods.
CO3	Determine absolute maximum bending moment and shear force in beams due to moving loads.
CO4	Find the maximum moment, shear and stresses produced in arches due to external loads temperature effects and support settlements.
CO5	To find the influence line diagram for determinate structures.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	M		M	H								
	CO2	M		M	H					L			
	CO3	M		M	H						L		
	CO4	M		M	H					L			L
	CO5	M		M	H						L		
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INDETERMINATE ANALYSIS 12

Indeterminate Structures: Introduction to static and kinematic Indeterminacy- two and three dimensional pin jointed and rigid jointed structures-space trusses-Energy method-application to indeterminate pin jointed trusses-temperature effect-beams curved in plan.

UNIT II SLOPE DEFLECTION METHOD 12

Slope deflection method: Analysis of continuous beams and portal frames with single storey.

UNIT III MOMENT DISTRIBUTION METHOD 12

Moment distribution method: Stiffness and distribution factors-carry over factor-analysis of continuous beams -single storied portal frames.

UNIT IV ROLLING LOADS 12

Rolling loads: Single concentrated loads - two concentrated loads-uniformly distributed loads-curves of maximum SFD and BMD – equivalent. UDL

UNIT V INFLUENCE LINE DIAGRAMS 12

Influence line for statically determinate beams for bending moment and shear force- absolute maximum BM-concentrated and UDL-Influence line for forces in members for statically determinate truss parallel chord truss.

TEXT BOOK:

1. Vaidyanadhan, R and Perumal, P, "Comprehensive Structural Analysis – Vol. 1 & Vol. 2",Laxmi Publications, New Delhi, 2003.

REFERENCE:

1. Bhavai Katti, S.S, Structural Analysis – Vol. 1 & Vol. 2, Vikas Publishing Pvt Ltd., New Delhi,2008
2. Analysis of Indeterminate Structures – C.K. Wang, Tata McGraw-Hill, 1992.
3. Negi L.S. Jangid & R.S., "Structural Analysis", Tata McGraw-Hill Publications, NewDelhi, Sixth Edition, 2003.

BCE502	APPLIED HYDRAULIC ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Fluid Mechanics				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To introduce the students to various hydraulic engineering problems like open channel flows and hydraulic machines.
2. At the completion of the course, the student should be able to relate the theory and practice of problems in hydraulic engineering.

COURSE OUTCOMES (COs)

CO1	Be able to apply their knowledge of fluid mechanics in addressing problems in open channels.
CO2	They will possess the skills to solve problems in uniform, gradually and rapidly varied flows in steady state conditions.
CO3	They will have knowledge in hydraulic machineries (Turbines)
CO4	Acquire skills in rotodynamic machineries that will help in their day-to-day-life.
CO5	Acquire skills in Reciprocal pumps.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	L	H	H							H
	CO2	H	M	L	H	H							H
	CO3	H	M	L	H	H							M
	CO4	H	M	L	H	H							M

	CO5	H	M	L	H	H							M
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)		
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I OPEN CHANNEL FLOW 9

Types of flow – State of Flow - Velocity distribution - Specific energy, specific force, critical flow computation - flow measurement. Chezy's and Manning's equation, Computation Uniform flow – Normal depth – Hydraulically best section.

UNIT II VARIED FLOW 9

Varied Flow- Rapid & Gradual - Dynamic equation characteristic of flow profiles – Classification of flow – Computation of the flow profiles – Direct step method - Canal transitions – Hydraulic Jump – Type of Jump, Location of Jumps – Energy losses in Jumps – Surges in Canal – Types of Surges.

UNIT III TURBINES 9

RotodynamicsMachinary Turbines: Classification of turbines -Work done - Efficiency of Turbines, Pelton Wheel, Francis turbine, Kaplan and propeller turbines. Similarity laws and specific speed. Performance of turbines - impact of free jets.

UNIT IV PUMPS 9

Rotodynamic Machinery Pumps: Classification of pumps –Centrifugal Pumps – Casing – Impellor – Work done and Efficiency – Cavitations.

UNIT V RECIPROCATING PUMPS 9

Reciprocating pump – Work done – Air Vessel – Indicator Diagram.

TEXT BOOK:

1. Bansal R K., A Text Book of Fluid Mechanics & Hydraulic Machines – Laxmi Publications 2010

REFERENCE:

1. Subramanya K., "Flow in Open channels ", Tata McGraw Hill Publishing Company 1986
2. Kumar K.L., "Engineering Fluid Mechanics ", Eurasia Publishing House (P) Ltd. New Delhi, 1992.
3. Rajput R.K, A Text of Fluid Mechanics & Hydraulic machines – S.Chand & Co.P.Ltd, 2009

BCE503	FOUNDATION ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Soil Mechanics				

	Course Designed by – Dept of Civil Engineering

OBJECTIVES

To impart knowledge on common method of sub soil investigation and design of foundation and to acquire the capacity to investigate the soil condition and to select and design a suitable foundation.

COURSE OUTCOMES (COs)

CO1	Select type of foundation required for the given soil condition.
CO2	Determine the settlement of the foundation on different types of soil
CO3	Find the dimensions of the foundation for isolated footing, combined footing and floating foundation
CO4	Analyze the group of piles for their load capacity
CO5	Carry out stability analysis of retaining walls.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	H								
	CO2			H	H								
	CO3	L		H	H								
	CO4	M		H	H								
	CO5	H		H	H								
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I SITE INVESTIGATION AND SELECTION OF FOUNDATION 9

Introduction – Scope and objectives – Method of exploration: boring – Sampling – disturbed and undisturbed sampling – sampling techniques – Bore log and report – Penetration tests– Data interpretation – Selection of foundation based on soil condition

UNIT II SHALLOW FOUNDATION 9

Introduction – Location and depth of foundation – codal provisions – bearing capacity of shallow foundation on homogeneous deposits – bearing capacity from in-situ tests – Factors influencing bearing capacity – codal provisions – Settlement – Components of settlement – Settlement of foundations on granular and clay deposits – Allowable and maximum differential settlements of buildings – Codal provision – Methods of minimizing settlement.

UNIT III DESIGN OF FOOTING 9

Types of foundation – structural design of spread footing – Design aspects of combined and mat foundation – Codal provisions.

UNIT IV PILE FOUNDATION 9

Types of piles – Factors influencing the selection of pile – Carrying capacity in granular and cohesive soils – Static and dynamic formulae – Capacity from in-situ tests– Piles subjected to uplift – Negative skin friction – Group capacity – Settlement of pile groups – Interpretation of pile load test – Pile caps – Codal provisions

UNIT V RETAINING WALLS 9

Earth pressure theory – Plastic equilibrium in soils – active and passive states – Rankine's theory – Coloumb's wedge theory – Classical and limit equilibrium solution – Earth pressure on retaining walls of simple configurations – pressure on the wall due to single line load alone – Graphical method (Culmann's method alone) – Stability of retaining wall.

TEXT BOOKS:

1. Punmia, B.C., Soil mechanics and foundations, Laxmi publications pvt. Ltd., New Delhi.

REFERENCES:

1. Khan, I.H., A text book of Geotechnical Engineering, Prentice Hall of India, New Delhi, 1999.
2. Arora K.R. Soil mechanics and foundation engineering, standard publishers and distributors, New Delhi, 1997.
3. Bowles J.E. Foundation analysis and design, McGraw Hill, 1994.
4. Gopal Ranjan and Rao, A.S.R. Basic and applied soil mechanics, Wiley Eastern Ltd., New Delhi (India), 1997.

BCE504	**REINFORCED CONCRETE STRUCTURES – I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Theory Of Structures				
	Course Designed by – Dept of Civil Engineering				

COURSE OUTCOMES (COs)	
CO1	Design RC concrete structural elements using various methods.
CO2	Design reinforced concrete slabs and beams by WSD for flexure
CO3	Design various basic elements of reinforced concrete structures like slabs, beams, columns and footings by LSD
CO4	Design reinforced concrete slabs and beams for shear and torsion by LSD
CO5	Design reinforced concrete Footing

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	M		H	M								
	CO2	M		H	M								
	CO3	M		H	M								
	CO4	M		H	M								
	CO5	M		H	M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 12

Actual and idealized stress- strain diagrams of concrete and steel (Mild Steel, High Strength deformed bars) – behavior of R.C.beam in bending – introduction to the ESD philosophy – Design of rectangular beams, tee beams, shear, development length- design of one way slab, two way slabs BIS 456 2000.

UNIT II WORKING STRESS METHOD 12

Design of continuous beams and slabs – axially and eccentrically loaded column footings for individual columns and combined rectangular footings for two columns.

UNIT III DESIGN OF BEAMS 12

Limit state design of rectangular T and L shaped beams for flexure, shear, bond torsion, - design of one way slab – Lintels – sun shades.

UNIT IV LSM: DESIGN OF SLABS &COLUMNS 12

Limit state design of two way slab using BIS 456 – limit state design of short rectangular and circular columns for axial and eccentric loads using SP- 16 design of long columns.

UNIT V LSM: DESIGN OF FOOTING 12

Limit state design of square / rectangular footings for axially and eccentrically loaded columns combined rectangular footings for two columns.

TEXT BOOKS:

1. Krishna Raju, N., "Design of Reinforced Concrete Structures", CBS Publishers &Distributors, New Delhi,2003

REFERENCES:

1. Jain.A.K. Limit State Design of R.C.Structures, Nerchand Publications
2. BIS 456 – 2000
3. S.P.16 of BIS
4. W.H. & R.S. Mosely, J.H.Bungcy an R.Hulse, Reinforced Concrete Design, 5th Edition, Macmillan Co.
5. Ramamrutham S, Design of Steel *Structures*, Dhanpat Rai *Publishing Co.,* New. Delhi, 2001
6. Dr.Purushothaman P Reinforced Concrete Structures Tata McGraw-Hill, 1984

BCE505	ENVIRONMENTAL ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3

	Prerequisite – Environmental Studies
	Course Designed by – Dept of Civil Engineering

OBJECTIVES:

To make the students conversant with principles of water supply, treatment and distribution

COURSE OUTCOMES (COs)

CO1	Plan water supply system for developing area
CO2	Design the various treatment plant in water supply system
CO3	Treat the drinking water using advanced techniques
CO4	Design the water distribution systems
CO5	Principles of design of water supply and drainage in buildings

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1			H	M								
	CO2	M		H	M				M				
	CO3			H	M							L	
	CO4	L		H	M								
	CO5	M		H	M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT-I PLANNING FOR WATER SUPPLY AND SEWERAGE SYSTEMS 9

Public water supply System and Sewerage system – Design Period – Prediction of population during design period – Selection of Sources of Water supply – Conveyance of Raw Water - Treatment site – Piped Flow – Open Channel Flow – Layout of Water Treatment Plant.

UNIT-II WATER TREATMENT SYSTEMS 9

Raw water Quality – Impurities in Water – Water Quality Standards – Plain Sedimentation - Pumping to Chemical House – Coagulation – Hydraulic Jump / Flash Mixer - Clariflocculator – Rapid Sand Filtration – Iron & Manganese Removal - Post Chlorination – Clear Water Tank – Pumping to Overhead Tank.

UNIT-III WATER DISTRIBUTION SYSTEM 9

Water Distribution Layout – Service Reservoirs – Hydraulics of Flow in Pipes - Appurtenances – Construction Operation and maintenance – Leak Detection – Strom Water Network – Plumbing Work in Houses.

UNIT-IV COLLECTION AND CONVEYANCE OF DOMESTIC SEWAGE 9

Sewer Pipe Network – Sewage Treatment Site – Activated Sludge Process – Aeration Tank Design – Design of Secondary Settling Tank – Sludge Digester – Sludge Drying Beds – Re-Use of Treated Effluent – Selection of Pumps.

UNIT-V SOLID WASTE MANAGEMENT 9

Collection and Conveyance of Solid Wastes – Segregation of Solid Wastes – Sanitary Land Fill – Incineration – Recycling and Re-use Concepts – Disposal of Electronic Wastes.

TEXT BOOKS:

1. Garg S.K.Environmental Engineering, Vol.I & II, Khanna Publishers, New Delhi, (1994).
2. Water Supply Engineeering, R.Pannirselvam, SPGS-Publications, Adambakkam, Chennai-600088, (2007).
3. Wastewater Engineering, SPGS-Publications, Adambakkam, Chennai-600088,(2007).
4. C.S.Shah, Water Supply Sanitation, Galgotia Publishing Company, New Delhi, (1994).

REFERENCES:

1. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, (1999).
2. Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, (1993).
3. Wastewater Engineering – Treatment and Re-Use, MetCalf & Eddy, Inc., Tata McGraw-Hill Publishing Company, New Delhi-(2003).

BCE506	CONSTRUCTION TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Building Construction				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. The main objective of this course is to make the student aware of the various construction techniques, practices and the equipment needed for different types of construction activities.
2. To understand various construction procedures from sub structure to super structure and also the equipment needed for construction of various types of structures from foundation to super structure.

COURSE OUTCOMES (COs)

CO1	Have a fundamental knowledge on the planning, different codes of practice, details and sequence of building construction
CO2	Have knowledge on temporary structures such as scaffolding, underpinning and formwork structures in construction
CO3	Will have the ability to understand the principles, types, merits & demerits of Prefabrication of structures
CO4	Will have the knowledge of manufacture, batching, mixing, transporting, placing, compaction of concrete
CO5	Will acquire knowledge on handling of different types of construction equipments

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
	CO1	H			M	H		M			M		M
	CO2			M									
	CO3	M			H						M		
	CO4					H		H					
	CO5	H									H		

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I PLANNING 9

Principles of Planning - regulations and byelaws, different codes of practice – Indian, American, & British codes of practice – Preparation of layouts - Orientation of Buildings- Specifications - details and sequence of construction – co-ordination – site clearance – marking (setting out)- Earthwork excavations – timbering – Dewatering

UNIT II TEMPORARY STRUCTURE & SHELL STRUCTURES 9

Temporary shed - centering and shuttering – sheet piles, scaffoldings, shuttering forms – special forms for shells – slip form, moving form- shoring, and under pinning.

UNIT III PREFABRICATION 9

Principles of prefabrication – Types – materials for prefabrication- standardization – systems – modular - co – ordination- production, transportation-erection-merits & demerits.

UNIT IV CONCRETE 9

Process of manufacture of concrete, batching, mixing, transporting, placing, compaction, and curing concrete with admixtures.

UNIT V CONSTRUCTION EQUIPMENTS 9

Selection of equipment for earth work, concreting, paving, pile erection- Material handling, hauling and erection of structures – Dewatering and pumping equipments.

TEXT BOOKS :

1. Sheety, M.S, Concrete Technology, Theory and Practice, S. Chand and Company Ltd, New Delhi, 2005.

REFERENCES:

1. Peurifoy R.L.,"Formwork for concrete structures", McGrew Hill Co., 1999
2. Jha J. and Sinha S.S., "Construction and Foundation Engineering", Khanna Publishers, 1993.

3. Chudley.R, "Construction Technology" (Vol. I, II, III,& IV) ELBS / Longman Publishers (second Edition)
4. Arora S.P and Bindra S.P. "Building Construction, Planning Techniques and Materials of Construction", Dhanpat Rai and sons 1997

BCE5L1	CONSTRUCTION ENGINEERING LABORATORY	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic Civil and Mechanical Engineering Practices Laboratory				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. To learn the principles and procedures of testing Concrete and Highway materials and to get hands on experience by conducting the tests and evolving inferences.
2. To know about the fresh mixed concrete and experience by mixing a freshly mixed concrete.

COURSE OUTCOMES (COs)

CO1	Have a fundamental knowledge of the basic test to be performed on the material used in the construction site
CO2	Testing the aggregate material which is used in the laying pavement
CO3	Designing the mix of the concrete for various structures in construction.
CO4	To know about the freshly mixed concrete and check their workability by slump, consistency and compaction.
CO5	To know the ability of the bitumen and their properties for laying pavements.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
	CO1	H				M	M						
	CO2					M							
	CO3		M	M									
	CO4	H			L	M							
	CO5						M						

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I TESTS ON CEMENT 9

Specific gravity, fineness, specific surface, soundness, consistency, initial and final setting time, compressive strength of cement mortar.

UNIT II TESTS ON AGGREGATES 12

a. Tests to find salinity, organic content etc.
b. Size distribution of particles.
c. Specific gravity / voids ratio.
d. Bulking of Sand.
Particle size, shape, flakiness index, elongation index, sieve analysis, specific gravity, density, absorption test, crushing and impact strength of coarse aggregates and abrasion tests.

UNIT III CONCRETE MIX DESIGN 6

UNIT IV TESTS ON FRESH AND HARDENED CONCRETE 12
Slump test, Vee-Bee Test, Compaction factor test, Test on cubes and cylinders – Determination of Young's modulus, compressive strength, tensile strength (beam and cylinder).

UNIT V HIGHWAY: TESTS ON BITUMINOUS MATERIALS AND MIXES 6
a. Penetration test on Bitumen
b. Ductility test on Bitumen
c. Softening point test on Bitumen or tar
d. Flash and fire point tests on bitumen cut back bitumen
e. Specific gravity test.
f. Viscosity test on black bitumen – cutback bitumen or tar (using orifice viscometer).
g. Marshall stability test on bituminous mix - preparation of bituminous mix and determination of density, voids, stability and flow values.

BCE5L2	**FLUID MECHANICS AND FLUID MACHINERY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Fluid Mechanics				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:
Students should be able to verify the principles studied in theory by performing the experiments in lab.

COURSE OUTCOMES (COs)

CO1	Measure theoretical discharge in pipes, Venturimeter, orificemeter and notches
CO2	Demonstrate and conduct experiment to find characteristic curves of various pumps
CO3	Demonstrate and conduct experiment to find characteristic curves of various turbines

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
	CO1		H										
	CO2		H		M				M				
	CO3		H				L						

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

A) Fluid Mechanics Lab Experiments

1. Determination of flow through pipes, losses in pipes.
2. Calibration of Orifice Meter &Venturi Meter
3. Flow through Notches & weirs.
4. Flow Through open orifices: Calculation of Cd, Co &Cv
5. Buoyancy experiment, Metacentric- height
6. Calibration of Mouth Pieces- Constant & Variable Head Method
7. Impact of jet on Vanes: inclined, curved.
8. Verification of Bernoulli's equation.

B) Fluid Machinery Lab Experiments

1. Performance characteristics of Centrifugal Pump.
2. Performance characteristics of Multistage Pump
3. Performance characteristics of Gear Pump
4. Performance characteristics of Reciprocating Pump
5. Performance characteristics of Impulse Turbine
6. Performance characteristics of Reaction Turbine.
7. Performance characteristics of Jet Pump
8. Performance characteristics of Vane Pump

REFERENCES:

1. Modi P.N & Sethi S.M "Hydraulics and Hydraulic Mechanics". Standard, Publishing Co, New Delhi.

BCE5C1	**COMPREHENSION I**	**L**	**T**	**P**	**C**
	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses up to fifth semester				
	Course Designed by – Dept. Civil Engineering				

OBJECTIVES

- To provide a complete review of Civil engineering topics covered up to fifth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to fifth semester.

BCE601	STRUCTURAL ANALYSIS – II	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Structural Analysis – I				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To introduce the students to basic theory and concepts of structural analysis and methods for the analysis of structures.

COURSE OUTCOMES (COs)

CO1	Analyze Space Truss using tension Coefficient method
CO2	Analyze cable suspension bridges
CO3	Perform plastic analysis of indeterminate beams and frames
CO4	Analyze structures by using matrix flexibility and stiffness methods
CO5	Implement basic concepts of finite element analysis

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M	H								
	CO2			M	H								
	CO3			M	H								
	CO4			M	H								
	CO5			M	H								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ILD FOR INDETERMINATE STRUCTURES 12

Influence line for statically indeterminate structures – Maxwell Betti theorem - Muller – Breslau Principle and its application to determine the influence lines of reactions. SF and BM at a section of continuous beams – qualitative influence lines for horizontal thrust reaction and moments for continuous beams, portal and arches.

UNIT II ARCHES & CABLES 12

Arches and suspension Cables : Three hinged and two hinged arches-parabolic and circular arches – influence lines for three and two hinged arches for horizontal thrust, SF and BM at any section - length of cable, maximum tension - types supports – forces in towers.

UNIT III PLASTIC THEORY 12

Plastic Theory: Plastic moment of resistance - plastic modulus – shape factor – plastic hinges – determination of collapse load for continuous beams and portals.

UNIT V STIFFNESS METHOD 12

Matrix Method of Structural Analysis: Stiffness methods-development of stiffness method - stiffness matrix for continuous beams and portals application to simple pin jointed trusses, continuous beams, portal frames.

UNIT V FLEXIBILITY METHOD 12

Matrix method of Structural Analysis: Flexibility method – statically determinate and indeterminate (up to 2 degrees only) structures- formation of flexibility matrix - simple problems on Continuous beams, Portal frame.

TEXT BOOKS:

1. S.S.Bhavikati. Structural Analysis Vol.-I & II. Vikas Publishing House pvt ltd, 2009

REFERENCES:

1. William Weaver, Computer Programs for structural Analysis, VNR Publishers, 2006
2. Rubinstein M.F, Matrix Computer Analysis of Structures, Prentice Hall, Englewood cliffs, 1990
3. Arya AS. and Jain." Theory and Analysis of Structures", Nem Chand & Bros, Dec 1992
4. Pandit G S and Gupta S P,"Matrix methods in structural analysis", Tata McGrawHill Publishing Company Limited, 2007

BCE602	**REINFORCED CONCRETE STRUCTURES – II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Reinforced Concrete Structures – I				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To give an exposure to the design of continuous beams, slabs, staircases, walls and bridge structures and to introduce yield line theory

COURSE OUTCOMES (COs)

CO1	Design counter-fort and cantilever retaining walls
CO2	Design underground and overhead water tanks
CO3	Design bridges and flat slab
CO4	Different methods and systems – uniform and non-uniform pre-stressing design
CO5	Design Slab using yield line theory

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	M								
	CO2			H	M								

	CO3			H	M								
	CO4			H	M								
	CO5			H	M								
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I RETAINING WALLS 12

Retaining Walls – Design of cantilever and counter fort types using working stress method.

UNIT II WATER TANKS 13

Water Tanks – Underground rectangular tanks – Domes – overhead circular and rectangular tanks – Design of staging and foundations.

UNIT III BRIDGES 13

Bridges – slab Bridge – Distribution of concentrated loads by effective width and Pigeaud's method. Load distribution in interconnected girders by Courbon's method – T – Beam Bridge.

UNIT IV PRE STRESSED CONCRETE 11

Principles of Pre–stressing – Materials for pre–stressed Concrete – Different methods and systems – uniform and non-uniform pre-stressing – losses in pre-stress – Analysis of simply supported beams with straight and parabolic tendons.

UNIT V YIELD LINE THEORY 11

Yield Line Theory: Application of virtual work method to square, rectangular, and Triangular slabs.

TEXT BOOKS:

1. N.Krishnaraju, Design of R.C.Structures, CBS Publishers and Distributors. Delhi, 1989

REFERENCE BOOKS:

1. Mac Ginley, T.J. Reinforced Concrete Design, Theory and Examples, E and N.Spon. Umited London, 1978
2. Jaikrishna and Jain O.P, Plain and Reinforced Concrete Vol. I & II",Nem Chand & Bros., 1958
3. Krishna Raju N, Bridge Engineering" Oxford and IBH Publishing,2010
4. Park R. and Paulay T. Reinforced Concrete Structures John Wiley and Sons, 1975.
5. Neville A.M. Properties of Concrete, Pitman Pub., 1981

BCE603	IRRIGATION ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3

	Prerequisite – Fluid Mechanics
	Course Designed by – Dept of Civil Engineering

OBJECTIVES:

To expose the student to different phases in Water Resources Management and National Water Policy. Further they will be imparted required knowledge on Reservoir planning, management and economic analysis including Irrigation and Irrigation management practices

COURSE OUTCOMES (COs)

CO1	Estimate water requirements for irrigation and drinking
CO2	Estimate consumptive use of water for irrigation
CO3	Perform water resources and prepare water budget
CO4	Prepare irrigation scheduling and water distribution for various crops.
CO5	Design cross drainage works

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M			H								
	CO2	M			H								
	CO3	M			H								
	CO4	M		H	H								
	CO5	M			H								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I IRRIGATION AS A SCIENCE 9

Definition, Need, Benefit, Historical Development, Scope in the country and the state - Sources for irrigation, wells, springs, rivers, streams, tanks, reservoirs - Flow and Lift irrigation. Methods of flow irrigation - Devices and equipments for lift irrigation - Duty, different concepts of duty and factors affecting duty.

UNIT II CROP WATER REQUIREMENTS 9

Soil – plant – water relationship – Evapo transpiration – consumptive use - Perennial, Annual and Seasonal crops - Principal irrigated, dry and wet irrigated crops - Assessment of crop water requirements - Effective rainfall - Net irrigation requirements for principal crops -Irrigational quality - Salt resistant crops - Water logging, remedial measures.

UNIT III CONVEYANCE AND DISTRIBUTION OF IRRIGATION WATER 9

Head works – Diversion and storage structures -Canals unlined and lined. Canal alignments - contour ridge, Branch canals, minors, water course and notches - Control structures - drops,

escapes, shutters and operating devices, division boxes - Cross drainage structures- under tunnels, aqueducts, siphons, siphon aqueducts - Cross masonry structures - road and railway bridges.

UNIT IV IRRIGATION WATER MANAGEMENT 9

Need for optimization of water use - Management and productivity - Minimizing irrigation water losses - Operational rules for regulation - physical structures for management on farm development works - Participatory Irrigation Management (PIM) - Water Users Associations (WUA) - Training the water users.

UNIT V DESIGN OF IRRIGATION STRUCTURES 9

Sluices and surplus weirs in tanks - Earth dam section, homogenous and zoned. Anicuts and weirs on solid and permeable foundation - Head regulators, canal drops, canal siphons and aqueducts, under tunnels - Simple design of masonry and earth dams- Designing channels- Computer aided designs.

TEXT BOOKS:

1. Sharma R.K, "Irrigation Engineering and Hydraulic Structures", Oxford and IBII Publishing Company, New Delhi, 2002.
2. Sathyanarayanan Murthy, "Irrigation Design and Drawing", Published by Mrs.L.Banumathi, Tuni, East Godavari District. A.P. 1998.

REFERENCES:

1. Michael A.M,"Irrigation – Theroy and practice", Vikas Publishing House, 2000.
2. Hand Book on irrigation system operation Practices, Water Management and training Project Technical Report No.33. CWC, 1990.
3. Hand Book for improving Irrigation System Maintenance Practices, Water Management and Training Report No.19A, CWC, Delhi, 1989.

BSS601	**VALUE EDUCATION AND PROFESSIONAL ETHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
- To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)

CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing

CO4	To learn more of Engineer as Responsible Experimenter.
CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To learn more of Responsibilities and Rights as Professional and facing Global Challenges

UNIT I : PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II : SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE) 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.

UNIT III: MIND CULTURE & TENDING PERSONAL HEALTH 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelizing the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV: ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS'S RESPONSIBILITIES FOR SAFETY 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Challenger, case study. Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies.

UNIT V: ENGINEERS'S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination. Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership

TEXTBOOKS:

1. Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata McGraw Hill, Newyork 2005 (Units IV & V)

REFERENCE:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)

2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall,New Mexico,2004(for Units IV-V)

BCE6L1	COMPUTER AIDED BUILDING DRAWING	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Computer Practices Lab				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To introduce the students to draw the plan, elevation and sectional views of buildings in accordance with development and control rules satisfying orientation and functional requirements as per National Building Code.

COURSE OUTCOMES (COs)

CO1	To study about drawing of Residential Building using Autocad
CO2	To study about drawing of RCC framed using Autocad
CO3	To study about drawing of office building using Autocad
CO4	To study about drawing of various types of Truss
CO5	To Study about 3D drawing of a building using revit architecture

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					M							
	CO2					M							
	CO3					M							
	CO4					M							
	CO5					M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

Building Drawing in Accordance with Development and Control Rules Satisfying Orientation and Functional Requirements for the following:

1. Residential buildings with load bearing walls (RCC roof) **9**
2. RCC framed structures **9**

3. Office buildings (RCC roof) **9**
4. Industrial buildings – North light roof structures – Trusses – Gantry arrangements **9**
5. Perspective view for small buildings **9**

TEXT BOOKS:

1. Verma B.P ,"Civil Engg. Drawing & House planning", Khanna publishers, Delhi, 2014
2. Balagopal & Prabhu T S, "Building drawing & detailing",Spades publishers, Calicut, 1984

REFERENCES:

1. M. G. Shah, C. M. Kale, S. Y. Patki ,"Building drawing", Tata McGraw-Hill, 2002
2. Kumaraswamy N, Kameswara Rao A,"Building Planning & Drawing", Charotar Publishing House, 1995

BCE6L2	**ENVIRONMENTAL ENGINEERING LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Physics and Chemistry Laboratory-I				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To understand the sampling and preservation methods and significance of characterization of wastewater.

COURSE OUTCOMES (COs)

CO1	Have a fundamental knowledge to conduct various quality tests on water and wastewater
CO2	Have a well-founded knowledge to assess the suitability of water for drinking and irrigation purpose.
CO3	Acquire skills in assessing the suitability of water for concreting works

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H	M		M							
	CO2		H	M		M							
	CO3		H	M		M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS:

1. a. Determination of pH.
   b. Determination of Turbidity
2. Determination of hardness.
3. Determination of Alkalinity.
4. Determination of Residual Chlorine
5. Estimation of Chlorides.
6. Estimation of Ammonia Nitrogen.
7. Estimation of Sulphate.
8. Determination of optimum coagulant dose.
9. Determination specific conductivity.
10. Estimation of available chlorine in Bleaching Powder.
11. Determination of dissolved Oxygen.
12. Determination of suspended settleable, Volatile and fixed solids.
13. B.O.D.Test
14. C.O.D.Test

REFERENCES:

1. Trivedhi and Goel. Chemical and Biological Methods for Water Pollution studies.
2. A Course manual – Water and Waste Water Analysis, national Environmental Engineering
3. Research Institute Nagpur Publication.
4. Standard Methods for Examination of Water and Wastewater - APHA, AWAA and WPCF, 1985 Edition.

BCE6P1	**TERM PAPER**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	0	0	4	2
	Prerequisite – Professional Courses				
	Lab Manual Prepared by – Dept of Civil Engineering				

OBJECTIVES

To teach the student the procedures and methodologies for understanding the literature survey an preparation for research paper.

COURSE OUTCOMES (COs)

CO1	To identify the area of research.
CO2	To prepare list of literatures in the relevant area.
CO3	Compile the abstract from the literatures.
CO4	Focus the search to a well defined theme and title.
CO5	Make and exhaustive report by compiling all the literatures that students
CO6	To prepare a research paper for publications in journal/conference proceedings.

LIST OF TASKS

1. **PREPARING PROPOSAL**
   Proposed Research Topic
   Purposes
   Background
   Method: (suggested methods – develop your own to suit your research topic)

2. CONDUCTING LITERATURE REVIEW
Exploring and Sharpening your Topic
Evaluating Information
Taking Notes and Keeping Records

3. COMPLETING ANNOTATED BIBLIOGRAPHY
Citing Your Sources and Avoiding Plagiarism
Writing and Annotated Bibliography

4. IDENTIFYING PROBLEM STATEMENT
Meeting the Challenges of Research
Developing New Information

5. COMPLETING OUTLINE FOR THE RESEARCH
Organizing Your Project into an outline
Pick up your critique paper and begin editing and incorporate the suggestions from guide

6. SUBMITTING FIRST DRAFT
Drafting your Project
Entering Conversations and Supporting Your Claims

7. SUBMITTING WORKS CITED
Create the individual citations
Apply the formatting rules

8. SUBMITTING FULL PAPER
Revising, Editing, and Proofreading
Designing and Presenting Your Project
Conducting Research in the Disciplines
Documenting Sources

REFERENCES:

1. Website.
2. Printed Journals.

BCE701	ESTIMATION AND COSTING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite - Building Construction				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To provide the student with the ability to estimate the quantities of item of works involved in buildings, water supply and sanitary works, road works and irrigation works, and also to equip the student with the ability to do rate analysis, valuation of properties and preparation of reports for estimation of various items.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge on methods and types of estimation and its merits and demerits
CO2	Have knowledge on specifications and tendering process for contracts
CO3	Will have the ability to understand the types, formation, terms and conditions in contracts and arbitration
CO4	Will have the knowledge of rate analysis of different item of work and MB and bill of quantities
CO5	Will able to value a property, price escalation recommendations and auditing

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									
	CO3	M			H						M		
	CO4					H		H					
	CO5	H									H		

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ESTIMATION 9

Purpose – Methods of estimation – advantages – types of estimates – detailed estimates of residential buildings – single storied and multistoried buildings – earthwork – foundations – Super structure – Fittings including sanitary and electrical fittings – paintings.

UNIT II SPECIFICATIONS AND TENDERS 9

Specifications – Detailed and general specifications – construction specifications – sources – types of specifications – Tender notices – types – corrigendum notice – tender procedures – Drafting model tenders

UNIT III CONTRACTS 9

Contract – types of contracts – formation of contract – contract conditions – contract problems – contract for labor, material, design and construction – drafting of contract documents – construction contracts – arbitration and legal requirements.

UNIT IV RATE ANALYSIS AND PREPARATION OF BILLS 9

Data – Rate analysis – abstract estimate – report to accompany estimate – measurement book – bills – types

UNIT V VALUATION 9

Basic – Principles of valuation – Value and Cost – value engineering – value analysis – phases in value engineering – information – function – escalation – evaluation – recommendation implementation – Audit

TEXT BOOK:

1. Estimating and costing in Civil Engineering –Dutta B.N & Dutta S UBS Publishers & Distributors Pvt. Company, Lucknow 1986

REFERENCES:

1. Kohli, D.D and Kohli, R.C., "A Text Book of Estimating and Costing (Civil)", S.Chand & Company Ltd., 2004
2. Birdie G.S. "A text book on estimating and costing" — Dhanpat Rai and Sons, New Delhi.
3. Jagannathan G, Getting more at less cost – The Value Engineering Way, Tata McGraw Hill, New Delhi, 1992.

BCE702	**COMPUTER AIDED DESIGN OF STRUCTURES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite -Computer Aided Building Drawing				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To introduce the students about computer graphics, structural analysis, design and optimization and expert systems, applications in analysis.

COURSE OUTCOMES (COs)

CO1	Prepare wire frame modeling and solid modeling using drafting packages
CO2	Perform structural analysis using computer packages
CO3	Prepare algorithms for the analysis and design of steel and RC structures
CO4	Analysis simple structures using expert systems
CO5	Analysis and design of structures by using STADD.PRO, STRAP

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H	H	H							
	CO2			H	H	H							
	CO3			H	H						M		
	CO4			H	H	H		L					
	CO5			H	H	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION & COMPUTER GRAPHICS 10

Introduction to computer graphics - Fundamentals of CAD – Hardware and software requirements – Design process – Applications and benefits – drafting packages- use of AUTOCAD – application to layout of buildings and structures - graphic primitives – wireframe modeling and solid modeling.

UNIT II DESIGN & OPTIMIZATION 12

Design and Optimization: Optimization techniques – principles of design of steel and RCC structures - applications to simple design problems.

UNIT III INTRODUCTION TO FINITE ELEMENT ANALYSIS 14

Introduction of Finite Element Analysis: Fundamentals of finite element analysis – steps involved - boundary value problems. Galerkin's approach – variation principles – finite element matrix - assemblage solution for deflections - stresses and strains - simple problems using triangular elements.

UNIT IV ANALYSIS OF STRUCTURES BY FINITE ELEMENT METHOD12

Analysis of Structures by FEM: Analysis of plane truss, space truss, plane frame and space frame by using FEM packages – ANSYS – STRUDL – NASTRAN – SAP 2000.

UNIT V STRUCTURAL ENGINEERING PACKAGES 12

Structural Engineering Packages: Introduction of various structural engineering packages - analysis and design of structures by using STADD.PRO, STRAP.

TEXT BOOKS:

1. Krishna Raju, "Structural Design & Drawing (Concrete & Steel)", CBS Publishers 2004.

REFERENCES:

1. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Design of steel structures", Lakshmi Publications Pvt. Ltd 2003.
2. Rajasekaran, S., Finite Element Analysis. AH Wheelers Publishing Company Ltd.,
3. Rao S.S.Optimization – Theory and Application, Wiley Eastern Ltd.
4. Auto CADD manual.

BCE703	DESIGN OF STEEL STRUCTURES	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite -Basic Structural Design				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

This course deals with some of the special aspects with respect to Civil Engineering structures in industries.

COURSE OUTCOMES (COs)

CO1	Design of plate girders, web and flange design, curtailment of flange plates.
CO2	Design of simple and built up columns subject to combined bending and axial loads

CO3	Design of flexural and compression members, Design of self supporting steel chimneys.
CO4	Design of overhead rectangular, cylindrical and pressed steel tanks
CO5	To study shape factor, plastic hinge ,plastic moment , plastic analysis of beams.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		H	M								
	CO2	M		H	M								
	CO3	M		H	M		M				L		
	CO4	M		H	M								
	CO5	M		H	M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PLATE GIRDER 12

Design of plate girders – web and flange design – curtailment of flange plates – Design of stiffeners and splices – Design of gantry girder.

UNIT II COLUMNS SUBJECTED TO COMBINED BENDING AND AXIAL LOADS 12

Design of simple and built up columns subject to combined bending and axial loads - design of column base and connections to foundation.

UNIT III LIGHT GAUGE STEEL SECTIONS 12

Behavior – Design of flexural and compression members – Design of self supporting steel chimneys.

UNIT IV STEEL WATER TANKS 12

Design of overhead rectangular, cylindrical and pressed steel tanks including the design of staging and foundations.

UNIT V PLASTIC THEORY 12

Shape factor – plastic hinge – plastic moment – plastic analysis of beams - design of beams.

BCE7L1	COMPUTER AIDED DESIGN OF STRUCTURES LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2

	Prerequisite – Computer Aided Building Drawing
	Course Designed by – Dept of Civil Engineering

OBJECTIVES:

To introduce the students to analyze and design different structures like trusses, beams, frames etc.

COURSE OUTCOMES (COs)

CO1	To Study about Microsoft office
CO2	To Study about drawing of buildings using Autocad in 2D
CO3	To Study about drawing of buildings using Autocad in 3D
CO4	To Study about Modeling
CO5	To Study about 3D objects
CO6	To Study about Solid Editing
CO7	To Study about drawings of plans and layouts
CO8	To Study about various mode of drawing in Autocad
CO9	To Study about file management
CO10	To Study about analysis of trusses and frame
CO11	To Study about analysis of different component in staad pro
CO12	To Study about analysis and design of different component in staad pro

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					M							
	CO2					M							
	CO3					M							
	CO4					M							
	CO5					M							
	CO6					M							
	CO7					M							
	CO8					M							
	CO9					M							
	CO10					M							
	CO11					M							
	CO12					M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Preparation of Script and Slide presentation
2. Creating 2D drawings plan, elevation, section of residential buildings
3. Creating 3D drawings, preparation of elevation for multi storeyed buildings.
4. Surface modeling and solid modeling
5. 3D objects – construction and enhanced viewing
6. Solid Editing and real time 3D rotations
7. Working with layouts.
8. Modifying AUTOCAD environment and plotting
9. File management
10. Analysis of Plane truss space truss – plane frame – space frame and other elements such as plate elements and shell elements.
11. Analysis of different structural components by using STAAD.PRO – STRAP.
12. Analysis and design of different structural components by using STRAP – STAAD.PRO – STAAD etc.

BCE7L2	**COMPUTER AIDED DESIGN AND DRAFTING LABORATORY** (R.C.C, Steel, Irrigation & Environment)	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Computer Aided Building Drawing				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. The student shall be able to conceive, design and draw all types of irrigation structures in detail showing plan, elevation and sections.
2. This subject includes process design (excluding Structural Design) of major units associated with water and sewage treatment and transport including house building drainage. At the end of the course, the student is expected to know about the sizing of treatment plant units and draw the general arrangement.
3. To understand the techniques for designing of reinforced concrete structures and steel structures

COURSE OUTCOMES (COs)

CO1	Have a fundamental knowledge of the design of irrigation structures.
CO2	Have a fundamental knowledge of the design of environmental works which can describe real life phenomena.
CO3	To learn about design and Drawing for concrete structures
CO4	To learn about design and Drawing for steel structures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H				L		M		H	
	CO2	H		H				L		M		H	
	CO3	H		H				L		M		H	
	CO4	H	M	H		M		M		M		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I **11**

Detailed design and drawing (Not to scale) of the following reinforced concrete structures.

1. a. Typical building floors consisting of stabs and beams.
   b. Flat slabs using BIS code formula.
2. Isolated and combined footings.

UNIT II **11**

Detailed design and drawing (Not to scale) of the following steel structures :

1. a. Columns and base plate
   b. Grillage foundation
2. Plate Girder

UNIT III

Design of following irrigation works are to be worked out and drawing (Not to Scale) are to be drawn. **12**

1. Earthen Dams – Sections of different types of earth dams, plan showing drainage systems.
2. Tank Sluice Wing type
3. Tank Surplus Weir
4. Canal Regulator (Head regulator)

UNIT IV

Design of the following Environmental works are to be worked out and detailed drawing (Not to Scale) to be drawn. **11**

1. General layout of water supply scheme
2. Mixing basin, flocculation and sedimentation tanks
3. Slow and rapid sand filters – Service and clear water reservoirs

TEXT BOOK:

1. Satyanarayana Murthy, "Irrigation Design and Drawing", Published by Mrs. L. Banumathi, Tuni, East Godavari District, A.P. 1998
2. Punmia, B.C., Jain, A.K., and Jain.A., Environmental Engineering,Vol.I& Vol.II, Lakshmi Publications, Newsletter, 2005.

REFERENCES:

1. Krishnamurthy D, Structural Design Drawing CBS Publication. New Delhi 1985.
2. Shah M.G & Kale C.M, Building Drawing to Built to Environment –Tata McGraw Hill Co.
3. Manual on Water Supply and Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1999.
4. Manual on Sewerage and Sewage Treatment, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 1993.

5. H.S.Peavy, D.R.Rowe and George Tchobanoglous, Environmental Engineering MoGrawHill Company, New Delhi, 1995.
6. Shah C.S, Water Supply and Sanitation, Galgotia Publishing Company, New Delhi 1994

BCE8C1	**COMPREHENSION II**	**L**	**T**	**P**	**C**
	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses upto eighth semester				
	Course Designed by – Dept. of Civil Engineering				

OBJECTIVES

- To provide a complete review of Civil Engineering topics covered up to eighth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to eighth semester.

BEC8P1	**PROJECT WORK**	**L**	**T**	**P**	**C**
	Total Contact Hours –18 periods a week	0	0	18	9
	Prerequisite –Term paper				
	Course Designed by – Dept. of Civil Engineering.				

OBJECTIVES

- Learn to work as a member of a project team.
- Understand project management tasks.
- Develop a hardware / software solution for a real-time, industry relevant problem.

COURSE OUTCOMES (COs)

CO1	Apply knowledge of basic science and engineering to Civil Engineering problems
CO2	Implement the simple applications and verify using modern simulation tools.
CO3	Identify, formulate, and model engineering equipment
CO4	Recognize the real world applications and to solve with core engineering knowledge.
CO5	Analyze and work on multidisciplinary tasks
CO6	Choose latest tools, software and equipment to solve real world problems

CORE ELECTIVE – I

BCE051	CONCRETE TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Building Construction				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To study the properties of concrete making materials, tests, mix design, special concretes and various methods for making concrete.

COURSE OUTCOMES (COs)

CO1	To learn about concrete making material IS specifications.
CO2	To know about properties of fresh concrete and hardened concrete.
CO3	To understand the principles and methods of concrete mix design
CO4	To know about the various types of special concrete.
CO5	To understand process of manufacturing of concrete.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H	H								
	CO2	H	M	H	H	H							
	CO3	H	M	H	H		M						
	CO4	H		H	H								
	CO5	H	M	H	H	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CONCRETE MAKING MATERIALS 9

Aggregates, IS Specifications, Properties, Grading, Methods of combining aggregates, specified grading. Cement, Grades of cement. Chemical composition, Hydration of cement, structure of hydrated cement, Special cements - Water Chemical admixtures. Mineral admixtures.

UNIT II CONCRETE 9

Properties of fresh concrete, Hardened concrete, Strength, Elastic properties, Creep and shrinkage. Variability of concrete strength. Concrete testing Methods: Non destructive tests ultrasonic pulse velocity, Rebound Hammer test. Pullout tests.

UNIT III MIX DESIGN 9

Principles of concrete mix design. Methods of concrete mix design. Indian standard Recommended Method. IS 10262-82

UNIT IV SPECIAL CONCRETE 9

Light Weight concrete, Fly ash concrete, Fibre reinforced concrete, Polymer Concrete, Super plasticised concrete, Epoxy resins and screeds for rehabilitation - Properties and Applications- High performance concrete.

UNIT V CONCRETING METHODS 9

Process of manufacturing of concrete, methods of transportation, placing and curing - Extreme weather concreting, special concreting methods. Vacuum dewatering underwatering concrete, Ready mix concentrate.

REFERENCES:

1. Neville, A.M. Properties of Concrete, Pitman Publishing Limited, Lnclon.
2. Shetty M.S., Conrete Technology, S. Chand and Company Ltd. Delhi.
3. RudhaniG., Light Weight Concrete Academic Kiado, Publishing HomeofHungarianAcademy of Science, 1963.

BCE052	INDUSTRIAL STRUCTURES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Reinforced Concrete Structures - I				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

This course deals with some of the special aspects with respect to Civil Engineering structures related to industries

COURSE OUTCOMES (COs)

CO1	Prepare the layout for industrial buildings
CO2	Design for functional requirements
CO3	Design steel girder, bunker and silos
CO4	Design RC structures like chimneys, silos and folded plates
CO5	Design prestressed precast concrete units.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		M	M								
	CO2			H	H								
	CO3			H	H								
	CO4			H	H								
	CO5			H	H								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I GENERAL 8

Specific equipments for industries like Engineering. Textile, Chemical etc., - Site layout and external facilities classification of industries minimum standards internal calculation – Materials – Works.

UNIT II FUNCTIONAL REQUIREMENTS 10

1. Lighting – Natural and artificial – protection from the sun – sky light.
2. Services, Layout, wiring fixtures, cable and pipe bridges – Electrical installations – lighting - Substations - effluent.
3. Ventilation and fire protection, ventilation & air – conditioning, fire escapes and, chutes, fire alarms, extinguishers and hydrants.

UNIT III PLANNING & DESIGN 9

(Requirement of factory and other rules)

Layout stages. Loading Design of single bay and design of multi bay multi storied frames in RCC and steel – Analysis of industrial structures.

UNIT IV DESIGN OF APARTMENT STRUCTURES 10

Cranes - Different types - principles - design of girder – open web and solid web bunkers – silos – R.C. ducts.

UNIT V CONSTRUCTION TECHNIQUES 8

Expansion joints- design of machine foundations and other foundations as per I.S. Code - Water proofing – roof drainage – joints – sound, shock proof mountings.

TEXT BOOKS:

1. Purushothaman P ,"Reinforced Concrete Structural elements", Tata McGraw-Hill, 1984.

REFERENCES:

1. Pasala Dayaratnam,"Design of Steel Structure", Wheeler publishers Allahabad , 1990.
2. Planning industrial structures Dunham, Industrial Structures McGraw-Hill Book Co; 1st edition (1948)
3. Henn W. Buildings for Industry, vols.I and II, London Hill Books, 1995.
4. Handbook on Functional Requirements of Industrial buildings, SP32 – 1986, Bureau of Indian Standards, New Delhi 1990.
5. Course Notes on Modern Developments in the Design and Construction of IndustrialStructures, Structural Engineering Research Centre, Madras, 1982.

BCE053	ADVANCED CONSTRUCTION TECHNIQUES	L	T	P	C
	Total Contact Hours -45	3	0	0	3
	Prerequisite – Building Construction				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To bring about a complete understanding of advanced construction techniques in sub structure super structure and repair construction

COURSE OUTCOMES (COs)

CO1	Understand the various processes involved in sub-structure construction
CO2	Understand the various processes involved in super-structure construction.
CO3	Understand the construction process of special structures and offshore structures.
CO4	Know about the rehabilitation techniques carried out for a structure.
CO5	Know about the demolition techniques carried out for a structure.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		M		H							
	CO2	M		M		H	L				L		
	CO3	M		M		H							
	CO4	M		M		H							
	CO5	M		M		H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SUB STRUCTURE CONSTRUCTION 15

Box jacking - pipe jacking - Under water construction of diaphragm walls and basement - Tunneling techniques - piling techniques - driving well and caisson - sinking cofferdam - cable anchoring and grouting - driving diaphragm walls, sheet piles - laying operations for built up offshore system - shoring for deep cutting - large reservoir construction - well points - dewatering and stand by plant equipment for underground open excavation.

UNIT II SUPER STRUCTURE CONSTRUCTION FOR BUILDINGS 10

Vacuum dewatering of concrete flooring – concrete paving technology – techniques of construction for continuous concreting operation in tall buildings of various shapes and varying sections – launching techniques – suspended form work – erection techniques of tall structures, large span structures – launching techniques for heavy decks – insitu prestressing in high rise structures, aerial transporting handling erecting lightweight components on tall structures.

UNIT III CONSTRUCTION OF SPECIAL STRUCTURES 10

Erection of lattice towers and rigging of transmission line structures – construction sequence in cooling towers, silos, chimney, sky scrapers, bow string bridges, cable stayed bridges – launching and pushing of box decks – Advanced construction techniques for offshore structures – construction sequence and methods in domes and prestress domes – support structure for heavy equipment and conveyor and machinery in heavy industries – erection of articulated structures, braced domes and space decks.

UNIT IV REHABILITATION TECHNIQUES 6

Mud jacking grout through slab foundation - micropiling for strengthening floor and shallow profile - pipeline laying - protecting sheet piles, screw anchors - sub grade water proofing, underpinning, crack stabilization techniques.

UNIT V DEMOLITION 4

Advanced techniques and sequence in demolition and dismantling.

REFERENCES:

1. Robertwade Brown, Practical foundation engineering hand book, McGraw Hill Publications, 1995.
2. Patrick Powers. J., Construction Dewatering: New Methods and Applications, John Wiley & Sons, 1992.
3. Jerry Irvine, Advanced Construction Techniques, CA Rocketr, 1984
4. Peter.H.Emmons, "Concrete repair and maintenance illustrated", Galgotia Publications Pvt. Ltd., 2001.
5. Sankar, S.K. and Saraswati, S., Construction Technology, Oxford University Press, New Delhi, 2008.

BCE054	CONSTRUCTION PLANNING,SCHEDULING ANDCONTROL	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Construction Technology				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To study the finer aspects of planning, scheduling and controlling of construction projects.

COURSE OUTCOMES (COs)

CO1	Know the elements of construction planning and estimating activity durations and resource requirements.
CO2	Know the elements of scheduling and to apply appropriate tools and techniques like networks and coding systems.
CO3	Understand the monitoring and accounting of projects through cost control.
CO4	Know the elements of quality control and safety of construction projects.
CO5	Know the concept of gathering and using project information

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	M			M			M	H				
	CO2	M			M			M	H				
	CO3	M			M			M	H				
	CO4	M			M			M	H				
	CO5	M			M			M	H				

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CONSTRUCTION PLANNING 9

Basic Concepts in the Development of Construction Plans - Choice of Technology and Construction Method - Defining Work Tasks - Defining Precedence Relationships among Activities - Estimating Activity Durations - Estimating Resource Requirements for Work Activities - Coding Systems

UNIT II SCHEDULING PROCEDURES AND TECHNIQUES 9

Construction Schedules - Critical Path Method – Scheduling Calculations - Float - Presenting Project Schedules - Scheduling for Activity-on-Node and with Leads, Lags, and Windows - Scheduling with Resource Constraints and Precedences - Use of Advanced Scheduling Techniques - Scheduling with Uncertain Durations - Calculations for Monte Carlo Schedule Simulation - Crashing and Time/Cost Tradeoffs - Improving the Scheduling Process.

UNIT III COST CONTROL, MONITORING AND ACCOUNTING 9

The Cost Control Problem - The Project Budget - Forecasting for Activity Cost Control - Financial Accounting Systems and Cost Accounts - Control of Project Cash Flows - Schedule Control - Schedule and Budget Updates - Relating Cost and Schedule Information.

UNIT IV QUALITY CONTROL DURING CONSTRUCTION 9

Quality Concerns in Construction - Organizing for Quality - Work and Material specifications - Total Quality Control - Quality Control by Statistical Methods - Statistical Quality Control with Sampling by Attributes - Statistical Quality Control with Sampling by Variables

UNIT V ORGANIZATION AND USE OF PROJECT INFORMATION 9

Types of Project Information - Accuracy and Use of Information - Computerized Organization and Use of Information - Organizing Information in Databases - Relational Model of Databases - Other Conceptual Models of Databases - Centralized Database Management Systems - Databases and Applications Programs - Information Transfer and Flow.

REFERENCES:

1. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
2. Calin M. Popescu, Chotchai Charoenngam, Project Planning, Scheduling and Control in Construction: An Encyclopedia of terms and Applications, Wiley, New York, 1995.

3. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
4. Willis, E. M., Scheduling Construction Projects, John Wiley & Sons, 1986.
5. Halpin, D. W., Financial and Cost Concepts for Construction Management, John Wiley & Sons, New York, 1985.

BCE055	INDUSTRIAL WASTE TREATMENT AND DISPOSAL	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Environmental Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To provide knowledge on sources and characteristics of industrial wastewater,techniques and approaches for minimizing the generation and application of physio-chemical and biological treatment methods for recovery, reuse and disposal.

COURSE OUTCOMES (COs)

CO1	Have a fundamental knowledge of the effluent discharge standards and waste minimization technology
CO2	Have a well-founded knowledge of characteristics of industrial wastewaterand treatment methods.
CO3	Acquire knowledge about conventional methods of treatment for industrial waste.
CO4	Understand various biological treatment methods
CO5	Have a fundamental knowledge of combined treatment of industrial and municipal wastes.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1							H	M			H	M
	CO2			L				M					
	CO3	L	M	M				M					
	CO4	L	M	M				M					
	CO5	L	M	M				H		H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I EFFECTS AND CONTROL OF INDUSTRIAL POLLUTION 9

Effects of industrial wastes on streams, land and air, wastewater treatment plants, water quality criteria – effluent standards : Process modification, method and material changes, housekeeping etc., to reduce water discharges and strength of the waste and established recovery methods for bye products within the plant operations.

UNIT II CHARACTERISTICSAND TREATMENT OF INDUSTRIALWASTEWATER 9

Characteristics of major industrial waste water (liquid wastes) Chemical Industries: Petrochemicals & refineries, pharmaceuticals. Apparel Industries: Textile, synthetic fibres, leather, paper. Agro Industries: Fertilizer Food Industries: Heat – packing pickles, canning poultry and eggs, distillers, sugar. Metallurgical Industries: Thermal power station, nuclear power plants.

UNIT III PHYSICAL TREATMENT METHODS 9

Conventional methods of treatment and disposal of industrial wastes. Equalisation and neutralization, separation of solids – sedimentation and filtrations.

UNIT IV BIOLOGICAL TREATMENT METHODS 9

Removal of organic contents: Biological treatment methods, aerobic and anaerobic, digestion, tickling filters, stabilization ponds, activated sludge process – oxidation ditch.

UNIT V PHYSICO - CHEMICALTREATMENT METHODS 9

Physico - Chemical Treatment Method – Neutralization, coagulation, flocculation, adsorption and precipitation. Combined treatment of industrial and municipal wastes.

TEXT BOOKS:

1. Eckenfalder W.W,"Industrial Water Pollution Control", McGraw Hill, New York, 1989

REFERENCES:

1. Arceivala S.J & Shyam Asolekar R, "Waste Water Treatment and Pollution Control Tata McGraw Hill, 1998.
2. Nelson Leonard Nemerow," Theories and practice of industrial waste treatment", Addison Wesley Pub. Co., 1963
3. World Bank Group "Pollution prevention and Treatment Hand Book" World Bank and UNEP Washington DC, 1998

BCE056	SOLID AND HAZARDOUS WASTE MANAGEMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Environmental Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To educate the students on the principles involved in the management of municipal solid waste and hazardous wastes- from source identification up to disposal.

COURSE OUTCOMES (COs)

CO1	To make them understand the fundamentals of solid and hazardous wastes and also the types, need and sources of solid and hazardous wastes.
CO2	To understand about the methods of waste characterization and source reduction and to study the various methods of generation of wastes.

CO3	To understand in detail about the storage, collection and transport of wastes. and also to study about the methods used for handling and segregation of wastes.
CO4	To improve the knowledge on the waste processing techniques which includes incineration, solidification and stabilization of hazardous wastes
CO5	To know about the basics of the waste disposal options and also a detailed study on the disposal in landfills and also to learn about landfill remediation

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				H				M			
	CO2	H			M					H			
	CO3			M			H						
	CO4	H						H		L			
	CO5		M			H				H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Types and Sources of solid and hazardous wastes-Need for solid and hazardous waste management- Elements of integrated waste management and roles of stakeholders- Salient features of Indian legislations on management and handling of municipal solid wastes, hazardous wastes, biomedical wastes, lead acid batteries, plastics and fly ash,financing waste management.

UNIT II WASTE CHARACTERIZATION AND SOURCE REDUCTION 9

Waste generation rates and variation-Composition, physical, chemical and biological properties of solid wastes- Hazardous Characteristics- TCLP tests- waste sampling and characterization plan- source reduction of wastes- Recycling and reuse- waste exchange.

UNIT III STORAGE, COLLECTION AND TRANSPORT OF WASTES 9

Handling and segregation of wastes at source- storage and collection of municipal solid wastes- Analysis of collection systems- Need for transfer and transport- Transfer stations Optimizing Waste allocation- compatibility, storage, labeling and handling of hazardous wastes- hazardous waste manifests and transport.

UNIT IV WASTE PROCESSING TECHNIQUES 9

Objectives of waste processing- material separation and processing technologies- biological and chemical conversion technologies-method and controls of composting- thermal conversion technologies and energy recovery- incineration- solidification and stabilization of hazardous wastes- treatment of biomedical wastes.

UNIT V WASTE DISPOSAL 9

Waste disposal options- Disposal in landfills- Landfill Classification, types and methods- site selection- design and operation of sanitary landfills, secure landfills and landfill bioreactors-

leachate and landfill gas management- landfill closure and environmental monitoring- closure of landfills- landfill remediation.

REFERENCES:

1. George Tchobanoglous, Hilary Theisen and Samuel A, Vigil "Integrated Solid Waste Management, McGraw- Hill International edition, New York, 1993.
2. CPHEEO "Manual on Municipal Solid waste management, Central Public Health and Environmental Engineering Organisation, Government of India, New Delhi, 2000.
3. Micheael D. Lagrega, Philip L Buckingham, Jeffrey C. E vans and Environmental Resources Management, Hazardous waste Management, McGraw- Hill International edition, New york, 2001.
4. Vesilind P.A., Worrell W and Reinhart, Solid Waste Engineering, Thomson Learning Inc., Singapore, 2002.

CORE ELECTIVE – II

BCE057	DESIGN OFR.C.FRAMED STRUCTURES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Reinforced Concrete Structures – I				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

The design aspects and analysis methodologies of tall buildings will be introduced. The stability analysis of tall buildings is another important objective of this course.

COURSE OUTCOMES (COs)

CO1	Computation of design moments and shears.
CO2	Analysis for wind and earthquake effects , Design of beams, columns and slabs.
CO3	Design by empirical and rigid frame analysis.
CO4	Design of various types of shear walls and detailing
CO5	Moment distribution and FEM methods of analysis of tall building using standard packages.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	H	H							
	CO2			H	H								
	CO3			H	H								
	CO4			H	H								
	CO5	M		H	H								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INDUSTRIAL FRAMES 8

Single Storey Industrial Frames: Estimation of member forces in single storey R.C.C. Industrial bents -of flat Top & gabled configuration from handbooks – Design of members, rigid joints and footing detailing.

UNIT II RC STRUCTURES ELEMENTS 10

Medium – Rise Framed Buildings : Computation of design moments and shears using substitute frame methods of IS 456 and explanatory handbooks – Analysis for wind and earthquake effects – Design of beams, columns and slabs by Sp-16 Design aid – Detailing of reinforcement – Design of staircases and footings.

UNIT III DESIGN OF FLAT SLAB 9

Flat Slab Design, Design of heavily loaded warehouse type – Multi storey frames using flat – slab type of construction – Design by empirical and rigid frame analysis – Detailing – Design of pile foundations.

UNIT IV FUNCTIONAL DETAILS OF TALL BUILDINGS 9

Tall building - functional details – wells, staris and shear walls – lateral deflection - Frame and shear wall interaction - Design of various types of shear walls and detailing – Design of pile foundations.

UNIT V COMPUTER APPLICATION 9

Computer Methods. Moment distribution and FEM methods of analysis of tall building using standard packages.

TEXT BOOKS:

1. Vazirani V.N & Ratwani MM,"Concrete Structures", Khanna Publishers, New Delhi, 1995

REFERENCES:

1. P.Purushothaman, Reinforced Concrete Structural elements Tata McGraw Hill Co, New Delhi.
2. R.Park&T.Paulay, Design of Reinforced Concrete Structural Elements – John Wiley & Sons, New York, 1975.
3. C.M.Reynolds& J.C. Steedam Reinforced Concrete Designers Handbook Rupa& Co, Calcutta, 1987.
4. V.Baikov, and E.Singalov, Reinforced Concrete Structures, Mir Publishers, Moscow,1971.
5. W.H.MosleyandW.J.Spencer, Micro Computer Application in Structural Engineering McMilfan Press, London, 1986.

BCE058	TALL STRUCTURES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Structural Analysis – I				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

The design aspects and analysis methodologies of tall structures will be introduced. The stability analysis of tall structures is another important objective of this course.

COURSE OUTCOMES (COs)	
CO1	Implement design philosophies for the development of high rise structures
CO2	Find out the design loads for high rise buildings
CO3	Analyze the behavior of tall buildings subjected to lateral loading.
CO4	Perform computerized general three dimensional analysis for high rise building
CO5	Perform stability analysis using various methods for tall buildings

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	H								
	CO2			H	H								
	CO3			H	H								
	CO4	M		H	H								
	CO5			H	H								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I GENERAL 9

Historical Development & Design Criteria: Design philosophy Loading, strength and stability. Stiffness and dirt limitations. Human comfort, Creep, shrinkage and temperature effects – Fire – Foundation -settlement – Soil structure interaction.

UNIT II LOADS 9

Gravity loading Methods and lively hood reduction- Impact loading - Construction loads – Wind loading – Static and dynamic approach – Analytical and experimental method – Earthquake loading – Model analysis.

UNIT III BEHAVIOUR SYSTEMS 9

Behaviour of Various Structural system: Factors affecting growth, height and structural form. High Rise behavior- Rigid frames - Braced frames - Infilled frames – Shear walls – Coupled shear walls – Walls frames – Tubular cores and hybrid mega systems.

UNIT IV ANALYSIS & DESIGN 10

Analysis & Design: Modeling – Analysis of building as total structural system considering overall integrity and major sub – system interaction. Analysis of member forces- Drift and twist - Computerised general three dimensional analysis - Section shapes, Properties and resisting capacity – Design of differential movement – Creep and shrinkage effects- Temperature effects and fiber resistance.

UNIT V STABILITY OF TALL BUILDINGS 8

Stability of Tall Buildings : Overall buckling analysis - Wall frames - Approximate methods – Second order effects – P – Delta – Simultaneous first – order and P – Delta analysis – Translational – Torsional instability – Out of plumb – Effect of foundation rotation.

TEXT BOOKS:

1. Wolfgang Schueller " High Rise Building Structures", John Wiley And Sons, NewYork, 1976.

REFERENCES:

1. Tung-Yen Lin &Sidney D. Stotesbury, "Structures Concept and Systems for Architects and Engineers", John Wiley & Sons, 1981
2. Lynn Baedle S., "Advances in Tall Buildings", CBS Publishers and Distributors. New Delhi, 1986.
3. Bryan Stafford Smith And Alex Coull, " Tall Building Structures ", Analysis And Design, John Wiley And Sons, Inc., 1991.

BCE059	**SAFETY PRACTICES IN CONSTRUCTION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Building Construction				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To study various safety practices that has to be adopted in construction and to know the finer aspects of safety programs, sampling and audit.

COURSE OUTCOMES (COs)

CO1	Know the safety concepts that have to be adopted in construction
CO2	Understand the elements of safety programmes
CO3	Know the awareness on safety practices that has to be ensured during construction.
CO4	Know about the accident prevention, safety sampling and audit.
CO5	Know the safety concepts in hand tools, grinding, lifting works and while operating fire fighting equipments.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M					H	M	H				
	CO2	M					H	M	H				
	CO3	M					H	M	H				
	CO4	M					H	M	H				
	CO5	M					H	M	H				

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SAFETY CONCEPTS 9

Construction accidents - Construction Safety Management: Importance - causes of accident, safety measures- Environmental issues in construction-Construction industry related laws. Human factors in safety – legal and financial aspects of accidents in construction – occupational and safety hazard assessment.

UNIT II SAFETY PROGRAMMES 9

Safety Programmes - Construction Safety - Elements of an Effective Safety Programmes - Job-site assessment - Safety Meetings - Safety Incentives. Contractual Obligations - Safety in construction contracts- Substance Abuse - safety Record Keeping.

UNIT III SAFETY PRACTICES 9

Safety Culture - Safe Workers- Safety and First Line Supervisors - Safety and Middle Managers - Top Management Practices, Company Activities and Safety - Safety Personnel - Sub-contractual Obligation - Project Coordination and Safety Procedures - Workers Compensation

UNIT IV SAFETY SAMPLING AND AUDIT 9

Accident prevention-cost of accidents-Safety and productivity-safety provision in the factories act-accident reporting investigation and statistics-total loss control and damage control-Safety sampling- safety audit - critical incident technique- safety equipment - planning and site preparation- safety system of storing construction materials-Excavation - blasting- timbering-scaffolding- safe use of ladders- safety in welding.

UNIT V SAFETY IN LIFTING AND FIRE 9

Safety in hand tools- Safety in grinding- Hoisting apparatus and conveyors- Safety in the use of mobile cranes-Manual handling- Safety in demolition work- Trusses, girders and beams- First-aid- Fire hazards and preventing methods-Interesting experiences at the construction site against the fire accidents.

REFERENCES

1. Jimmy W. Hinze, Construction Safety, Prentice Hall Inc., 1997
2. Richard J. Coble, Jimmie Hinze and Theo C. Haupt, Construction Safety and Health Management, Prentice Hall Inc., 2001.
3. Hand Book on Construction Safety Practices, SP:70, BIS, 2001.

BCE060	MODERN CONSTRUCTION MATERIALS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Building Construction				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To bring about an exposure to design concepts structures, the loads, systems, structural materials, design procedures, repair and rehabilitation of systems

COURSE OUTCOMES (COs)

CO1	Identify the various types of concretes and their constituents and properties.

CO2	Identify the various types of metals, their properties and applications.
CO3	Identify the various composite materials, their properties and applications.
CO4	Understand the concept of water-proofing and identify the purpose of flooring and façade materials.
CO5	Design and develop smart intelligent buildings.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M				H		M			L		
	CO2	M				H		M					
	CO3	M				H		M		L			
	CO4	M				H		M					
	CO5	M				H		M					

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I SPECIAL CONCRETES 10

Concretes, Behaviour of concretes - High Strength and High Performance Concrete – Fibre Reinforced Concrete, Self compacting concrete, Alternate Materials to concrete.

UNIT II METALS 10

Steels - New Alloy Steels – Aluminum and its Products –Coatings to reinforcement – Applications.

UNIT III COMPOSITES 10

Plastics –Reinforced Polymers – FRP – Applications

UNIT IV OTHER MATERIALS 10

Water Proofing Compounds – Non-weathering Materials – Flooring and Façade Materials

UNIT V SMART AND INTELLIGENT MATERIALS 5

Smart and Intelligent Materials for intelligent buildings - Special features

REFERENCES:

1. Santhakumar A.R., Concrete Technology, Oxford University Press, New Delhi. 2007.
2. Mamlouk, M.S. and Zaniewski, J.P., Materials for Civil and Construction Engineers, Prentice Hall Inc., 1999.
3. Ashby, M.F. and Jones.D.R.H.H. “Engineering Materials 1: An Introduction to Properties, applications and designs”, Elsevier Publications, 2005.

4. Shan Somayaji, Civil Engineering Materials, Prentice Hall Inc., 2001
5. Aitkens , High Performance Concrete, McGraw Hill, 1999
6. Deucher, K.N, Korfiatis, G.P and Ezeldin, A.S, Materials for Civil and Highway Engineers, Prentice Hall Inc., 1998.
7. Shetty M.S, Concrete Technology: Theory and Practice, S.Chand & Company Ltd., 2005.
8. ACI Report 440.2R-02, "Guide for the Design and Construction of Externally Bonded Rp Systems For Strengthening Concrete Structures", American Concrete Institute, 2002.

BCE061	AIR & NOISE POLLUTION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Environmental Studies				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. This subject covers the sources, characteristics and effects of air and noise pollution and the methods of controlling the same. The student is expected to know about source inventory and control mechanism.

2. The emphasis in this course will be the monitoring and control of particulate and Gaseous pollutants, Minimization of the noise and noise pollution including technical measures, Codes, regulations, directives and standards about noise pollution.

COURSE OUTCOMES (COs)

CO1	To learn about the air pollutants, sources and its effects.
CO2	To have a clear understanding on the air quality standards and its techniques.
CO3	To determine the fluid resistance for organic materials.
CO4	To find the Properties of air pollution and its control measures.
CO5	To learn about the effects and the sources of noise pollution.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L				M	H					
	CO2			H						L			M
	CO3		M		H			H		H			
	CO4	H							M	M			
	CO5				H					H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Definition of clean air, nature, air pollutants, sources of air pollutants, effects of air pollution on man, animal, vegetation and properties.

UNIT II AMBIENT AIR QUALITY STANDARDS AND AIR QUALITY MONITORING 10

Harmful concentration – geographical factors in air pollution – air pollution control legislation. Classification sampling; sampling techniques; monitoring atmospheric pollution.

UNIT III FLUID RESISTANCE TO PARTICLE MOTION 9

Principles of removal of a gaseous constituent; adsorption and combustion; catalytic combustion of organic materials; catalytic oxidation and decomposition.

UNIT IV AIR POLLUTION AND CONTROL MEASURES 9

Setting chambers; momentum separators, fibrous filters; electro static precipitators; bag houses centrifugal spray scrubbers; venture scrubbers; elementary principles of air pollution e-control techniques.

UNIT V NOISE POLLUTION 8

Sound and noise; sources of noise pollution, environmental and industrial noise; effects of noise pollution: measures for prevention and control of noise; environmental and industrial noise; noise control legislation.

TEXT BOOKS:

1. Anjaneyulu D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2002.

REFERENCES:

1. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi,1996.
2. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 1996.
3. Stern A.C. *ed,* " Air Pollution Vol. I, II & III", Academic Press, New York, 1968
4. Cunniff P.F, "Environmental Noise Pollution", John Wiley & Sons, New York. 1977.
5. Docks H.M., "Environmental Pollution", John Wiley & Sons. New York 1981.
6. Chanlett T Emit,"Environmental Protection", McGraw Hill series in Water Resources and Environmental Engineering, New York. 1973.
7. Patrick C.F,"Environemental noise pollution", John Wiley & Sons, 1977.

BCE062	**ENVIRONMENTAL IMPACT ASSESSMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Environmental Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1.To educate the students on the scope, steps involved and various methods related to assessment of environmental impact due to development projects

COURSE OUTCOMES (COs)

CO1	To make them understand the basics of EIA and its limitations across sectoral issues and terms of references in EIA. It also includes the study of participation of

	Public and Non-Governmental Organizations in environmental decision making.
CO2	To understand about the methods and components of EIA and to learn about the expert systems
CO3	To understand in detail about the prediction tools for EIA along with the mathematical modeling for impact prediction
CO4	To improve the knowledge on the ethical and quality aspects of Environmental Impact Assessment
CO5	To know in detail about the Case studies of EIA related to the various sectors in a country like infrastructure, sources of energy etc.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				M					L		
	CO2		H		M					M			
	CO3	H			H		M						
	CO4							H		M			
	CO5	H							M	H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INTRODUCTION 9

Environment Impact Assessment (EIA) - Environmental Impact statement – EIA in Project Cycle – Legal and Regulatory aspects in India according to Ministry of Environment and Forests – Types and Limitations of EIA- cross sectoral issues and terms of references in EIA- participation of Public and Non-Governmental Organizations in environmental decision making.

UNIT II COMPONENTS AND METHODS 9

Components of EIA – Processes – screening – scoping – setting – analysis - mitigation. Matrices-Networks –Checklists – connections and combinations of processes – Cost benefit analysis - Analysis of alternatives - Software packages for EIA-Expert systems in EIA.

UNITIII PREDICTION, ASSESSMENT OF IMPACTS AND REPORTING 9

Prediction tools for EIA-Mathematical modeling for impact prediction-Assessment of impacts-air-water-soil-noise-biological-socio-cultural environments-Cumulative Impact Assessment-Documentation of EIA findings-planning-organization of information and visual display materials-Report preparation.

UNIT IV ENVIRONMENTAL MANAGEMENT PLAN 9

Environmental Management Plan-preparation, implementation and review- Mitigation and Rehabilitation Plans-Policy and guidelines for planning and monitoring programmes - post project audit-Ethical and Quality aspects of Environmental Impact Assessment.

UNIT V CASE STUDIES 9

Case studies related to the following sectors-Infrastructure-Mining-industrial-Thermal Power – River valley and Hydroelectric-Nuclear Power.

REFERENCES:

1. Lawrence, D.P., Environmental Impact Assessment - Practical Solutions to Recurrent Problems, Wiley- Interscience, New Jersey, 2003.
2. Petts, J., Handbook of Environmental Impact Assessment, Vol., I and II, Blackwell Science London,1999.
3. Canter, L.W., Environmental Impact Assessment , McGraw- Hill, New York,1996.
4. Biswas, A.K. and Agarwala, S.B.C. Environmental Impact Assessment for Developing Countries, Butterworth Heinemann, London,1994.
5. The World Bank Group, Environmental Assessment Source Book Vol. I, II and III. The World Bank, Washington,1991.

CORE ELECTIVE – III

BCE063	**PRESTRESSED CONCRETE STRUCTURES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Construction Technology				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES: To introduce the students to the basic concepts and principles of Prestressed concrete structures

COURSE OUTCOMES (COs)

CO1	To design prestressed concrete beam
CO2	To design prestressed composite beams
CO3	To design flexural members with partial prestressing
CO4	To design prestressed concrete tanks, poles and sleepers
CO5	To design prestressed concrete bridges

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	H								
	CO2			H	H								
	CO3			H	H								
	CO4			H	H								
	CO5			H	H								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION – THEORY AND BEHAVIOUR 8

Basic concepts – Advantages – Materials required – Systems and methods of prestressing. Analysis of sections. Stress concept, Strength concept, Load balancing concept -. Effect of loading on the tensile stresses in tendons - Effect of tendon profile on deflections – Factors influencing deflections – Calculation of deflections – Short term and long term deflections – Losses of prestress – Estimation of crack width.

UNIT II DESIGN OF END BLOCK ` 10

Flexural strength – Simplified procedures as per codes – strain compatibility method – Basic concepts in selection of cross section for bending – stress distribution in end block- Design of anchorage zone reinforcement – Limit state design criteria – Partial prestressing- Applications.

UNIT III CIRCULAR PRESTRESSING 9

Design of prestressed concrete tanks – Poles and sleepers

UNIT IV COMPOSITE CONSTRUCTION 8

Analysis for stresses – Estimate for deflections – Flexural and shear strength of composite members.

UNIT V PRESTRESSED CONCRETE BRIDGES 10

General aspects pretensionedprestressed bridge decks - Post tensioned prestressed bridge decks - Advantages over R.C.bridges - Principles of design only.

TEXT BOOKS:

1. Krishna Raju N. "Prestressed concrete", Tata McGraw Hill Company, New Delhi 2007

REFERENCES:

1. MallieS.K.and Gupta A.P. "Prestressed concrete", Oxford and VB publishing Co. Pvt Ltd., 1987.

BCE064	**ADVANCED CONCRETE DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Reinforced Concrete Structures - I				
	Course Designed by – Dept of Civil Engineering				
OBJECTIVES: To apprise the students about the basics of design of flat slabs, folded plates and cylindrical shells.					
COURSE OUTCOMES (COs)					
CO1	To study Limit Analysis of beams in Flexure.				
CO2	Limit analysis and design of Portal frames				
CO3	Analysis and design of orthogrid floors/roofs.				
CO4	Analysis and design of prismatic folded plates and circular cylindrical shells				
CO5	To study the Design of bunkers and silos.				

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	H								
	CO2			H	H								
	CO3			H	H								
	CO4			H	H								
	CO5			H	H								
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
								√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I LIMIT STATE ANALYSIS OF BEAMS 9

Limit Analysis of beams in Flexure: Behaviour of reinforced concrete members in bending and shear. Plastic hinge Rotation capacity. Factors affecting rotation capacity of a section. Plastic moment. Moment curvature relationship.

Redistribution of moments – Analysis and limit state design of continuous beams.

UNIT II PORTAL FRAMES 9

Limit Analysis & Design: Limit analysis and design of Portal frames.

UNIT III DESIGN OF FLAT SLABS 9

Design of Flat Slabs Using BIS 456: Analysis and design of orthogrid floors/roofs.

UNIT IV PLATES AND SHELLS 9

Analysis and design of prismatic folded plates and circular cylindrical shells using beam approximation.

UNIT V BUNKERS AND SILOS 9

Design of bunkers and silos.

TEXT BOOKS:

1. Krishna Raju N," Advanced Concrete Design",CBS Publishers and Distribution, Delhi, 1988.

REFERENCES:

1. Jain OP and Jaikrishna,"Plain and reinforced Concrete Vol.2", Nemchand and bros, Roorkee, 1958
2. Dunham C W,"Advanced Concrete Design",Mc Graw Hills Company, 1992
3. Malick and Rangasamy, "Reinforced Concrete Design", Khanna Publishers, Delhi,1976

BCE065	CONSTRUCTION EQUIPMENT AND MANAGEMENT	L	T	P	C

	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Building Construction				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To introduce various construction equipment and study the efficient utilization of the same using scientific principles.

COURSE OUTCOMES (COs)

CO1	Manage the equipment, cost control and maintenance of a project.
CO2	Identify and understand the working principle of earthwork equipments.
CO3	Identify and understand the working of various equipments for different construction process
CO4	Identify and understand the working principle of material handling equipments.
CO5	Understand the working of aggregate production and concreting equipments.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		M		H				L			
	CO2	M		M		H							
	CO3	M		M		H							
	CO4	M		M		H		L					
	CO5	M		M		H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I CONSTRUCTION EQUIPMENT MANAGEMENT 10

Identification – Planning - Equipment Management in Projects - Maintenance Management – Replacement - Cost Control of Equipment - Depreciation Analysis – Safety Management.

UNIT II EQUIPMENT FOR EARTHWORK 10

Fundamentals of Earth Work Operations - Earth Moving Operations - Types of Earth Work Equipment - Tractors, Motor Graders, Scrapers, Front end Waders, Earth Movers.

UNIT III OTHER CONSTRUCTION EQUIPMENTS 10

Equipment for Dredging, Trenching, Tunneling, Drilling, Blasting - Equipment for Compaction - Erection Equipment - Types of pumps used in Construction - Equipment for Dewatering and Grouting – Foundation and Pile Driving Equipment – Equipment for Demolition.

UNIT IV MATERIALS HANDLING EQUIPMENT 5

Forklifts and related equipment - Portable Material Bins – Conveyors – Hauling Equipment.

UNIT V EQUIPMENT FOR PRODUCTIO OF AGGREGATE AND CONCRETING 10

Crushers – Feeders - Screening Equipment - Handling Equipment - Batching and Mixing Equipment - Hauling, Pouring and Pumping Equipment – Transporters.

REFERENCES:

1. Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., Construction Planning, Equipment and Methods, McGraw Hill, Singapore, 2006.
2. Sharma S.C. Construction Equipment and Management, Khanna Publishers, New Delhi, 1988.
3. Deodhar, S.V. Construction Equipment and Job Planning, Khanna Publishers, New Delhi, 1988.
4. Dr.Mahesh Varma, Construction Equipment and its planning and Application, Metropolitan Book Company, New Delhi. 1983.

BCE066	**PREFABRICATION AND CONSTRUCTION TECHNIQUES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Construction Technology				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To bring about an understanding of the prefabrication and construction techniques adopted

COURSE OUTCOMES (COs)

CO1	Know the standardization and tolerances-system for prefabrication
CO2	Understand the Pre-casting and handling techniques
CO3	Know the Curing techniques including accelerated curing.
CO4	Know the Pre-cast and pre-fabricating technology for low cost and mass housing schemes.
CO5	Understand the Repairs and economical aspects on prefabrication

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		M		H				L			
	CO2	M		M		H							
	CO3	M		M		H							
	CO4	M		M		H							
	CO5	M		M		H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Materials - Modular co-ordination, standardization and tolerances-system for prefabrication. Pre-cast concrete manufacturing techniques, Moulds –construction design, maintenance and repair.

UNIT II TECHNIQUES OF PRE-CASTING 9

Pre-casting techniques - Planning, analysis and design considerations - Handling techniques - Transportation Storage and erection of structures.

UNIT III INDUSTRIAL STRUCTURES 9

Joints -Curing techniques including accelerated curing such as steam curing, hot air blowing etc., -Test on precast elements - skeletal and large panel constructions - Industrial structures.

UNITIV APPLICATIONS 9

Pre-cast and pre-fabricating technology for low cost and mass housing schemes. Small pre-cast products like door frames, shutters, Ferro-cement in housing - Water tank service core unit.

UNIT V QUALITY CONTROL 9

Quality control - Repairs and economical aspects on prefabrication.

REFERENCES:

1. Levitt. M., Precast concrete - Materials, Manufacture Properties and Usage, Applied Science Publs. 1982,
2. Konex.T., Handbook of Pre-cast Construction, Vol.1.2&3.
3. Richardson,J.G., Pre-cast concrete Production, Cement and Concrete Association, London, 1973.
4. Madhava Rao.A-G., Modern Trends in Housing in Developing Countries, Oxford & UBH Publishing co., 1985. -
5. Lewicki.B., Building with Large Pre-fabrications, Elsevier Publishers.
6. Large Panel Prefabricated Constructions, Proc. of Advance Course conducted by SERC, Madras.
7. Bruggeling.A.S.G., & Huyghe.G.F., Prefabrication with Concrete, A.s.A., Balkema Publishers, Netherland, 1991.

BCE067	ENVIRONMENTAL HEALTH ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Environmental Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. To introduce types of pollution and its impacts
2. To acquaint the student with various methods and techniques of disposing and management of waste
3. To give an insight into the various diseases that affect human beings and introduces the importance of sanitation processes

COURSE OUTCOMES (COs)

CO1	To learn about the air pollutants, sources and its effects.
CO2	To have a clear understanding on the air quality standards and its techniques.
CO3	To determine the fluid resistance for organic materials.
CO4	To find the Properties of air pollution and its control measures.
CO5	To learn about the effects and the sources of noise pollution.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L				M	H					
	CO2			H						L			M
	CO3		M		H			H		H			
	CO4	H							M	M			
	CO5				H					H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INTRODUCTION 9

Definition of clean air, nature, air pollutants, sources of air pollutants, effects of air pollution on man, animal, vegetation and properties.

UNIT II AMBIENT AIR QUALITY STANDARDS AND AIR QUALITY MONITORING 10

Harmful concentration – geographical factors in air pollution – air pollution control legislation. Classification sampling; sampling techniques; monitoring atmospheric pollution.

UNIT III FLUID RESISTANCE TO PARTICLE MOTION 9

Principles of removal of a gaseous constituent; adsorption and combustion; catalytic combustion of organic materials; catalytic oxidation and decomposition.

UNIT IV AIR POLLUTION AND CONTROL MEASURES 9

Setting chambers; momentum separators, fibrous filters; electro static precipitators; bag houses centrifugal spray scrubbers; venture scrubbers; elementary principles of air pollution e-control techniques.

UNIT V NOISE POLLUTION 8

Sound and noise; sources of noise pollution, environmental and industrial noise; effects of noise pollution: measures for prevention and control of noise; environmental and industrial noise; noise control legislation.

TEXT BOOKS:

1. Anjaneyulu D., "Air Pollution and Control Technologies", Allied Publishers, Mumbai, 2002.

REFERENCES:

1. Rao, C.S. Environmental Pollution Control Engineering, Wiley Eastern Ltd., New Delhi,1996.
2. Rao M.N., and Rao H. V. N., Air Pollution Control, Tata-McGraw-Hill, New Delhi, 1996.
3. Stern A.C. *ed*, " Air Pollution Vol. I, II & III", Academic Press, New York, 1968
4. Cunniff P.F, "Environmental Noise Pollution", John Wiley & Sons, New York. 1977.
5. Docks H.M., "Environmental Pollution", John Wiley & Sons. New York 1981.
6. Chanlett T Emit,"Environmental Protection", McGraw Hill series in Water Resources and Environmental Engineering, New York. 1973.
7. Patrick C.F,"Environemental noise pollution", John Wiley & Sons, 1977.

BCE068	**INDOOR AIR QUALITY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Environmental Studies				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To educate the students on air pollution and control in the indoor environment.

COURSE OUTCOMES (COs)

CO1	To make them understand the fundamentals of Design and operation of buildings for improvements of public health associated with indoor air quality
CO2	To understand about the air pollutants in indoor environments and its characteristics, consequences
CO3	To understand in detail about the classification and control of pollutants and case studies associated with it.
CO4	To improve the knowledge on the Concepts and tools in indoor air quality along with the statistical models associated with it.
CO5	To know about the basics of the Indoor air pollution from outdoor sources.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M		H			
	CO2	M	H		M					H			
	CO3	H										H	
	CO4	H								M			

	CO5		M				H				H			
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)		Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
								√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016												

UNIT I INTRODUCTION 9

Indoor activities of inhabitants – residence time. Levels of many pollutants in indoor and outdoor air. Design and operation of buildings for improvements of public health.IAQ policy issues: Sustainability; indoor air quality as a basic human right

UNIT II INDOOR AIR POLLUTANTS 9

Air pollutants in indoor environments, private residences, offices, schools sand public buildings, factors that govern pollutant indoors concentrations, including ventilation. Characteristics, Consequences.

UNIT III CONTROL OF POLLUTANTS 9

Control of several pollutant classes, such as radon ,toxic organic gases, combustion byproducts, and microorganisms such as molds and infectious bacteria. Case study by an exploration of public policy related to indoor air.

UNIT IV CONCEPT AND TOOLS 9

Concepts and tools: exposure, material-balance models, statistical models ventilation.

UNIT V INDOOR AIR POLLUTION FROM OUTDOOR SOURCES 9

Indoor air pollution from outdoor sources: particulate matter and ozone ;Combustion byproducts; Radon and its decay products. Volatile organic compounds: odors and sick-building syndrome, Humidity Bio-aerosols: infectious disease transmission. Special indoor environments: A/C units in indoor: museums -labs; Measurement methods, Control Technologies, Control strategies.

REFERENCES:

1. Thaddes Godish, Indoor air and Environment Quality, CRC press,2000.
2. Nazaroff W.W and L Aivarez-Cohen, Environmental Engineering Science Wiley Sons, New York, 2001.
3. Moroni Marco , Seifet Bernd and Lindrall Thomas, Indoor Air Quality: A Comprehensive Reference Book, Elsvier Science .Vol.3,1995.

NON MAJOR ELECTIVE-I

BCE069	MATRIX METHODS AND STRUCTURAL ANALYSIS	L	T	P	C

	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Structural analysis-II				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To introduce the students to advanced methods of analysis like matrix methods, structural analysis stiffness method, Flexibility method and also analysis of space structures.

COURSE OUTCOMES (COs)

CO1	Apply the basic concepts of matrix methods in structural Analysis
CO2	Find out the deflections in beams and trusses using various methods
CO3	Analyze the structures using flexibility and stiffness method
CO4	Determine member forces using element and system matrices for determinate and indeterminate structures
CO5	Determine the forces in various members due to lack of fit and thermal expansion.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		M	H	H							
	CO2	M		M	H								
	CO3	M		M	H								
	CO4	M		M	H								
	CO5	M		M	H								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ANALYSIS OF INDETERMINATE STRUCTURES 9

Concept of Indeterminate Structural Analysis –Indeterminacy - flexibility method stiffness method – choice of method.

UNIT II STIFFNESS METHOD 9

Stiffness Method: Three dimensional structures – space trusses – grid structures – rigid frame structures.

UNIT III ANALYSIS OF SUBSTRUCTURE 9

Analysis of Structural system using substructure: Basic concepts – analysis of substructure – simple examples.

UNIT IV FLEXIBILITY METHOD 9

Flexibility method: Trusses, beams and space frames.

UNIT V COMPUTER APPLICATIONS 9

Preparation of Computer Programmes: Trusses – beam – space frames

TEXT BOOKS:

1. L.S. Negi & R.S. Jangid, "Structural Analysis", Tata McGraw-Hill Publications, New Delhi,2003.

REFERENCES:

1. BhaviKatti, S.S, "Structural Analysis – Vol. 1 Vol. 2", Vikas Publishing House Pvt. Ltd., New Delhi, 2008
2. William Weaver,"Computer Programs for Structural Analysis",Van Nostrand,1967)
3. Rubinstein M.E, "Matrix Computer Analysis of Structures", Prentice Hall, 1969.

BCE070	**CONCRETE STRUCTURES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Reinforced Concrete Structures - I				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES: To study the properties of concrete making materials, tests, mix design, special concretes and various methods for making concrete.

COURSE OUTCOMES (COs)

CO1	To learn about calculation of deflection and crack width according to IS 456-2000
CO2	To know about design of special RC elements.
CO3	To Design flat slabs and flat plates according to ACI method.
CO4	To know about the inelastic behavior of concrete beams.
CO5	To analyze problems based on detailing for ductility.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			H	H							
	CO2	H			H	H							
	CO3	H			H	H							
	CO4	H	M		H	H							
	CO5	H			H	H	M						

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Review of limits state design of beams, Slabs and columns according to IS: 456-2000 Calculation of deflection and crack width according to IS 456-2000.

UNIT II DESIGN OF SPECIAL RC ELEMENTS 11

Design of Slender columns - Design of Rewalls - Ordinary and shear walls - Design of Corbels - Deep beams and grid floors.

UNIT III FLAT SLABS AND FLAT PLATES 10

Design of flat slabs and flat plates according to ACI method - Design of shear load - reinforcement and edge (Spandrel) beams - Yield line theory and Hillerberg method of design of slabs.

UNIT IV INELASTIC BEHAVIOUR OF CONCRETE BEAMS 9

In elastic behavior of concrete beams - moment - rotation curves - moment redistribution - Baker's method of plastic design, Design of cast in situ Joints in frames.

UNIT V GENERAL 6

Detailing for ductility - Fire resistance of buildings - field control of concrete.

REFERENCES:

1. Purushothaman P, Reinforced Concrete Structural Elements: Behaviour Analysis and Design, Tata McGraw Hill, 1986.
2. Varghese P. C., Limit State Design of Reinforced Concrete, Prentice Hall of India, 1995.
3. Krishna Raju, N. Advanced Reinforced Concrete Design, CBS Publishers and Distributors, 1986.
4. N. C. Sinha, S. K. Roy, Fundamentals of Reinforced concrete, S. Chand&Company Ltd, 2001.
5. Varghese. P. C. Advanced Reinforced concrete design, Prentice Hall of India, 2005.

BCE071	SHORING, SCAFFOLDING AND FORMWORK	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Construction Technology				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. To bring about a thorough exposure to shoring, scaffolding and formwork procedures in construction practice by studying the materials, planning and design aspects and erection procedures.

COURSE OUTCOMES (COs)

CO1	Study the materials associated with formwork.
CO2	Study the design aspects of formwork under various requirements.
CO3	Know the design of forms and shores
CO4	Study the planning and erection aspects of form work for buildings.
CO5	Understand few other special types of forms.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H	M						
	CO2			M		H	M		L				
	CO3			M		H	M						
	CO4			M		H	M						
	CO5			M		H	M						
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
										√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I PLANNING AND SITE EQUIPMENT & PLANT FOR FORM WORK 9

At Tender stage – Development of basic system – Planning for maximum reuse – Economical form construction – Planning examples – Crane size, effective scheduling estimate – Recheck plan details – Detailing the forms. Overall Planning – detail planning – Standard units – Corner units – Schedule for column formwork – Formwork elements – Planning Crane arrangements – Site layout plan – Transporting plant – Formwork beams – Formwork ties – Wales and ties – scaffold frames from accessories – Vertical transport table form work.

UNIT II FORM MATERIALS 9

Lumber – Types – Finish – Sheathing boards working stresses – Repetitive member stress – Plywood – Types and grades – Textured surfaces and strength – Reconstituted wood – Steel – Aluminium Form lining materials – Hardware and fasteners – Nails in Plywood Concrete density – Height of discharge – Temperature – Rates of Placing – Consistency of concrete – Live loads and wind pressure – Vibration Hydrostatic pressure and pressure distribution – Examples – Vertical loads - Uplift on shores – Adjustment for non standard conditions.

UNIT III DESIGN OF FORMS AND SHORES 9

Basic simplification – Beam formulas – Allowable stresses – Deflection bending lateral stability – Shear, Bearing – Examples in wall forms – Slab forms – Beam forms – Ties, Anchors and Hangers – Column forms – Examples in each. Simple wood stresses – Slenderness ratio – Allowable load – Tubular steel shores patented shores – Site Preparation, Size and spacing – Steel Tower Frames – Safety practices – Horizontal shores shoring for multistories – More concentrated shore loads T- heads – Tow Tier wood shores – Ellis shores – Dayton sure grip and Baker Roofs shores – Safeway Symons shores – Beaver – advance shores Dead shore – Raking and Flying shores.

UNIT IV FORMWORK FOR BUILDINGS 9

Location of job mill – Storage – Equipment – Footings – Wall footings – Column footings Sloped footing forms – Curb and gutter forms – Wall forms –Prefabricated panel systems – Giant forms curved wall forms – Column heads – Beam or girder forms – Beam pockets – Suspended forms – Concrete joint construction – Flying system forms. Causes of failures –

Inadequate shoring inadequate bracing of members – improper vibration – Premature stripping – Errors in design – Failure to follow codes – How formwork affects concretes quality – ACI – Case studies – Finish of exposed concrete design deficiencies – Safety factors – Prevention of rotation – Stripping sequence – Advantages of reshoring.

UNIT V FORMS FOR DOMES AND TUNNELS, SLIP FORMS AND SAFETY PRACTICES FOR SCAFFOLDS 9

Hemispherical, Parabolic, Translational typical barrel vaults, Hyperbolic Folded plates– Shell form design considerations loads – Inserts , Anchors bolts – Building the forms-Placing concrete – Form removed – Strength requirements – Tunnel forming components – Curb forms invert forms – Arch forms – Concrete placement methods – Cut and cover construction – Tolerances – Form construction – Shafts. Slip Forms -Principles – Types – advantages – Functions of various components – Planning – Desirable characteristics of concrete – Common problems faced – Safety in slip forms special structures built with slip form Technique – Codal provisions Types of scaffolds – Putlog and independent scaffold – Single pole scaffolds – Fixing ties – Spacing of ties plan – bracing – knots – safety net – General safety requirements – precautions against particular hazards – Truss suspended – Gantry and system scaffolds.

REFERENCES:

1. Robert L. Peurifoy and Garold D. Oberlender, Formwork For Concrete Structures, McGraw – Hill , 1996.
2. Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996
3. Michael P. Hurst, Construction Press, London & New York, 2003
4. Austin, C.K., Formwork for Concrete, Cleaver – Hume Press Ltd., London, 1996.

BCE072	CONSTRUCTION PROJECT MANAGEMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Building Construction				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To study the elements of construction project management; consisting of owners' perspective, organization, design and construction procedures, resource utilization and cost estimation.

COURSE OUTCOMES (COs)

CO1	Know the types and financing of construction and changing Environment of the industry.
CO2	Understand the organisation of project management
CO3	Know the design and construction process as an integrated system.
CO4	Know the labour, material and equipment utilization
CO5	Understand Cost Estimates and the Costs Associated with Construction Facilities.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l
2	CO1	M				L	M		M				
	CO2	M					M		M				
	CO3	M					M		M		L		
	CO4	M					M		M				
	CO5	M					M		M				
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
										√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I THE OWNERS' PERSPECTIVE 9

Introduction - Project Life Cycle - Types of Construction - Selection of Professional Services - Construction Contractors - Financing of Constructed Facilities - Legal and Regulatory Requirements - Changing Environment of the Construction Industry - Role of Project Managers

UNIT II ORGANIZING FOR PROJECT MANAGEMENT 9

Project Management – modern trends - Strategic Planning - Effects of Project Risks on Organization - Organization of Project Participants -Traditional Designer- Constructor Sequence - Professional Construction Management - Owner-Builder Operation - Turnkey Operation - Leadership and Motivation for the Project Team

UNIT III DESIGN AND CONSTRUCTION PROCESS 9

Design and Construction as an Integrated System - Innovation and Techno logical Feasibility - Innovation and Economic Feasibility - Design Methodology - Functional Design - Construction Site Environment

UNIT IV LABOUR, MATERIAL AND EQUIPMENT UTILIZATION 9

Historical Perspective - Labour Productivity - Factors Affecting Job-Site Productivity - Labour Relations in Construction - Problems in Collective Bargaining - Materials Management - Material Procurement and Delivery - Inventory Control - Tradeoffs of Costs in Materials Management. - Construction Equipment - Choice of Equipment and Standard Production Rates - Construction Processes Queues and Resource Bottlenecks

UNIT V COST ESTIMATION 9

Costs Associated with Constructed Facilities - Approaches to Cost Estimation - Type of Construction Cost Estimates - Effects of Scale on Construction Cost - Unit Cost Method of Estimation - Methods for Allocation of Joint Costs - Historical Cost Data - Cost Indices - Applications of Cost Indices to Estimating - Estimate Based on Engineer's List of Quantities - Estimation of Operating Costs.

REFERENCES:

1. Chris Hendrickson and Tung Au, Project Management for Construction – Fundamental Concepts for Owners, Engineers, Architects and Builders, Prentice Hall, Pittsburgh, 2000.
2. Chitkara, K.K. Construction Project Management: Planning, Scheduling and Control, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
3. Frederick E. Gould, Construction Project Management, Wentworth Institute of Technology, Vary E. Joyce, Massachusetts Institute of Technology, 2000.
4. Choudhury, S, Project Management, Tata McGraw-Hill Publishing Company, New Delhi, 1988.
5. George J.Ritz , Total Construction Project Management - McGraw-Hill Inc, 1994.

BCE073	GROUND WATER CONTAMINATION AND TRANSPORT MODELING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Transportation Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES: To educate the students on the hydraulics related ground water contamination and modeling ground water quality.

COURSE OUTCOMES (COs)

CO1	To make them understand the fundamentals of Ground water and the various hydrologic cycles.
CO2	To understand about the various steady state hydrologic budgets and various case studies associated with it.
CO3	To understand in detail about the development of Ground Water resources and Aquifers.
CO4	To improve the knowledge on the basics of Chemical equilibrium and Geochemical interpretation of ^{14}C Dates
CO5	To know about the basics of the Transport process in solute transfer and hydro chemical behavior of contaminants in the ground water.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H				M				L		
	CO2		H	H						M			
	CO3	H	H						H	H	L		
	CO4									M			
	CO5	H	M				H		W				

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Ground water and the hydrologic cycles – Ground water as resources – Ground water contamination –Water quality standards-Sources of contamination-Land disposal of solid wastes – Sewage disposal on Land. Ground water and geologic processes. Physical properties and principles-Darcy's Law- Hydraulic Head and Fluid Potential- Piezometers and Nestes. Hydraulic conductivity and permeability- Homogeneity and Anisotropy – Porosity and voids Ratio-Unsaturated flow and the water table- steady state flow and transient flow – Compressibility and effective stress – Transmissivity and storability – Equations of ground water flow – Limitations of Darcian Approach – Hydro dynamic dispersion – Case Studies.

UNIT II HYDROLOGIC CYCLE AND FLOW NETS 9

Flow nets – Graphical construction – Flow nets by numerical simulation. Steady state Regional Ground Water flow – steady state hydrologic budgets – Fluctuations in ground water levels – Case Studies.

UNIT IIIRESOURCE EVALUATION 9

Development of Ground Water resources – Exploration for Aquifers – the response of Ideal acquifers to pumping – Measurement of parameters – Laboratory tests - Piezometer test – Pumping tests – Estimation of saturates Hydraulic conductivity – Numerical simulation for aquifer yield prediction – Artificial recharge and induced infiltration – Land subsidence – Sea water intrusion –Case Studies.

UNIT IV CHEMICAL PROPERTIES AND PRINCIPLES 9

Constituents – Chemical equilibrium _ Association and Dissociation of dissolved species – effects of concentration gradients – Mineral dissolution and solubility – Oxidation and reduction process – Ion exchange and Adsorption – Environmental isotopes – Field Measurment of Index parameters- Hydro chemical facies – Ground water in carbonate terrain – Ground Water in crystalline rocks- ground water in complex sedimentary systems – Geochemical interpretation of ^{14} C Dates – Process rates and molecular diffusion.

UNITV SOLUTE TRANSPORT 9

Transport process – non-reactive constituents in homogeneous media and Heterogeneous media – Transport in Fracture media – Hydro chemical behavior of contaminants- trace metals – Trace nonmetals – Nitrogen, organic substances- Measurement of parameters – Velocity – Dispersivity – chemical partitioning.

REFERENCES:

1. Randall J. Charbeneau, "Ground water Hydraulics and Pollutant transport " Prentice Hall,Upper Saddle.
2. Todd David Keith , Ground water Hydrology, second edition , john Wiley and sons New York, 1980.
3. Allen Freeze, R. and John A. Cherry , "Ground Water ", Prentice Hall, Inc.1979.

BCE074	PHYSICAL AND CHEMICAL TREATMENT OF WATER AND WASTEWATER	L	T	P	C
	Total Contact Hours - 45	3	0	0	3

	Prerequisite – Environmental Engineering
	Course Designed by – Dept of Civil Engineering

OBJECTIVES:

To educate the student on the working principles and design of various physical and chemical treatment systems for water and wastewater.

COURSE OUTCOMES (COs)

CO1	To make them understand the fundamentals of waste water treatment .To learn about the various Pollutants in water and waste water and also to study about their characteristics.
CO2	To understand about the methods of waste characterization , source reduction and to study the various methods of generation of wastes.
CO3	To understand in detail about the various principles of chemical treatment which include precipitation coagulation etc.
CO4	To improve the knowledge on the Selection of unit operation and processes and to study the design oriented aspects of sand filters and other treatment processes.
CO5	To know about the basics of the design of industrial waste water treatment and reclamation processes

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				M					L		
	CO2				M			M		H			
	CO3	H					H						
	CO4							H		L			
	CO5	H	M			H		M			L		

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNITI INTRODUCTION 9

Pollutant in water and wastewater – characteristics, standards for performance – significant and need for physic – chemical treatment.

UNITII PHYSICAL TREATMENT PRINICIPLES 9

Principles of screening – mixing, equalizations –sedimentation – filtration –modeling – backwashing –evaporation-incineration- gas transfer-mass transfer coefficients. Adsorption-isotherms-principles, equilibrates and kinetics, reactors, regeneration, membrane separation, reverse osmosis, nano filtration ultra filtration and hyper filtration – electro dialysis, distillation – stripping and crystallization-recent advances.

UNITIII CHEMICAL TREATMENT PRINCIPLES 9

Principles of chemical treatment – coagulation flocculation – precipitation –floatation, solidification and stabilization- disinfection .ion exchange, electrolytic methods -Solvent extraction –advanced oxidation / reduction –recent advances.

UNITIV DESIGN OF CONVENTIONAL TREATMENT PLANTS 9

Selection of unit operation and processes – design of conventional water treatment plant units – aerators –chemical feeding –flocculation –clarifier – filters –rapid sand filter, slow sand filter, pressure filter-chlorinators. Displacement and gaseous type. layouts- flowcharts –hydraulic profile –O & M aspects- case studies , residue management – up gradation of existing plants – recent advances.

UNITV DESIGN OF INDUSTRIAL WATER TREATMENT AND ECLAMATIO 9

Selection of process –design of softeners – demineralisers –wastewater reclamation – reverse osmosis plants –residue management – O & M aspects –recent advances –case studies.

REFERENCES:

1. Metcalf and Eddy, Wastewater Engineering, Treatment and Reuse Tata McGraw-Hill, New Delhi, 2003.
2. Manual on water supply and Treatment CPHEEO, Ministry of Urban Development ,GOI, New Delhi,1999.
3. Lee ,CC and Shun dar Lin , Handbook of Environmental Engineering Calculations, McGraw-hill,Newyork , 1999.
4. Qasim,S.R motely, E.N., Zhu, G. Water Works Engineering – Planning, Design and Operation,Prentice Hall,New Delhi, 2002.
5. Casey, T.J.Unit Treatment Processes in Water and Wastewater Engineering, John Wiley and Sons, London1993.

BCE075	GROUND WATER ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Irrigation Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. To introduce the student to the principles of Groundwater governing Equations and Characteristics of different aquifers,
2. To understand the techniques of development and management of groundwater.

COURSE OUTCOMES (COs)

CO1	To learn about the basics of ground water Engineering including the hydrogeological cycle and water level fluctuations
CO2	To learn about the basics of hydrology of ground water and to make a clear understanding of ground water flow equations of velocity equations.
CO3	To study the basics of unsteady flow and various methods unsteady flow.
CO4	To know about the various sources of ground water like collector wells, infiltration galleries.

CO5	To study about the ground water quality chemistry its origin and water quality standards.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M						L		
	CO2						H		L			M	
	CO3				H					M			
	CO4						M			H	L		
	CO5					M							S

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I FUNDAMENTALS OF GROUND WATER 9

Introduction – Characteristics of Ground water – Global distribution of water – ground water column- Permeability- Darcy's Law, laboratory permeability test Types of aquifers. Hydro geological Cycle, water level fluctuations.

UNIT II HYDRAULICS OF FLOW 9

Storage coefficient, Specific yield, Heterogenetiy and AnisotrophyTransmissivity – governing equations of ground water flow – Steady state flow – DupuitForchheimer assumption. Velocity potential flow nets.

UNIT III ESTIMATION OF PARAMETERS 9

Transmissivity and Storativity Pumping test - Unsteady state flow- Thies method- Jacob methods - Image well theory - Effect of partial penetrations of well – collectors wells.

UNIT IV GROUND WATER DEVELOPMENT 9

Collector wells – infiltration gallery – Conjunctive use – Artificial recharge – Safe yield – Yield test – Geophysical method – Selection of pumps.

UNIT V WATER QUALITY 9

Ground water chemistry – origin, movement and quality – water quality standards – salt water intrusion – Environmental concern.

TEXT BOOKS:

1. Reghunath H.M. "Ground Water Hydrology", Wiley Eastern Ltd., Second reprint, 2000.

REFERENCES:

1. Tood D.K,"Ground Water Hydrology", Johnand Sons, 2000.
2. Ramakrishnan S,"Ground Water Groundwater",,Ramakrishnan Publication,Chennai 1998.
3. William C Walton, "Ground Water Resource Evaluation", McGraw Hill New York 1970.

BCE076	COASTAL ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Fluid Mechanics				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. To provide an overview of the analysis and design procedures used in the field of coastal engineering.
2. To introduce the processes of including coastal and estuarine circulation, coastal and shelf waves, surf zone hydrodynamics, sediment transport, hurricane-induced storm surge and inundation, beach nourishment etc
3. To enable students apply these engineering principles to solve the problems in this environment such as shoreline erosion, natural flooding hazards, water quality deterioration and coastal habitat evanescence.

COURSE OUTCOMES (COs)

CO1	To provide an overview of the fundamental principles of ocean science and technology.
CO2	To provide the background needed to undertake coastal oceanographic investigations and sets them in context by incorporating case studies and sample problems based on local and global examples.
CO3	To facilitate students to work across disciplinary boundaries and develop an approach that will enable them to incorporate human society in their exploration and analysis of coastal areas.
CO4	To be able to "see" the features and components of the natural, engineering and human aspects of the coast, the functions of components and relationship between them.
CO5	To provide students understanding of the materials and processes associated with the major natural natural and artificial harbours.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											M
	CO2	H		M									M
	CO3	H					H				M		M
	CO4	H											M
	CO5	H											M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I WAVES GENERATION, PROPAGATION AND FORCE 9

Definition – Wave classification – Linear theory of waves- Assumptions and derivations of relationship of wave characteristics- Pressure within progressive wave- Wave energy - Fundamental aspects of stokes theory.

UNIT II WAVE FORECASTING 9

Need for forecasting – SMB and PNJ methods of wave forecasting.

UNIT III TIDES 9

Origin and classification of tides - Karwin's equilibrium theory of tides- Effects on structure - Seiches, surges and Tsunamis.

UNIT IV SEDIMENT MOVEMENT 8

Types of sediment movement – Types of beaches and beach profile – long shore drift and its engineering significance – Causes of coastal erosion and methods of protection.

UNIT V HARBOURS 10

Classification - types of their requirements – Requirements of modern port -Selection of site. BreakWater and their types of selection - Functional design of entrance Channel and breakwaters- Dredging - Need & types of selection of dredgers.

TEXT BOOKS:

1. Garrison .T, "Oceanography", Wadsworth Publications, 4th edition, 2002.

REFERENCES:

1. Sorenson .R. M, "Coastal Zone Engineering", Chapman & Hall, 3rd edition, 2006.
2. Wiegal. R.L., Oceanographical Engineering Prentice Haff, Englewood Cliff's, New Jersy, 1964.

NON MAJOR ELECTIVE-II

BCE077	FINITE ELEMENT ANALYSIS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Structural Analysis – II				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To study the energy principles, finite element concept, stress analysis, meshing, linear problems and applications

COURSE OUTCOMES (COs)

CO1	To learn concepts of piecewise Approximation and Finite Elements
CO2	To know about two dimensional problems in stress analysis.
CO3	Tounderstand the meshing and solution problems
CO4	To know about thenonlinear and vibration problems
CO5	To understand the Application to Thermal Analysis Problems.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			H	H							
	CO2	H			H	H							
	CO3	H			H	H	M						
	CO4	H			H	H							
	CO5	H			H	H							H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 10

Boundary Value problem – Approximate Solution - Variational and Weighted Residual Methods – Ritz and Galerkin Formulations – Concepts of piecewise Approximation and Finite Elements - Displacement and Shape Functions Weak formulation Minimum Potential Energy. Generation of Stiffness Matrix and Load Vector.

UNIT II STRESS ANALYSIS 10

Two dimensional problems – Plane Stress, Plane Strain and Axisymetric problems – Triangular and Quadrilateral Elements – Natural Coordinates –Isoparametric Formulation – Numerical Integration – Plate Bending and Shell Elements Brick elements for Fracture Analysis.

UNIT III MESHING AND SOLUTION PROBLEMS 10

Higher Order Elements – P & H methods of refinement – III conditional Elements – Discretisation Errors – Auto and Adaptive Mesh Generation Techniques – Error Evaluation.

UNIT IV NONLINEAR AND VIBRATION PROBLEMS 10

Material and Geometric Nonlinearity Methods of Treatment consistent System, Matrice Dynamic Condensation – Eigen Value Extraction.

UNIT V THERMAL ANALYSIS 5

Application to Thermal Analysis Problems.

REFERENCES :

1. Bathe, K.J. Finite Elements Procedures in Engineering analysis. Prentice Hall Inc., 1995.
2. Zienkicwicz, O.C. Arid Taylor, R.L. The Finite Elements Method, McGraw Hill, 1987.
3. Chandrupatla, R.T. and Belegunda. A.D, Introduction to Finite Elements in Engineering, 2nd Edition, Prentice Hall of India, 1997.
4. Moaveni.S., Finite Element Analysis: Theory and Application with ANSYS, Prentice Hall Inc., 1999.

BCE078	STUCTURES ON EXPANSIVE SOILS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Soil Mechanics				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. To understand the dynamics of earth and to estimate dynamic properties of soils
2. To develop the site specific design spectrum for design of sub structure and evaluation of liquefaction potential.
3. To design these structures in expansive soil
4. To study the effectiveness of some supper structure resting on treated expansive soil
5. Factors influencing mechanisms in expansive soils

COURSE OUTCOMES (COs)

CO1	To understand the dynamics of earth and to estimate dynamic properties of soils
CO2	To improve the engineering properties and make it suitable for construction
CO3	The engineering properties, problems and solution need to be considered when constructing a foundation on expansive soils.
CO4	To develop the site specific design spectrum for design of sub structure and evaluation of liquefaction potential.
CO5	To study the behaviour of the stabilized soil subjected to cyclic loading

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	L	H	M							
	CO2	H	M	H	M	M							
	CO3	M	M	L	H	M							
	CO4	H	H	M	H	M							
	CO5	M	M	M	H	M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I GEOTECHNICAL PROBLEM 9

Occurrence and distribution - moisture equilibrium - Soil, structure, environmental interaction-distress symptoms - case histories.

UNIT II EXPANSIVE SOIL PROPERTIES 9

Clay mineralogy - swell potential - field exploration - laboratory tests for identification.

UNIT III SOIL HEAVING 9

Heave Prediction - Method of prediction of heave- Empirical methods - double of dometer tests - soil moisture suction - field observations, shrinkage.

UNIT IV DESIGN OF FOOTING 9

Foundation Design – Design consideration – individual and continuous footings- stiffened mats- underreamed piles- codal provisions.

UNIT V STABILIZATION 9

Stabilization methods

TEXT BOOKS:

1. John .D.N & Debora .J.M, "Expansive Soils Problems And Practice In Foundation & Pavement Engineering", J. Wiley, 1992.

REFERENCES:

1. Satish Grower, The Architecture of India, Buddist, Hindu Period and Islamic PeriodVikas Publishing HousPvt Ltd., New Delhi, 1984.
2. Chen F.R," Foundation on Expansive Soils", Elseivier ,1973.
3. Parcher J.V & Means R.E, Soil Mechanics & Foundation, Columbus, 1968.
4. Perkk R.E., Hansen W.E, Thombum T.H, "Foundation Engineering", John Wiley, 1974.
5. Kameswarao N.S.V," Dynamic Soil Test & Applications", Wheeler Publishing Co., 2002

BCE079	**STUCTURES ON EXPANSIVE SOILS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Soil Mechanics				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1.To understand the dynamics of earth and to estimate dynamic properties of soils

2.To develop the site specific design spectrum for design of sub structure and evaluation of liquefaction potential.

COURSE OUTCOMES (COs)

CO1	To understand the dynamics of earth and to estimate dynamic properties of soils
CO2	To improve the engineering properties and make it suitable for construction
CO3	The engineering properties, problems and solution need to be considered when constructing a foundation on expansive soils.
CO4	To develop the site specific design spectrum for design of sub structure and evaluation of liquefaction potential.
CO5	To study the behaviour of the stabilized soil subjected to cyclic loading

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	L	H	M							
	CO2	H	M	H	M	M							
	CO3	M	M	L	H	M							
	CO4	H	H	M	H	M							

	CO5	M	M	M	H	M							
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)		
									√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I GEOTECHNICAL PROBLEM 9

Occurrence and distribution - moisture equilibrium - Soil, structure, environmental interaction-distress symptoms - case histories.

UNIT I EXPANSIVE SOIL PROPERTIES 9

Clay mineralogy - swell potential - field exploration - laboratory tests for identification.

UNIT III SOIL HEAVING 9

Heave Prediction - Method of prediction of heave- Empirical methods - double of dometer tests - soil moisture suction - field observations, shrinkage.

UNIT IV DESIGN OF FOOTING 9

Foundation Design – Design consideration – individual and continuous footings- stiffened mats-underreamed piles- codal provisions.

UNIT V STABILIZATION 9

Stabilization methods

TEXT BOOKS:

1. John .D.N & Debora .J.M, "Expansive Soils Problems And Practice In Foundation & Pavement Engineering", J. Wiley, 1992.

REFERENCES:

1. Satish Grower, The Architecture of India, Buddist, Hindu Period and Islamic Period.Vikas Publishing HousPvt Ltd., New Delhi, 1984.
2. Chen F.R," Foundation on Expansive Soils", Elseivier ,1973.
3. Parcher J.V & Means R.E, Soil Mechanics & Foundation, Columbus, 1968.
4. Perkk R.E., Hansen W.E, Thombum T.H, "Foundation Engineering", John Wiley, 1974.
5. Kameswarao N.S.V," Dynamic Soil Test & Applications", Wheeler Publishing Co., 2002

BCE080	**QUALITY CONTROL AND ASSURANCE IN CONSTRUCTION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Building Construction				
	Course Designed by – Dept of Civil Engineering				
OBJECTIVES: To create a complete understanding on quality planning, quality assurance, quality control and safety management					
COURSE OUTCOMES (COs)					
CO1	Know the Quality plan and Quality Management Guidelines				

CO2	Understand the Quality system and standard Documents and Quality related training
CO3	Know the quality planning, Contract and construction programming, Inspection procedures, Processes and products
CO4	Know the quality assurance, appraisals and quality control by reliability testing
CO5	Understand how the quality techniques can be improved.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1						M	M	M				
	CO2						M	M	M				
	CO3						M	M	M		L		
	CO4						M	M	M				
	CO5	L					M	M	M				

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I QUALITY MANAGEMENT 9

Introduction – Definitions and objectives – Factor influencing construction quality - Responsibilities and authority - Quality plan - Quality Management Guidelines – Quality circles.

UNIT II QUALITY SYSTEMS 9

Introduction - Quality system standard – ISO 9000 family of standards – Requirements – Preparing Quality System Documents – Quality related training – Implementing a Quality system – Third party Certification.

UNIT III QUALITY PLANNING 9

Quality Policy, Objectives and methods in Construction industry - Consumers satisfaction, Ergonomics - Time of Completion - Statistical tolerance – Taguchi's concept of quality – Codes and Standards – Documents – Contract and construction programming – Inspection procedures - Processes and products – Total QA / QC programme and cost implication.

UNIT IV QUALITY ASSURANCE AND CONTROL 9

Objectives - Regularity agent, owner, design, contract and construction oriented objectives, methods - Techniques and needs of QA/QC - Different aspects of quality - Appraisals, Factors influencing construction quality - Critical, major failure aspects and failure mode analysis, - Stability methods and tools, optimum design - Reliability testing, reliability coefficient and reliability prediction.

UNIT V QUALITY IMPROVEMENT TECHNIQUES 9

Selection of new materials -Influence of drawings, detailing, specification, standardization -Bid preparation -Construction activity, environmental safety, social and environmental factors -

Natural causes and speed of construction -Life cycle costing -Value engineering and value analysis.

REFERENCES:

1. James, J.O' Brian, Construction Inspection Handbook – Quality Assurance and Quality Control, Van Nostrand, New York, 1989.
2. Kwaku, A., Tena, Jose, M. Guevara, Fundamentals of Construction Management and Organisation, Reston Publishing Co., Inc., Virginia, 1985.
3. Juran Frank, J.M. and Gryna, F.M. Quality Planning and Analysis, Tata McGraw Hill, 1993
4. Hutchins.G, ISO 9000, Viva Books, New Delhi, 2000
5. Clarkson H. Oglesby, Productivity Improvement in Construction, McGraw-Hill, 1989.
6. John L. Ashford, The Management of Quality in Construction, E & F.N.Spon, New York, 1989.
7. Steven McCabe, Quality Improvement Techniques in Construction, Addison Wesley Longman Ltd, England. 1998.

BCE081	**CONSTRUCTION PERSONNEL MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Personality Development				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To introduce the elements of human behaviour and their impact on construction personnel management

COURSE OUTCOMES (COs)

CO1	Know about the Manpower Planning and Organising
CO2	Understand the Development and Operation of human resources
CO3	Understand the awareness on fundamentals of human behavior under varying stress conditions
CO4	Know the welfare measures and Laws related to welfare measures.
CO5	Understand Management and Development MethodsProductivity of Human resources.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1						M		M				
	CO2						M		M				
	CO3						M		M				
	CO4						M		M				
	CO5						M		M				

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I MANPOWER PLANNING 10

Manpower Planning, Organising, Staffing, directing, and controlling – Personnel Principles

UNIT II ORGANISATION 10

Organisation – Span of Control – Organisation Charts – Staffing Plan - Development and Operation of human resources - Managerial Staffing – Recruitment – Selection - Placement, Training and Development.

UNIT III HUMAN BEHAVIOUR 10

Introduction to the field of people management - basic individual psychology; motivation - ob design and performance management - Managing groups at work - self-managing work teams - intergroup behaviour and conflict in organisations – Leadership - Behavioural aspects of decision-making; and communication for people management

UNIT IV WELFARE MEASURES 5

Compensation – Safety and health – GPF – EPF – Group Insurance – Housing - Pension –Laws related to welfare measures.

UNIT V MANAGEMENT AND DEVELOPMENT METHODS 10

Compensation - Wages and Salary, Employee Benefits, employee appraisal and assessment - Employee services - Safety and Health – Discipline and discharge - Special Human resource problems, Performance appraisal. - Employee hand book and personnel manual – Job descriptions and organization structure and human relations – Productivity of Human resources.

REFERENCES:

1. Carleton Counter II and Jill Justice Coutler , The Complete Standard Handbook of Construction Personnel Management, Prentice-Hall, Inc., New Jersey, 1989.
2. Memoria,C.B., Personnel Management, Himalaya Publishing Co., 1997.
3. Josy.J. Familaro, Handbook of Human Resources Administration, McGraw- Hill International Edition, 1987.
4. Charles D Pringle, Justin Gooderi Longenecter, Management, CE Merril Publishing Co.1981.
5. Dwivedi R.S, Human Relations and Organisational Behaviour, Macmillian IndiaLtd.,2005.

BCE082	WATER AND SEWAGE CONVEYANCE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3

	Prerequisite – Applied Hydraulic Engineering
	Course Designed by – Dept of Civil Engineering

OBJECTIVES:

To educate the students in detailed concepts related to water transmission mains, water distribution system, sewer networks and storm water drain, with emphasis on computer application

COURSE OUTCOMES (COs)

CO1	To make them understand the fundamentals of hydraulic engineering and the various fluid flow phenomenon
CO2	To understand about the methods of water transmission and distribution and the economics related to water transmission
CO3	To understand in detail about the waste water collection and conveyance and also the maintenance of sewers and design of sewer outfalls
CO4	To improve the knowledge on the planning and estimation of storm water flow.
CO5	To know about the basics of the Case Studies and Computer applications for water transmission..

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H									L		
	CO2	H	M		M		H					L	
	CO3		M						H				
	CO4	H					H			L			
	CO5		M		H								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I PRINCIPLES OF HYDRAULICS 9

Fluid properties; fluid flow – continuity principle, energy principle and momentum principle; frictional head loss in free and pressure flow, major and minor head loss, formula for estimation of head loss – pumping of fluids – selection of pumps – Flow measurement.

UNIT II WATER TRANSMISSION AND DISTRIBUTION 9

Planning factors – Water transmission main design – pipe material – economics – water hammer analysis; water distribution pipe networks - methods for analysis and optimization - Laying and maintenance, insitu lining – appurtenances – corrosion prevention – minimization of water losses – leak detection.

UNIT III WASTEWATER COLLECTION AND CONVEYANCE 9

Planning factors – Design of sanitary sewer; partial flow in sewers, economics of sewer design; sewer appurtenances; material, construction, inspection and maintenance of sewers; Design of sewer outfalls-mixing conditions; conveyance of corrosive wastewaters.

UNIT IV STORM WATER DRAINAGE 9

Planning – run-off estimation, rainfall data analysis, storm water drain design – rain water harvesting

UNITV CASE STUDIES AND COMPUTER APPLICATIONS 9

Computer applications for water transmission, water distribution and sewer design.

REFERENCES:

1. G.S.Bajwa, Practical Handbook on Public Health Engineering, Deep Publishers, Shimla, 2003.
2. "Manual on water supply and Treatment", CPHEEO, Ministry of Urban Development, Gol, New Delhi, 1999.
3. "Manual on sewerage and Sewage Treatment', CPHEEO, Ministry of Urban Development, Gol, New Delhi, 1993.
4. B.A. Hauser, Practical Hydraulics Handbook, Lewis Publishers, New York, 1991.

BCE083	ENVIRONMENTAL ENGINEERING STRUCTURES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Environmental Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To educate the students in detailed concepts related to water transmission mains, water distribution system, sewer networks and storm water drain, with emphasis on computer application

COURSE OUTCOMES (COs)

CO1	To make them understand the fundamentals of Structural design of Concrete, Prestressed Concrete, Steel and Cast iron etc
CO2	To understand about the methods of analysis and design of water tanks and the types of cement roofing system
CO3	To understand in detail about the design of special purpose structures like underground reservoirs and swimming pools.
CO4	To improve the knowledge on the repair and rehabilitation of structures and also diagonising and identification of the cause and damage
CO5	To know about the exposure on steel, lattice structures used in water and sewerage works.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	H											
	CO2	H			M						L		
	CO3	H	L										
	CO4						H			L			
	CO5		M		H								
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
										√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I DESIGN OF PIPES 9

Structural design of a) Concrete b) Prestressed Concrete c) Steel and d) Castiron piping mains, sewerage tanks design - anchorage for pipes - massive outfalls - structural design and laying - hydrodynamic considerations. Advances in the manufacture of pipes.

UNIT II ANALYSIS AND DESIGN OF WATER TANKS 9

Design of concrete roofing systems a) Cylindrical b) Spherical and c) Conical shapes using membrane theory and design of various types of folded plates for roofing with concrete. IS Codes for the design of water retaining structures. Design of circular, rectangular, spherical and Intze type of tanks using concrete. Design of prestressed concrete cylindrical tanks - Economic analysis - introduction to computer aided design and packages.

UNIT III DESIGN OF SPECIAL PURPOSE STRUCTURES 9

Underground reservoirs and swimming pools, Intake towers, Structural design including foundation of water retaining structures such as settling tanks, clarifloculators, aeration tanks etc. - effect of earth pressure and uplift considerations - selection of materials of construction.

UNIT IV REPAIR AND REHABILITATION OF STRUCTURES 9

Diagonising the cause and damage, identification of different types of structural and non-structural cracks - repair and rehabilitation methods for Masonry, Concrete and Steel Structures.

UNIT V EXPOSURE ON STEEL, LATTICE STRUCTURES USED IN WATER AND SEWERAGE WORKS 9

TEXT BOOKS:

1. Reinforced Concrete by P .Dayaratnam.
2. Prestressed Concrete by Krishna Raju, Tata McGraw-ill Publishing Co. 2nd Edition 1988.
3. Reinforced Concrete by N.C.Sinha & S.K.Roy - S.Chand and Co. 1985.

REFERENCES:

1. Hulse R., and Mosley, W.H., "Reinforced Concrete Design by Computer", Macmillan Education Ltd., 1986.

2. Ramaswamy, G.S., "Design and Construction of Concrete shell roofs", CBS Publishers, India, 1986.
3. Green, J.K. and Perkins, P.H., "Concrete liquid retaining structures", Applied Science Publishers, 1981.

BCE083	SOIL DYNAMICS & MACHINE FOUNDATION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Soil Mechanics				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. To understand the soil properties and suitable remedial measures to improve their behavior.
2. To familiarize students with the dynamic properties of soil.
3. To create an understanding about the importance of designing machine foundation for reciprocating and impact machines.

COURSE OUTCOMES (COs)

CO1	To understand the Vibration of elementary systems
CO2	To improve the engineering properties and application in soil dynamics.
CO3	The engineering dynamic properties of soil Field & Laboratory methods.
CO4	To develop specific design Impact type machine and Rotary type machines
CO5	To study the principles of vibration neutralizer

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		H					
	CO2	M	L	H	M	M		M					
	CO3	M	M	L	H	M		M					
	CO4	M	H	M	H	M		M					
	CO5	M	M	M	H	M		M					

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 8

Vibration of elementary systems – vibratory – single degree freedom -system – free and forced vibrations with and without damping – transient response of single degree freedom systems.

UNIT II WAVES & WAVE PROPAGATION 9

Wave propagation in an elastic homogeneous isotropic medium - Shear and compression waves - wave propagation in elastic, half space (no theoretical treatment or derivation) properties of compression, shear and Raleigh waves – application in soil dynamics.

UNIT III DYNAMIC PROPERTIES OF SOILS 9

Elastic properties of soils – soil treated as spring or elastic half space – Co – efficient – provision of dynamic properties of soil as per latest BIS 5249 -Co efficient of elastic, uniform and non-uniform compression and shear- Determination of dynamic properties of soil- Field & Laboratory methods.

UNIT IV DESIGN OF MACHINE FOUNDATION 10

General requirements of machine foundations – Design criteria – principles of & simple procedures of design of foundations for machineries of reciprocating type, Impact& Rotary type (treated as single degree freedom only) – dynamic loads, simple design procedures for foundations under Reciprocation machines. Impact type machine and Rotary type machines.

UNIT V VIBRATION ISOLATION & SCREENING 9

Vibration isolation technique mechanical isolation, foundation isolation, isolation by location isolation by barriers – active and passive isolation tests – problems – types of Isolation – active, passive – principles of vibration neutralizer (no derivation)

TEXT BOOKS:

1. Swamisaran, "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt. Ltd., 2010.

REFERENCES BOOKS:

1. Rtehart F.E, R.D.Woods & J.R. Hall, vibrations of Soils and Foundations, Prentice Hall, 1970.
2. Prakash S.& Pun V.K, Soil Dynamics & Design foundation, McGraw Hill Co. 1998.
3. Srinivasulli P &Vaidanathan C," Handbook on machine Foundations", McGraw Hill Co.1976.
4. Code Practice of Design and Construction of Machine Foundations, I.S.2974, 1987 Part I to IV.Prakash .S and Puri V.K, "Foundation for Machines", McGraw Hill Publishing Company, Newyork, 1988

BCE084	HYDROLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Fluid Mechanics				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To impart knowledge on hydrological cycle, spatial and temporal measurement and analysis of rainfall and their applications including flood routing and ground water hydrology.

COURSE OUTCOMES (COs)

CO1	Measure the rainfall intensity , duration and frequency
CO2	Assess the losses of precipitation due to evaporation
CO3	Prepare the unit hydrograph for surface runoff
CO4	Solve the flood routine and channel routine problems
CO5	Conduct yield test on aquifers

UNIT I HYDROMETEOROLOGY 9

Hydrological cycle -Hydro meteorological factors -Cloud formation- Winds and their movement -types of precipitation.- Forms for precipitation- Density and Adequacy of rain gauges – Recording and non-recording gauges.

UNIT II PRECIPITATION AND ABSTRACTIONS 9

Spatial distribution – Consistency analysis – Frequency analysis – Intensity, duration, frequency relationships- Evaporation –Infiltration- Norton's equation Infiltration indices – Types of streams – Stage discharge relationships – Flow measurements – Currents meter method for velocity measurements.

UNIT III HYDROGRAPH ANALYSIS 9

Factors affecting the shape of hydrograph- Components of DRH. Baseflow- Unit hydrograph - Scurve hydrograph- Synthetic unit hydrograph.

UNIT IV GROUND WATER HYDROLOGY 9

Occurrence of ground water – Types of aquifer – Dupuifs assumptions – Darcy's law – Estimation of aquifer parameters – Pump tests.

UNIT V FLOOD ANALYSIS 9

Flood estimation – Gumbel's method – log Pearson types III method – Reservoir flood routing, Channel routing, Other methods of routing.

TEXT BOOKS:

1. Subramanya K. Engineering Hydrology, Tata McGraw Hill. Publishing Company Limited, 2006

REFERENCES:

1. Raghunath H M, Hydrology, Witey Eastern Limited, New Delhi 1998.
2. Vijay Singh P, Elementary Hydrology -Prentice Hall of India, 1998.
3. Mutreja K N, Applied Hydrology, Tata McGraw Hill Publications, New Delhi, 1998.
4. Jayaram Reddy P Hydrology, Tata McGraw Hill Publications, New Delhi, 1998.

NON MAJOR ELECTIVE-III

BCE085	CONCRETE BRIDGES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Construction Technology				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To make the student to know about various bridge structures, selection of appropriate bridge structures and design it for the given site conditions.

COURSE OUTCOMES (COs)

CO1	Design of through type and deck type steel highway bridges.
CO2	Design various type of plate girder and truss girder railway bridge
CO3	Design various types of RC slab bridges for IRC loading
CO4	Design various types of RC girder bridges for IRC loading
CO5	Design prestressed concrete bridges

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	H								
	CO2			H	H								
	CO3			H	H								
	CO4			H	H								
	CO5			H	H								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I GENERAL 8

a. Types of concrete bridges, advantages, Limitation, Selection of site and Spacing of piers.B. I. R.C. code provisions, loading standards impact load theories of load distribution for Bridges, decks – Usage of Charts and curves for deck slab design.

UNIT II R.C. GIRDER BRIDGES 9

T. Beam and slab bridges, Balanced Cantilever bridges: Advantages – General proportions for spans, Impact factor – Design of main girder and articulation.

UNIT III BOX CULVERTS AND CONTINUOUS BEAMS 8

Design of single, multiple vent box Culverts – Moment distribution method - Design of continuous beams.

UNIT IV PRE – STRESSED CONCRETE BRIDGES 12

Advantages – Examples of pre-stressed concrete Bridges - types – Design principles – Simply supported bridges.

UNIT V BEARING AND SUBSTRUCTURES 8

Types of bearings, design of bearings for girder bridges- Types bridge substructure - Piers abutments, shallow and deep foundations - General arrangements.

TEXT BOOKS:

1. Ratwani NM, Vazirani VN , “Design of Concrete Bridge”, Khanna Publishers, New Delhi,1975

REFERENCES:

1. Johnson Victor W,”Essentials of Bridge Engineering”,Oxford IBH Publishing Co, New Delhi, 1980
2. Dr Krishnamorthy, "Introduction to Bridges", Two Editions, 1959, 1963
3. Jain OP and Jaikrishna,”Plain and reinforced Concrete Vol.2”, Nemchand and bros, Roorkee, 1958
4. Rowe, R.E. “Concrete Bridges Design”, John Wiley & Sons, Inc, New York, 1962
5. Jacques Ramsay Robinson,”Piers,Abutments and Formwork for Bridges”, C. Lockwood, 1964

BCE086	MAINTENANC AND REHABILITATION OF STRUCTURES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Building Construction				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1.To study the damages, repair and rehabilitation of structures

COURSE OUTCOMES (COs)

CO1	To learn about general consideration in quality assurance, structural appraisal etc
CO2	To know about techniques for repair in building cracks
CO3	Tounderstand the reason for ineffective DPC and remedial treatments
CO4	To know about types, causes for deterioration and preventive measures
CO5	To learn the concepts of strengthening of existing structures

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		H		M		H					
	CO2	H		H		H							
	CO3	H	M	H		M	H						
	CO4	H		H	H	H							
	CO5	H		H		H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INTRODUCTION 9

General Consideration – Distresses monitoring – Causes of distresses – Quality assurance – Defects due to climate, chemicals, wear and erosion – Inspection – Structural appraisal – Economic appraisal.

UNIT II BUILDING CRACKS 9

Causes – diagnosis – remedial measures – Thermal and Shrinkage cracks – unequal loading – Vegetation and trees – Chemical action – Foundation movements – Techniques for repair – Epoxy injection.

UNIT III MOISTURE PENETRATION 9

Sources of dampness – Moisture movement from ground – Reasons for ineffective DPC – Roof leakage – Pitched roofs – Madras Terrace roofs – Leakage of Concrete slabs – Dampness in solid walls – condensation – hygroscopic salts – remedial treatments – Ferro cement overlay – Chemical coatings – Flexible and rigid coatings.

UNIT IV DISTRESSES AND REMEDIES 9

Concrete Structures: Introduction – Causes of deterioration – Diagnosis of causes – Flow charts for diagnosis – methods of repair – repairing, spalling and disintegration – Repairing of concrete floors and pavements. Steel Structures : Types and causes for deterioration – preventive measures – Repair procedure – Brittle fracture – Lamellar tearing – Defects in welded joints – Mechanism of corrosion – Design of protect against corrosion – Design and fabrication errors – Distress during erection. Masonry Structures: Discoloration and weakening of stones – Biotical treatments – Preservation – Chemical preservatives – Brick masonry structures – Distresses and remedial measures.

UNIT V STRENGTHENING OF EXISTING STRUCTURES 9

General principle – relieving loads – Strengthening super structures – plating – Conversation to composite construction – post stressing – Jacketing – bonded overlays – Reinforcement addition – strengthening the substructures – under pinning – Increasing the load capacity of footing – Design for rehabilitation.

REFERENCES:

1. Allen R.T and Edwards S.C, “Repair of Concrete Structures”, Blakie and Sons, UK, 1987
2. Dayaratnam.P and Rao.R, “Maintenance and Durability of Concrete Structures”, University Press, India, 1997.
3. Denison Campbell, Allen and Harold Roper, “Concrete Structures, Materials, Maintenance and Repair”, Longman Scientific and Technical, UK, 1991.
4. Dodge Woodson.R,”Concrete Structures – protection, repair and rehabilitation”, Elsevier Butterworth – Heinmann, UK, 2009.
5. Peter H.Emmons, “Concrete Repair and Maintenance Illustrated”, Galgotia Publications Pvt. Ltd., 2001.
6. Raikar, R.N., “Learning from failures - Deficiencies in Design, Construction and Service” – Rand D Centre (SDCPL), Raikar Bhavan, Bombay, 1987.

BCE087	PROJECT FORMULATIONS AND APPRAISAL	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Estimation & Costing				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. To introduce and study formulation, costing, appraisal and finance of construction projects.

COURSE OUTCOMES (COs)

CO1	Formulate and generate the project and prepare reports for executing the work
CO2	Understand the costing and cash flows of a project.
CO3	Assess various methods of project appraisal.
CO4	Understand the project financing and special schemes.
CO5	Know about private sector participation in Infrastructure Development Projects

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M				H	M		M				
	CO2	M				H	M		M		L		
	CO3	M				H	M		M				
	CO4	M				H	M		M				
	CO5	M				H	M		M				

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PROJECT FORMULATION 10

Project – Concepts – Capital investments - Generation and Screening of Project Ideas - Project identification – Preliminary Analysis, Market, Technical, Financial, Economic and Ecological - Pre-Feasibility Report and its Clearance, Project Estimates and Techno-Economic Feasibility Report, Detailed Project Report – Different Project Clearances required.

UNIT II PROJECT COSTING 10

Project Cash Flows – Time Value of Money – Cost of Capital.

UNIT III PROJECT APPRAISAL 15

NPV – BCR – IRR – ARR – Urgency – Pay Back Period – Assessment of Various Methods – Indian Practice of Investment Appraisal – International Practice of Appraisal – Analysis of Risk – Different Methods – Selection of a Project and Risk Analysis in Practice.

UNIT IV PROJECT FINANCING 5

Project Financing – Means of Finance – Financial Institutions – Special Schemes – Key Financial Indicators – Ratios.

UNIT V PRIVATE SECTOR PARTICIPATION 5

Private sector participation in Infrastructure Development Projects - BOT, BOLT, BOOT - Technology Transfer and Foreign Collaboration - Scope of Technology Transfer.

REFERENCES:

1. Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation Review,Tata McGraw Hill Publishing Company Ltd., New Delhi. 2006.
2. Joy P.K., Total Project Management - The Indian Context, New Delhi, Macmillan India Ltd., 1992
3. United Nations Industrial Development Organisation (UNIDO) Manual for the Preparation of Industrial Feasibility Studies, (IDBI Reproduction) Bombay, 1987
4. Barcus, S.W. and Wilkinson.J.W., Hand Book of Management Consulting Services, McGraw Hill, New York, 1986.

BCE088	GIS IN CONSTRUCTION ENGINEERING AND MANAGEMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Surveying I				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To introduce the elements of GIS as applied to construction management and achieve awareness on application techniques

COURSE OUTCOMES (COs)

CO1	Know the characteristics of map and map projections.
CO2	Understand the various types of data, data analysis methods and data quality requirements
CO3	Know the concepts of raster and vector data structure and applications of DEM.
CO4	Know the Measurement, Buffering, Overlaying and Components of data quality.
CO5	Understand means of getting suitable data output and to use the data output forconstruction management using GIS tools.

UNIT I GEOGRAPHIC INFORMATION SYSTEM 9

GIS - Definition - Components of GIS -Maps - Definition - Types of Maps - Characteristics of Maps - Map Projections -- Hardware, Software and Organizational Context - GIS software

UNIT II SPATIAL DATA 9

Data Types - Spatial and Non-Spatial - Spatial Data - Points, Lines and areas- Non-spatial data - Nominal, Ordinal, Interval and Ratio - Digitizer - Scanner - Editing and Cleaning - Geo reference data

UNIT III DATA STRUCTURE 9

Raster and Vector Data Structure - Raster data storage - Run length, Chain and Block Coding - Vector Data Storage - Topology - Topological Models - Arc Node Structure - Surface Data - DEM - Grid DEM and TIN structure- Applications of DEM

UNIT IV SPATIAL ANALYSIS 9

Reclassification - Measurement - Buffering - Overlaying - SQL for Queries - Neighbourhood and zonal operations - Data Quality - Components of data quality - Sources of errors in GIS - Meta data

UNIT V GIS APPLICATION 9

Output - Maps, Graphs, Charts, Plots , Reports - Printers - Plotters - Fields of application - Natural Resource Management, construction management-Parcel based, AM/FM applications examples - Case study

REFERENCES

1. Burrough P.A., Principles of GIS for Land Resources Assessment, Oxford Publication, 1998
2. Robert Laurini and Derek Thompson, Fundamentals of Spatial Information Systems, Academic Press, 1996
3. Anji Reddy, Remote Sensing and Geographical Information Systems , BS Publications 2001
4. Srinivas M.G. (Edited by), Remote Sensing Applications, Narosa Publishing House, 2001
5. Rhind, D., Understanding of GIS, The ARC / INFO Method, ESRI Press. 1990

BCE089	**ENVIRONMENTAL QUALITY MODELLING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Environmental Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To educate the students on the basic principles,development and application of air and water quality models with computer applications.

COURSE OUTCOMES (COs)

CO1	To make them understand the fundamentals of mathematical Modeling and explain how modeling can be used as a tool in assessing environmental quality.
CO2	To understand about the methods of application of these models in simulation, parameter estimation and experimental design
CO3	To understand in detail about the water quality modeling process ,dissolved oxygen models and models on Groundwater
CO4	To improve the knowledge on the emerging trends of air pollution modeling and prediction, performance and its utilization.
CO5	To know about the various case studies on air quality modeling and water quality modeling and other software package applications.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H									L		
	CO2		M		H		H						
	CO3	H		H			M			H			
	CO4				M					H			
	CO5	H	M			H							
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
										√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION 9

Basics of mathematical Modeling- Modeling as a tool. Procedures of model development. Importance of model building. Characteristics of deterministic models. Classical approach to constrained and unconstrained optimization. State of the art in environmental engineering systems models-climate and system modeling-Erosion and sediment transport.

UNIT II COMPUTER BASED SOLUTIONS 9

Formulation of linear optimization models. Linear programming. Sensitivity testing and duality. Solution techniques and computer programming; Formulation of linear optimization models. Application of models-simulation, parameter estimation and experimental design.

UNIT III WATER QUALITY MODELLING 9

Rivers and streams water quality modeling-river hydrology and flow-low flow analysis-dispersion and mixing-flow, depth; water quality modeling process-model sensitivity-assessing model performance; Models for dissolved oxygen, pathogens; Groundwater modeling.

UNIT IV AIR QUALITY MODELLING 9

Air pollution modeling and prediction, modeling technique, modeling for non reactive pollutants, single source short term impact; multiple sources and area sources, model performance, accuracy and utilization.

UNIT V CASE STUDIES 9

Software package applications: Air quality modeling and water quality modeling.

REFERENCES:

1. John Wainwright and Mark Mulligan, Environmental Modelling Finding Simplicity in Complexity, John Wiley and sons Ltd, USA, 2004
2. Dynamic Modeling of Environmental Systems by Deaton and Wine brake, Wiley & Sons, 2002.
3. Steven C. Chapra, Surface water quality modeling, McGraw-Hill Inc., New York, 1997.

4. Boubel R.W., Fox, D.L., Turner D.B.& Stern, A C. "Fundamentals of Air Pollution, Academic Press, New York,1994.

BCE090	MARINE POLLUTION MONITORING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Applied Hydraulic Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES: To educate the students on aspects of marine pollution and methods of water quality assessment and marine pollution control

COURSE OUTCOMES (COs)

CO1	To make them understand the fundamentals of General features of oceans and principles of marine geology
CO2	To understand about the Living resources in and around the oceans
CO3	To understand in detail about the planning and preparation of marine Surveying and sea surveying which includes the oceanographic instrumentation
CO4	To improve the knowledge on the emerging trends of marine pollution applications of remote sensing and GIS in marine studies.
CO5	To know about the control strategies of marine pollution associated with sustainable development

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M					
	CO2				M		H						
	CO3	H						M			H		
	CO4						H			L			
	CO5		M				H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I OCEANOGRAPHY 9

General features of ocean- Conservation laws- Wave characteristics and theories- Sediment transport- Tides- ocean Currents- Thermocline circulation- General circulation of ocean waters, Tsunamis, Storm Surge- Principles of Marine geology

UNIT II COASTAL ENVIRONMENT 9

Living resources- coral reefs, mangroves, seagrass, seaweeds, fishery potential- nonliving resources- manganese nodules, heavy minerals- Beaches, Estuaries, Lagoons- Shoreline changes

UNIT III MARINE SURVEYING 9

Sea surveying planning and preparation- Oceanographic instrumentation- Hydrographic Surveying- Underwater surveying- Measurement of physical properties of ocean water- sea bad sampling

UNIT IV MARINE POLLUTION AND MONITORING 9

Physiochemical properties of sea water- Sources of marine pollution and impacts on coastal ecosystems, Oil pollution- oil spill detection, dispersion, impacts on adjacent area- Oil spill modeling, mitigation measures- Oil exploration and their effects- Marine outfalls- Impacts of Ports and Harbour on marine water quality- dredging- Human intervention in estuarine ecosystem- sea water classification- Physical modeling in Coastal Engineering-Ocean monitoring satellites- Applications of Remote sensing and GIS in marine studies

UNIT V MARINE POLLUTION CONTROL 9

National and International treaties, protocols in marine pollution- Exclusive Economic Zone- Sustainable development.

REFERENCES:

1.Kennish, M.J., Pollution impacts on Marine Biotic Communities, CRC press New York,1998.
2.Newman, M.C., Roberts Jr. M.H., Male R.C.(Editors), Coastal and Estuarine Risk Assessment, Lewis Publishers, Washington,D.C.,2002.
3.U.S. Army Corps of Engineers, Shore protection Manual, Washington D.C.,2002.

BCE091	OPERATION & MANAGEMENTOF IRRIGATION SYSTEMS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Irrigation Engineering- II				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. To enable the students for a successful career as water management professionals. To create a potential among students in the area of irrigation management with specific enrichment to synthesis of data and their analysis.
2. To expose the students the need for an interdisciplinary approach in irrigation water management and providing a platform to work in an interdisciplinary team.

COURSE OUTCOMES (COs)

CO1	Understand the concepts of soil-water-plant relationship as well as to expose them to the principles and practices of crop production.
CO2	Exposure to ground water, hydraulics of ground water related to drainage, drainage concepts, planning, design and management of drainage related irrigation system management
CO3	The students will be able to understand an irrigation system, its components, its performance, and management of irrigation complexities to tackle different issues.
CO4	Understand the various principles of irrigation management and to analyse the different types of irrigation systems and their performances based on service oriented approach.

CO5	The students will acquire knowledge about the need for participatory approach and irrigation management transfer along with irrigation policy and institutional aspects.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l
2	CO1	H	M	L	H	H							H
	CO2	H	M	L	H	H							H
	CO3	H	M	L	H	H							M
	CO4	H	M	L	H	H							M
	CO5	H	M	L	H	H							M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I IRRIGATION SYSTEM REQUIREMENTS 8

Irrigation system – requirements – Gravity and lift irrigation – Supply and demand of water – croping pattern – Estimation of total and peak crop water requirements – Effective and dependable rainfall -allowable deficit – irrigation efficiency.

UNIT II IRRIGATION SCHEDULING 9

Frequency of irrigation – Methods of scheduling irrigation – Developing typical schedules – Case studies – Water conveyance Systems – Water measurements.

UNIT III MANAGEMENT 9

Structural and non structural strategies in water use and management. Conductive use of surface and ground water.

UNIT IV OPERATION 10

Operational plans – Main canals, laterals and field channels – Water control and regulating structures – Physical and administrative control – Water law.

UNIT V FARMERS INVOLVEMENT 9

Farmers role in system operation – Farmers committee for water distribution, On – farm management and maintenance of the irrigation system -Government – Father Partnership in irrigation.

TEXT BOOKS:

1. Dilip Kumar Majumdar, “Irrigation Water Management – Principles and Practice”, Prentice Hall of India Pvt. Ltd., New Delhi, 2000

REFERENCES:

1. Hand book on Irrigation Water Requirement, R.T. Gandhi, et. al., Water ManagementDivision, Department of Agriculture, Ministry of Agriculture, New Delhi
2. R.T.Gandhi, et .al, Handbook on Irrigation Water Requirements, Water Management Division, Defantment of Agriculture, ministry of Agriculture, New Delhi, 1989.
3. R.E.Robinson, C.M.Laurizen and D.C.Muckel, Distribution Control and Measurement of Irrigation Water on The Form USDA Mise Publication No.926.1989.
4. W.Cly AM, Max , Lowdermilk K and Gilbert Lorey L,"A Research Development Process For Improvement on Form Water Management" - Technical Report No.47, ColoradoState, University, Colorado, USA, 1977.
5. Max, K. Lowdermilk Farmer Involvement Planning Guide No.11,"Water Management Synthesis Project", Utah state University Logan, Utah, 1981.

BCE092	**TRANSPORTATION STRUCTURES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Transportation Engineering				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:
To introduce the students to the basic concepts and principles of transport structures such as bridges, parking facilities

COURSE OUTCOMES (COs)

CO1	To learn about the IRC codes.
CO2	To analyze and design the Deck slab and columns in bridges.
CO3	Designing the substructures.
CO4	To perform the design of Steel Bridges
CO5	To perform the designing of parking, and different amenities related to transportation.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2	H					H						
	CO3			H									
	CO4			H									
	CO5	M		H									

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I GENERAL 8

IRC Code provision, loading standard, impact loads, theories of load distribution in bridge docks – Charts and curves for deck slab design.

UNIT II BALANCED CANTILEVER BRIDGES 9

Balanced cantilever bridges and bearing. Advantages, general proportions for spans, impact factors – Influence lines for B.M. and S.F. at critical sections. Design of main girders and articulation. Types of bearings, design of bearings for girder bridges.

UNIT III BRIDGE SUBSTRUCTURES 10

Types of bridge structures-Piers abutments-shallow and deep foundations – General arrangements (descriptive study only) - Design of single and multiple vent box culverts. Moment distribution method.

UNIT IV STEEL BRIDGES 9

Steel bridges for highway and railway locations – Selection of Types and its advantages – Comparison with R.C.C. bridges – Design of deck and through bridges and bearing.

UNIT V AMENITIES 9

Design of depot buildings, parking lots, terminals, box culverts.

TEXT BOOKS

1. Johnson Victor D., "Essentials of Bridge Engineering", Oxford and IBH Publishing Co., New Delhi, 1990.

REFERENCES:

1. JaiKrishna & Jain O.P.. "Plain and Reinforced Concrete" Vol. 1 NemChand & Bros. Roorkee. 1987
2. Ramachandra, "Design of Steel Structures",Standard Pub, New Delhi 2013.
3. Fredrick W. Taylor E.Thompson & Edward Smulski, "Reinforced Concrete Bridges",John Wiley & Sons, Inc, New York 1939.

OPEN ELECTIVE-I

BCE093	REMOTE SENSING AND GIS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite-Engineering Physics – II				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. To introduce the students to the basic concepts and principles of various components of remote sensing.
2. To provide an exposure to GIS and its practical applications in civil engineering.

COURSE OUTCOMES (COs)

CO1	Apply the concepts of Electro Magnetic energy, spectrum and spectral signature curves in the practical problems
CO2	Apply the concepts of satellite and sensor parameters and characteristics of different platforms

CO3	Apply the concepts of DBMS in GIS												
CO4	Analyze raster and vector data and modeling in GIS												
CO5	Apply GIS in land use, disaster management, ITS and resource information system												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				H	H				H			
	CO2				H	H				H			
	CO3				H	H				H			
	CO4				H	H				H			
	CO5				H	H				H			
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
											√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I REMOTE SENSING 9

Definition Historical Components of Remote Sensing Principles & methods of remote sensing - Active and Passive remote sensing - Remote Sensing platforms -Electro magnetic radiation- Spectrum- Block body radiation – planks law – Stefan – Boltzmann law – satellites classification – based on orbit- sun synchronous and Geosynchronous based on purpose Earth Resources satellites, communication satellite Weather satellites Spy satellites Sensors Description of sensor in landscape, spot, IRS series and current satellites- Radar SLAR-and SAR.

UNIT II EMR INTERACTIONS 9

Interaction with atmosphere Scattering of EMR Raleigh, Mie, Non Selective and Raman Scattering Bach scattering Speckle EMR Interaction with water and Ozone Atmospheric windows and its significance EMR interaction with the earth surface materials Radiance, irradiance, Absorbed and Transmitting energy – reflectance- Specular- and diffuse surface- Spectral signature – and curves EMR interaction with soil Resolution Spectral, Spatial, Radiometric, and Temporal.

UNIT III RESOURCES ENGINEERING 9

Characteristics of Digital satellite image enhancement Filtering Applications of Aerial photographs and satellite imageries – merits – Limitations – Water resources – watershed management – Urban Studies – Flood Management- Fishing Forestry etc.,

UNIT IV GEOGRAPHIC INFORMATION SYSTEM 9

GIS – Components of GIS – Hardware, Software and Organisational Context – Data – Spatial and Non-Spatial – Maps – Types of Maps – Projection – Types of Projection - Data Input – Digitizer, Scanner – Editing – Raster and Vector data structures – Comparison of Raster and Vector data structure – Analysis using Raster and Vector data – Retrieval, Reclassification, Overlaying, Buffering – Data Output – Printers and Plotters.

UNIT V MISCELLANEOUS TOPICS 9

Visual Interpretation of Satellite Images – Elements of Interpretation - Interpretation Keys Characteristics of Digital Satellite Image – Image enhancement – Filtering – Classification - Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Urban Applications- Integration of GIS and Remote Sensing – Application of Remote Sensing and GIS – Water resources – Urban Analysis – Watershed Management – Resources Information Systems

TEXT BOOKS:

1. Anji Reddy, "Remote Sensing and Geographical Information Systems", BS Publications 2001

REFERENCES:

1. Anand P.H,"Principles of remote Sensing and Geographical Information Systems", Sri Venkateswara Publishers, 2003.
2. Lillesand T.M and Kiefer R.W. Remote sensing and Image, Interpretation, John Wiley and Sons, INC, New York, 1987.
3. Burrough P A,"Principle of GIS for land resource assessment", Oxford University, 1990.

BMA008	TOTAL QUALITY MANAGEMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

1. To introduce to the student about the basic terms related to quality and concepts of quality management
2. To familiarize the student about the basic principles of total quality management
3. To acquaint the student with the basic statistical tools used in process control
4. To introduce to the student about the various tools used in implementing and checking total quality management
5. To familiarize the student about the different quality systems used in auditing the quality of a company/industry/organization

COURSE OUTCOMES (COs)

CO1	By understanding about various quality terms, it will be helpful for the student to maintain quality in his/her organization
CO2	The student will be able to formulate new plans/procedures to be implemented to achieve the desired quality status by knowing about the various principles of quality management
CO3	The student will be able to analyze the periodical data in quality control using statistical tools

CO4	The total quality management tools will help the student to understand the procedures in measuring the quality of the organization/process and will also enable him/her to identify the parameters that are improving/depriving the quality
CO5	By knowing about the quality ISO systems, the student will be maintain processes/documentation properly so that the quality maintained by his/her organization gets recognized

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
								√	

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INTRODUCTION 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation

UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership –Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA –Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System –Elements, Implementation of Quality System, Documentation, Quality Auditing, TS16949, ISO 14000 – Concept, Requirements and Benefits

TEXT BOOKS:

1. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education, Inc.2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCE BOOKS:

1. Evans. J. R. & Lindsay. W,M "The Management and Control of Quality", (5th Edition),South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991.
3. Oakland.J.S. "Total Quality Management", Butterworth Hcinemann Ltd., Oxford,1989.
4. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks",New Age International 1996.
5. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991.

BCE094	**OPTIMIZATION TECHNIQUES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Fundamentals of Computing and Programming				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. To introduce the students to the basic concepts and principles of optimization, linear programming and queuing theory

COURSE OUTCOMES (COs)

CO1	Understanding the Concept of optimization and classification of optimization problems.
CO2	Formulation simplex methods variable with upper bounds
CO3	Study theQueuing Model, poison and exponential distributions
CO4	Understand the maximization and minimization of convex functions
CO5	To study equality constraints, inequality constraints

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1							M	H				M
	CO2							M	H				M
	CO3	L			M			M	H				M

	CO4							M	H				M
	CO5							M	H				M
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
											√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION 8

Concept of optimization – classification of optimization – problems.

UNIT II LINEAR PROGRAMMING 10

Examples of linear programming problems – formulation simplex methods variable with upper bounds – principle- duality -dual simplex method - sensitivity analysis – revised simplex procedure – solution of the transportation problem – assignment – network minimization – shortest route problem – maximal two problem – L.P.representation of networks.

UNIT III QUEUING THEORY 9

Queuing Model, poison and exponential distributions -Queues with combined arrivals and departures- random and series queues.

UNIT IV UNCONSTRAINED OPTIMIZATION 9

Maximization and minimization of convex functions. Necessary and sufficient conditions for local minima – speed and order of convegence – unibariate search – steepest and desent methods- metcher reeves method -conjugate gradient method.

UNIT V CONSTRAINED OPTIMIZATION 9

Necessary and sufficient condition – equality constraints, inequality constraints -kuhu – tucker conditions – gradient projection method – penalty function methods – cutting plane methods of sibel directions.

TEXT BOOKS:

1. Rao S.S,"Optimization – Theory and applications", Wiley Easter Ltd., 1979.

REFERENCES:

1. David G.Luerbeggan, "Introduction to Linear and Non Linear Programming", Addison Wesley Publishing Co. 1973.
2. Hadley G. "Nonlinear and – dynamic programming" Addison Wesley Publishing Co. 1964.
3. Cordan C.C. Beveridge and Robert S. Schedther, "Optimization, Theory and Practice" McGraw Hill Co.1970.
4. HarndyA.Tahh. "operations Research, An Introduction", Macmillan Publishers Co.NewYork,1982.
5. Beightferand S. others, "Foundations of Optimization Pill", New Delhi, 1979.

OPEN ELECTIVE-II

BCE095	GEOGRAHICS INFORMATION SYSTEM	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Remote Sensing and GIS				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To introduce the students to the basic concepts and principles of various components of Geographic Information System

COURSE OUTCOMES (COs)

CO1	To procure knowledge about History and development of GIS
CO2	Apply the concept of Data Entry, Storage & Maintenance
CO3	Apply the concepts of DBMS in GIS
CO4	Analyze raster and vector data and modeling in GIS
CO5	Apply GIS in land use, disaster management, ITS and resource information system

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M			H	H				H			
	CO2	M			H	H				H			
	CO3	M			H	H				H			
	CO4	M			H	H				H			
	CO5	M			H	H				H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
								√	
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Definition – Map and amp analysis – Automated carrography, History and development of GIS. Hardware requirement -system concepts Coordinate systems - Standard GIS packages.

UNIT II DATA ENTRY, STORAGE & MAINTENANCE 9

Type of data. Spatial and non-spatial data – Data structure – points – Lines – polygon - Vector and raster Piles and data formats- Data compression.

UNIT III DATA ANALYSIS OF MODELING 9

Spatial analysis - Data retrival- Query Simple analysis- Record overlay- vector data analysis- raster data analysis - Modeling in GIS- Digital elevation model- DIM cost and path analysis - Artificial intelligence- Expert system.

UNIT IV DATA OUTPUT & ERROR ANALYSIS 9

Types of output data – Display on screen – Printer – Plotter – Other output devices – Sources of errors – Types of error – Elimination. Accuracies.

UNIT V APPLICATION 9

GIS Application: Application areas – Resources management – Agriculture Soil – Water Resources management – Cadestral records and US – Integrated remote sensing application with GLS – Knowledge based techniques.

TEXT BOOKS:

1. Anji Reddy .M, "Remote sensing and Geographical information system", B.Publications, 2011.

REFERENCES:

1. Chester (England), Geo informational System, Application of GIS and Related SpatialInformation Technologies – ASTER Publication Co. 1992.
2. Burrough .P.A, "Principles of GIS for Land Resources Assessment", Oxford Publication,2000.
3. Jeffrey Star and Join Estes, "Geographical Information System An Introduction" – Prentice Hall, 1990.

BCE096	**ENGINEERING ECONOMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Management Concepts For Civil Engineers				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

1. To impart knowledge on Economics and its importance in the field of Engineering

COURSE OUTCOMES (COs)

CO1	Have knowledge about the importance of Economics and the factors affecting demand and supply
CO2	Have a well-founded knowledge about the cost aspects and cost-output relationship
CO3	Acquire skills in assessing functions and principles of management and also the types of organizations
CO4	Have knowledge about plant layout and its maintenance
CO5	Have knowledge about the concepts of productivity, economic growth and standard of living.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H					H					
	CO2		H							M			
	CO3			H			M					L	
	CO4		H										

	CO5			H									
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
											√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I BASIC CONCEPT 9

Basic economic concept - importance of economics in engineering- economic and Technical decisions- demand and supply- factors influencing demand- elasticity of demand - demand forecasting- competition.

UNIT II COST 9

Actual cost and opportunity cost- marginal cost- incremental. costs and sunk cost, fixed and variable cost- short-run long- run cost- cost output relationship- price fixation pricing methods, break even analysis.

UNIT III PROCESS OF MANAGEMENT 9

Nature of management and its process- contribution of Taylor and. Foyal of management Functions and principles of management- types of organizations- organization charts and Manuals - industrial ownership - types, formation, merits, and demerits management by Objective, management by exception and management information system.

UNIT IV PLANNING TECHNIQUES 9

Plant location - factors- decisions- plant layout, types, procedure and techniques material handling- principles, equipments and selection- plant maintenance- objective types and techniques

UNIT V PRODUCTION AND ITS APPLICATION 9

Production, productivity, economic growth and standard of living- factors affecting Productivity - role of work study- human factor- method study-objective and procedures- charting and photographic techniques- SIMO chart - principles of motion economy- work measurement- stop watch time study- ruling concept and systems- allowances - work sampling.

TEXT BOOK:

1 Varshney and Maheshwari, Managerial Economics

2. Dewett, Modern Economic Theory

REFERENCE:

1. L.M.Prasad, Principles and Practice of Management, Sultan Chand and Sons.
2. V.P.S.Rao and P.S.Narayana, Principles of Management.

	RENEWABLE SOURCES OF ENERGY	**L**	**T**	**P**	**C**

BCE097	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engineering Earth Science				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES:

To impart knowledge on sources and characteristics of various renewable source of energy and strategies for its implementation.

COURSE OUTCOMES (COs)

CO1	Have knowledge about the various renewable sources of energy
CO2	Have a well-founded knowledge about the Primary energy sources
CO3	Acquire skills in assessing the suitability of direct energy conversion
CO4	Have knowledge about bio – energy
CO5	Have knowledge about solar energy.

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H	H									
	CO2		H	H									
	CO3		H	H									
	CO4		H	H									
	CO5		H	H									

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
								√	
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I GENERAL 9

Primary energy sources -direct energy - conversion -comparison with conventional energy-conversion devices.

SOLAR ENERGY – Principles of solar energy collection – solar radiation – measurement instruments - data and estimation - types of collectors - characteristics and design principles of different types of collectors - testing of collectors.

UNIT II SOLAR ENERGY APPLICATIONS 9

Solar thermal applications – water heaters and air heaters performance and applications - simple calculations on solar cooling, solar drying, solar ponds, solar tower concepts and solar furnace.

UNIT III WIND AND TIDAL ENERGY 9

Energy from the wind – general theory of windmills – design aspects of horizontal axis and vertical axis windmills – applications. Energy from tides and waves – working principles of tidal plants and ocean thermal energy conversion plants – power from geothermal energy – principles of working of geothermal power plants.

UNIT IV BIO – ENERGY 9

Energy from bio – mass bio – gas plants – various types -design principles of bio – gas plants applications- Energy from waste burning- power plants, utilization of industrial and municipal wastes – energy from the agricultural wastes.

UNIT V DIRECT ENERGY CONVERSION 9

(Description, principle of working and basic design aspects only) Magneto hydrodynamic systems, thermo electric generators, thermionic generators fuel cells solar cells types, e.m.f. generated, power output, tosses and efficiency and applications.

TEXT BOOKS:

1. D. Yogi Goswami, Frank Kreith&Jan F. Kreider," Principles of Solar Energy Engineering", CRC Press, 2000

REFERENCES:

1. John A. Duffie, William A. Beckman,"Solar Energy Thermal processes", John Wiley & Sons; 4th Edition (17 May 2013).
2. Sukhatme K, Suhas P. Sukhatme," Solar Energy", Tata McGraw-Hill Education, 1996
3. Rai G.D,"Solar Energy Utilisation",Khanna Publishers, 1987
4. Shao-lee Soo,"Direct Energy Conversion", Prentice-Hall, 1968

CURRICULUM AND SYLLABUS (R2015)
CHOICE BASED CREDIT SYSTEM
(Applicable to the batches admitted from July 2015)
B.TECH – COMPUTER SCIENCE AND ENGINEERING
I – VIII SEMESTERS

SEMESTER I						
Course Code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN101	HS	English – I	3	1	0	3
BMA101	BS	Mathematics – I	3	1	0	3
BPH101	BS	Engineering Physics - I	3	0	0	3
BCH101	BS	Engineering Chemistry – I	3	0	0	3
BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
BFI201 #	HS	Foreign/Indian Language	3	0	0	3
BME102	ES	Engineering Graphics – C	1	0	3	3
BEE101	ES	Basic Electrical and Electronics Engineering	2	0	0	2
PRACTICAL						
BCS1L1	ES	Computer Practice Laboratory –I	0	0	3	1
BEE1L1	ES	Basic Electrical and Electronics Engineering Practices Laboratory	0	0	3	1
BPC1L1/2L1	BS	Physics and Chemistry Laboratory@	0	0	3/3	0
BSS1L7	HS	Yoga	0	1	2	1

#Any one of the following courses:BFR201–French, BGM201–German, BJP201– **Japanese**, BKR201 – Korean, BCN201 – Chinese, BTM201 - Tamil

@Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)

Total Number of Contact Hours = 38 **Total Number of Credits= 26**

SEMESTER II						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN201	HS	English-II	3	1	0	3
BMA201	BS	Mathematics –II	3	1	0	3
BPH201	BS	Engineering Physics –II	3	0	0	3
BCH201	BS	Engineering Chemistry – II	3	0	0	3
BCS202	ES	Internet programming	2	0	0	2
BSS2L2	HS	Personality Development	2	0	0	2
BBT202	BS	Biology for Engineers	2	0	0	2
BME201	ES	Basic Mechanical Engineering	2	0	0	2
BCE201	ES	Basic Civil Engineering	2	0	0	2
PRACTICAL						
BCS2L1	ES	Internet Practices lab	0	0	3	1
BCM2L1	ES	Basic Civil & Mechanical Engg. Practices Lab	0	0	3	1
BPC2L1	BS	Physics and Chemistry Lab	0	0	3/3	1
BSS2L4/ BSS2L5/ BSS2L6	HS	NSS/NCC/NSO (to be conducted during weekends)	0	1	2	1
#Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)						
Total No. of Contact Hours: 36				**Total Credits: 26**		

SEMESTER- III						
THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BMA 301	BS	Mathematics – III	3	2	0	4
BCS301	PC	Data Structures	3	0	0	3
BCS302	PC	System Modeling and Simulation	3	0	0	3
BCS303	PC	Computer Organization and Architecture	3	0	0	3
BCS304	PC	Digital Computer Fundamentals	3	0	0	3
BEC305	PC	Electronics Circuits	3	0	0	3
PRACTICAL						
BCS3L1	PC	Data Structures using C Laboratory	0	0	3	2
BCS3L2	PC	Object Oriented Programming using C++ Laboratory	0	0	3	2
BEC3L2	PC	Electronics Circuits Laboratory	0	0	3	2
BCS3S1	PR	Technical Seminar – I	0	0	2	1
Total No. of Contact Hours: 29 Total No. of Credits: 26						

Semester -IV						
THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BMA402	BS	Numerical Methods	3	2	0	4
BCS401	PC	Database Management System	3	0	0	3
BCS402	PC	Design and Analysis of Algorithm	3	0	0	3
BCS 403	PC	System Software	3	0	0	3
BCS405	PC	Operating Systems	3	0	0	3
BCE406	BS	Environmental Studies	3	0	0	3
PRACTICAL						
BCS4L1	PC	DBMS Laboratory	0	0	3	2
BCS4L2	PC	Operating Systems Laboratory	0	0	3	2
BCS4L3	PC	Computer Graphics and Multimedia Laboratory	0	0	3	2
BCS4S1	PR	Technical Seminar-II	0	0	2	1
Total No. of Contact Hours: 30 Total No. of Credits: 26						

SEMESTER-V						
THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BMA501	BS	Discrete Mathematics	4	0	0	4
BCS501	PC	Software Engineering	3	0	0	3
BEC501	PC	Microprocessors and its applications	3	0	0	3
BCS502	PC	Computer Networks	3	0	0	3
BCS5E1	CE	Core Elective-I	3	0	0	3
BCS5E2	OE	Open Elective-I	3	0	0	3
PRACTICAL						
BCS 5L1	PC	Networking Laboratory	0	0	3	2
BEC5L1	PC	Microprocessor Laboratory	0	0	3	2
BCS5L2	PC	Software Engineering Laboratory	0	0	3	2
BCS5C1	PR	Comprehension I	0	0	0	1
Total No. of Contact Hours: 27					**Total No. of Credits: 26**	

SEMESTER-VI						
THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BCS601	PC	Data Warehousing and Data Mining	3	0	0	3
BSS601	HS	Value Education and Professional Ethics	3	0	0	3
BCS602	PC	Distributed Computing	3	0	0	3
BCS603	PC	Principles of Compiler Design	3	0	0	3
BCS6E3	CE	Core Elective- II	3	0	0	3
BCS6E4	NE	Non Major Elective-I	3	0	0	3
PRACTICAL						
BCS6L1	PC	Data Warehousing and Data Mining Laboratory	0	0	3	2
BCS6L2	PC	C # and .Net Laboratory	0	0	3	2
BCS6L3	PC	Programming in Java Laboratory	0	0	3	2
BCS6P1	PR	Mini Project	0	0	3	1
Total No. of Contact Hours: 30					**Total No. of Credits: 25**	

Semester-VII						
THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BCS701	PC	Grid and Cloud Computing	3	0	0	3
BCS702	PC	Mobile and Pervasive Computing	3	0	0	3
BCS703	PC	Web Technology	3	0	0	3
BCS704	PC	Artificial Intelligence and Expert System	4	0	0	4
BCS7E5	OE	Open Elective -II	3	0	0	3
BCS7E6	NE	Non Major Elective- II	3	0	0	3
PRACTICAL						
BCS7L1	PC	Grid and Cloud Computing Laboratory	0	0	3	2
BCS7L2	PC	Web Technology Laboratory	0	0	3	2
BCS7P1	PR	Term Paper	0	0	4	2
Total No. of Contact Hours: 29		**Total No. of Credits: 25**				

Semester-VIII						
THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BCS8E7	CE	Core Elective-III	3	0	0	3
BCS8E8	NE	Non Major Elective-III	3	0	0	3
PRACTICAL						
BCS8C1	PR	Comprehension II	0	0	0	1
BCS8P1	PR	Project Work	0	0	18	9
Total No. of Contact Hours: 24		**Total No. of Credits: 16**				

OVERALL CREDITS FOR THE PROGRAMME : 196

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	7	6	-	-	-	3		-	16	08.63
2	Maths &Basic Sciences (BS)	9	12	4	7	4	-	-	-	36	18.37
3	Engineering Sciences (ES)	10	8	-	-	-	-	-	-	18	09.18
4	Professional Core (PC)	-	-	21	15	15	15	17	-	83	42.35
5	Core Electives (CE)	-	-	-	-	3	3		3	9	04.59
6	Non major Electives (NE)	-	-	-	-	-	3	3	3	9	04.59
7	Open Electives (OE)	-	-	-	-	3	-	3	-	6	03.06
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	1	1	1	1	2	10	16	08.17
	Total Credit	26	26	26	26	26	25	25	16	196	100%
	Total Contact Hour	38	36	29	30	27	30	28	25	244 Hrs	

LIST OFELECTIVES

CORE ELECTIVE(CE)- I					
SUB.CODE	**SUBJECT NAME**	**L**	**T**	**P**	**C**
BCS001	Parallel Computing	3	0	0	3
BCS002	Data Science	3	0	0	3
BCS003	Software Reliability	3	0	0	3
CORE ELECTIVE (CE)-II					
BCS004	VHDL	3	0	0	3
BCS005	Big Data Analytics	3	0	0	3
BCS006	Software Quality Assurance	3	0	0	3
CORE ELECTIVE(CE)- III					
BCS007	Computer Vision	3	0	0	3
BCS008	Bio Inspired Computing	3	0	0	3
BCS009	Real Time Software Testing	3	0	0	3
NON MAJOR ELECTIVE(NE)- I					
SUB.CODE	**SUBJECT NAME**	**L**	**T**	**P**	**C**
BET407	Digital Signal Processing	3	0	0	3
BET702	Cellular Mobile Communication	3	0	0	3
BBR701	Bio Safety, Bio Ethics, IPR Patents	3	0	0	3
BBM405	Biosensors and Transducer	3	0	0	3
BBM054	Bio Informatics	3	0	0	3
NON MAJOR ELECTIVE(NE)- II					
BET603	Telecommunication Switching Networks	3	0	0	3
BET605	Telecommunication Switching and System Modelling	3	0	0	3
BBA001	Principles of Management and Organizational Behaviour	3	0	0	3
BBM701	Digital and Medical Image Processing	3	0	0	3
BBM604	Medical Informatics	3	0	0	3
NON MAJOR ELECTIVE(NE)- III					
BET301	Principles of Analog and Digital System	3	0	0	3
BEC405	Linear Integrated Circuits	3	0	0	3
BET703	Satellite Communication	3	0	0	3
BBM055	Telemedicine	3	0	0	3
BBR 404	Genomics and Proteomics	3	0	0	3
OPEN ELECTIVE(OE) –I					
SUB.CODE	**SUBJECT NAME**	**L**	**T**	**P**	**C**
BCS010	TCP / IP Principles and Architecture	3	0	0	3
BCS011	Performance Evaluation in Computer Systems	3	0	0	3
BCS012	Advanced Computer Networks	3	0	0	3
BCS013	Mobile Communication	3	0	0	3
BCS014	High Speed Networks	3	0	0	3
BBA009	Intellectual Property Rights	3	0	0	3
BSS001	NSS Paper I	2	0	2	3
OPEN ELECTIVE(OE) –II					
BCS015	PHP Programming	3	0	0	3
BCS016	Virtual Reality	3	0	0	3
BCS017	E Commerce	3	0	0	3
BCS018	Advanced Web Design	3	0	0	3

BCS019	Object Oriented Database Design	3	0	0	3
BSS002	NSS Paper II	2	0	2	3
BMO001	Massive Open Online Course	3	0	0	3

BEN101	ENGLISH - I	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Dept of English				

OBJECTIVES

To make the students learn the basic modes of communication for fluency and attainment of confidence in speech, reading and writing.

COURSE OUTCOMES (COs)

CO1	Understand the importance of being responsible, logical, and thorough.
CO2	Respond to the situations where short reports and instructions are required.
CO3	Explain "how things work", and what to suggest when "things don't work
CO4	Develop our confidence and authority in the practical use of language.
CO5	Understand the importance of being responsible, logical, and thorough.
CO6	e to Face interviews and competitive examinations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H	H	M	L	L	H	H	H	H
	CO2							L					
	CO3	H						H		H			H
	CO4	H	M				M	L	H	H			H
	CO5							L					
	CO6	H		H	H	H	H	L		H	H	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I STRUCTURES 12

Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT II TRANSCODING 12

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT III REPORTING 12

Degrees of comparison – Positive, Comparative, Superlative - questions- SI units -Lab reports - Physics chemistry, workshop and Survey report for introducing new product in the market.

UNIT IV FORMAL DOCUMENTATION 12

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT V METHODOLOGY 12

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives , prepositional relatives.

TEXT BOOK:

1. Department Of Humanities and Social Sciences Division, Anna University, Oxford University Press, 2013.

REFERENCES:

1. S.P.Danavel, English and Communication for Students of Science and Engineering, Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007.
3. Murali Krishna and Sunitha Moishra, Communication Skills for Engineers . Pearson, New Delhi, 2011.

BMA101	**MATHEMATICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – + 2 Level Mathematics				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To make the students learn Mathematics in order to formulate and solve problems effectively in their respective fields of engineering.

COURSE OUTCOMES (COs)

CO1	Study the fundamentals of mathematics
CO2	Students learn multiple integral techniques
CO3	Students gain knowledge in application of variables
CO4	Find area and volume based on a function with one or more variables.
CO5	Apply matrix operations to solve relevant real life problems in engineering.
CO6	Formulate a mathematical model for three dimensional objects and solve

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	D	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2			M		H							
	CO3		H				M						
	CO4								L				
	CO5							H			L		
	CO6											L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT 1 MATRICES 12

Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes- Envelopes- Applications of Evolutes and Envelopes.

UNIT 1V FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives- Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobians- Taylor's expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates-Area as double integral- Volume as triple integral.

TEXT BOOK:

1. Ravish R.Singh and Mukkul Bhatt, "Engineering Mathematics-I" First Reprint, Tata McGraw Hill Pub Co., New Delhi. 2011.
2. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi. 2007.

REFERENCES:

1. Ramana.B.V. "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons, New York, 2003.
4. Murray R.Spiegel, "Advanced Calculus", Schaum's Outline Series, First Edn, McGraw Hill Intl Book Co.,New Delhi, 1981.

PH101	**ENGINEERING PHYSICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES:

To enhance the fundamental knowledge in Physics and its applications relevant to various stream Engineering and Technology

COURSE OUTCOMES (COs)

CO1	Understand the Principles and Laws of Physics
CO2	To understand the impact of Crystal Physics
CO3	Learn the Properties of Elasticity and Heat transfer.
CO4	Acquire Knowledge on Quantum Physics.
CO5	Understand the concepts on Laser & Ultrasonic's and its Applications
CO6	Understand the Principle of Laser and its Applications in Engineering and Medicine.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	A	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M			H		
	CO2		L	H		M				M		L	H
	CO3												
	CO4	H		M	L						L		M
	CO5		L	L								L	L
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)-

Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity-Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress -strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion –Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO2, Semiconductor lasers (homo junction & hetero junction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TEXT BOOKS:

1. Jayaraman D Engineering Physics I. Global Publishing House, 2014.
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai Publishers, 2009.
4. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
4. http://ocw.mit.edu/courses/find-by-topic
5. http://nptel.ac.in/course.php?disciplineId=122
6. https://en.wikipedia.org/wiki/Engineering_physics

BCH101	ENGINEERING CHEMISTRY - I	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level Chemistry				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Understand the principles of water characterization and treatment for portable and industrial purposes.
CO2	To impart knowledge on the essential aspects of Principles of polymer chemistry and engineering applications of polymers
CO3	Having a sound knowledge in the Field of the Conventional and non-Conventional energy
CO4	To impart knowledge on the essential aspects of electrochemical cells, emf and applications of EMF measurements
CO5	To make the students understand the Principles of corrosion and corrosion control .
CO6	To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I WATER TECHNOLOGY 9

Introduction-Characteristics : Hardness of water – types - temporary and permanent hardness - estimation by EDTA method Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –Domestic water treatment – disinfection methods (Chlorination, Ozonation

, UV treatment) Boiler feed water – requirements – disadvantages of using hard water in boilers Internal conditioning (Calgon Conditioning method) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

UNIT II POLYMERS 9

Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization– Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III ELECTRO CHEMISTRY 9

Introduction CELLS: types of Electrochemical cells , Electrolytic cells – Reversible and irreversible cells EMF – measurement of EMF– Single electrode potential – Nernst equation Reference electrodes : Standard Hydrogen electrode -Calomel electrode Ion selective electrode :Glass electrode and measurement of pH using Glass electrode Electrochemical series – significance Titrations :Potentiometer titrations (redox - Fe^{2+}vs dichromate titrations) Conduct metric titrations (acid-base – HCI vs, NaOH titrations)

UNIT IV CORROSION AND CORROSION CONTROL 9

Introduction: Chemical corrosion Definition - Chemical Corrosion - Electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion control – sacrificial anode and impressed cathodic current methods – Protective coatings :Paints– constituents of the paint and their functions Metallic coatings – electroplating of Gold and electro less plating of Nickel.

UNIT V NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES9

Introduction : Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor Solar energy conversion – solar cells – wind energy Fuel cells – hydrogen – oxygen fuel cell Batteries :Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries :Lead–acid storage battery –working –uses Nickel–cadmium battery - working – uses Solid – state battery : Lithium battery

TEXT BOOKS:

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara “A text book of engineering chemistry” S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).

REFERENCES :

1. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Electrochemistry

BCS101	FUNDAMENTALS OF COMPUTING AND PROGRAMMING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES

Students will understand the basics of computers and solve computer oriented problems using various computing tools.

COURSE OUTCOMES (COs)

CO1	Learn the fundamental principles in computing.
CO2	Learn to write simple programs using computer language
CO3	To enable the student to learn the major components of a computer system.
CO4	Computing problems
CO5	To learn to use office automation tools.
CO6	To interpret and relate programs

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H					H						
	CO2		L	H		M							
	CO3		L		S								
	CO4	M		M	W		M						
	CO5		L	L									
	CO6	H					H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO COMPUTER 9

Introduction- Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers- Basic Computer Organization-Number system. Computer Software: Types of Software—System software-Application software-Software Development Steps

UNIT II PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program – Purpose – Algorithm – Flowcharts– Pseudo code Introduction to Office Packages: MS Word, Spread Sheet, Power Point, MS Access, Outlook.

UNIT III INTRODUCTION TO C 9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions. Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV ARRAYS AND STRUCTURES 9

Arrays - Handling of Character Strings - Pointers – Structures-Union -Functions – Recursion-Call by value and Call by reference.

UNIT V INTRODUCTION TO C++ 9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TEXT BOOKS:

1. Ashok, N.Kamthane,"Computer Programming", Pearson Education (2012).
2. Anita Goel and Ajay Mittal,"Computer Fundamentals and Programming in C", Dorling V Kindersley (India Pvt Ltd).,Pearson Education in South Asia,(2011).
3. Yashavant P. Kanetkar, "Let us C",13th Edition,BPB Publications(2013).
4. Yashavant P. Kanetkar,"Let us C++"10th Edition, BPB Publications (2013**).**

REFERENCES:

1. Pradeep K.Sinha, Priti Sinha "Foundations of Computing", BPB Publications (2013).
2. Byron Gottfried, "Programming with C", 2nd edition, (Indian Adapted Edition), TMH Publication.
3. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in 'C' First Edition, Oxford University Press(2009).
4. The C++ Programming Language , 4th Edition, Bjarne Stroustrop, Addison-Wesley Publishing Company (2013).

BFR 101	**FRENCH**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

Language gives access and insights into another culture. It is a fundamental truth that cultures define themselves through languages.

COURSE OUTCOMES (COs)	
CO1	Introduce the basics of the language to beginners
CO2	Understand a dialogue and dialogue presentation
CO3	To develop their knowledge as well as their communicative skills so as to be able to respond in simple everyday contexts.

CO4	Synchronies I includes documents which initiate the learners to another world, another culture and which acclimatize them to the authentic use of the French language through the exploitation of written and iconographic documents. The Indian context has been used.
CO5	Grammatical and lexical notions as well as activities required for communication are learnt by the students.
CO6	Interpreting skills and confidence in the language.
CO6	Interpreting skills and confidence in the language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION 8

At the airport: Savoir– faire: exchanging greetings, self introduction, introducing another, welcoming someone, identifying someone - Grammar: verbs 'to be', 'to call oneself', subject pronouns, interrogation

UNIT II GRAMMAR 8

At the University: Savoir-faire: enquiring after one's welfare, taking leave, expressing appreciation - Grammar: definite & indefinite articles, gender of nouns, adjectives, present tense of regular 'er' verbs, 'to have', 'to learn', negation, irregular verbs

UNIT III CONVERSATION 8

At the café: Savoir –faire: speaking about one's likes, giving information, expressing admiration, asking information about someone - Grammar: Interrogative adjectives, irregular verbs, possessive and interrogative adjectives

UNIT IV PROPOSAL WRITING 7

At the beach: Savoir faire: proposing an outing, accepting/ refusing the proposal - Grammar: singular & plural, indefinite pronoun, demonstrative adjectives, negation, irregular verbs

UNIT V FORMAL LETTERS 7

A concert: Savoir –faire: inviting, accepting, expressing one's inability to accept an invitation

UNIT VI REGULAR & IRREGULAR VERBS 7

Grammar: Present tense of more irregular verbs, contracted articles, future tense, interrogative adverbs, **At Nalli's** Savoir- faire: asking the price of an article, protesting against the price, Grammar: possessive adjectives, Exclamative adjectives, imperative tense

REFERENCES:

1. Course Material: Synchronie I –Méthode de Français
2. Madanagobalane -Samita Publications, Chennai, 2007

BGM 101	**GERMAN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

At the end of this course, students shall be able to obtain good knowledge of the language, to r write and speak German, whereby the emphasis is laid on speech.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand German lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

		√							
4	Approval	37th Meeting of Academic Council, May 2015							

Course structure:

A. German Language (speaking, reading, writing, grammar and test)
B. Life in Germany (shopping, restaurant, doctor, government, bank, post)
C. The German Way (introduction, doing business, conversation, meetings, dining)
D. Germany (Culture, Climate)

UNIT I PRONOUNCIATION 9

Welcome: Introduction to the Language, Spelling and Pronunciation (The alphabets and numbers) Greetings, ordering, requesting, saying thank you - Grammar **– the article "the", conjugation** of verbs

UNIT II SELF INTRODUCTION 9

Shopping - Grammar **–** adjectives, endings before nouns, practice. Self introduction

UNIT III TRAINING 9

Addresses, Occupations, Studies - Grammar **- 'to be', the definite/indefinite** articles, individual Training

UNIT IV ORAL 9

Leisure Time, Sports, Hobbies - Grammar **–** position of a verb in a main clause , oral practice

UNIT V NARRATION 9

At a Restaurant, Food and Drink - Grammar **–** the personal pronoun in the Nominative and Accusative, Narrating an event

RESOURCES:

1. Sprachkurs Deutsch 1 (Verlag Diesterweg), New Delhi Learning Centre

BJP 101	**JAPANESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Japanese language, Japanese culture and heritage
To impart knowledge Japanese lifestyle.
To give sufficient exposure to develop basic conversational skills.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.

CO4	Will understand Japanese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CULTURAL HERITAGE 9

Introduction-history and origin of Japanese language-Japan and its cultural heritage-Self introduction-counting numbers (1-100)-time-conversation with the use of audio devices, grammar– usage of particles wa, no, mo and ka

UNIT II USAGE 9

Greetings, seasons, days of the week and months of the year-numbers (up to 99,999)-grammar– usage of kore, sore, are, kono, sono, ano, koko and kochira, arimasu and imasu-i-ending and na-ending adjectives-use of audio and drills for practice

UNIT III ORAL 9

Asking the price–associated vocabulary-usage of particles ni, ga and ne- use of audio and drills for practice-Introduction to basic Kanji characters- use of audio and drills for practice

UNIT IV ART AND CULTURE 9

Family relationships- colours-Kanji (numbers) and festivals of Japan-religion-Japanese art and culture-ikebana, origami-introduction to hiragana- use of audio and drills for practice

UNIT V DRILLS AND PRACTICE 9

Vocobulary associated with directions-asking way-particles – e, de, mo, koko, soko, asoko, doko, nani, mae, ushiro, ue, shita- use of audio and drills for practice-introduction to katakana

TEXT BOOKS

1. Japanese Hiragana and Katakana for beginners, Timothy G. Stout, 2011
2. Genki I: An integrated course in elementary Japanese, Eri Banno and Yuko Ikeda, 2011

REFERENCE BOOKS

1. Japanese Reader collection Volume I, Yumi Boutwell and Clay Boutwell, Kotoba books, 2013
2. Living Language Japanese Complete Edition beginners through advanced course, Living Language, 2012

BKR 101	**KOREAN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Korean language, Korean culture and heritage
To impart knowledge on Korean lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Korean lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I PLANNING 9

Asking/giving reasons for studying Korean, making plans for the holiday, writing letters, describing past travel experiences and future travel plans, shopping in a grocery store, shopping in electronics store, storytelling Grammar: would like to (do), want to (do), construct future tense.

UNIT II MODIFIERS 9

Asking about feelings, asking about problems and giving advice, brief introductions - Grammar: Noun modifier, please try doing (something), irregular adjective/verb

UNIT III PLACING ORDERS 9

Asking about hobbies, asking about abilities (sports), job requirements, Ordering things for delivery, ordering a meal at a restaurant - Grammar: Sentence ending for the honorific form, please do something for me, have tried (something),

UNIT IV DESCRIPTIONS 9

Asking about evening plans, making plans with others, making preparations - Asking about rooms, describing your room to your classmates, describing your house. Grammar: to know/not know how to do something, must (do), have to (do), should,

UNIT V GRAMMAR 9

Describing your plans and giving reasons, cancelling appointments. Grammar: Shall we~? / Should we~?, with, and, irregular verbs/adjective, so, because, cannot, intend to, plan to, or hope to, (more) than, the most, tag question/is n't it? ,will (do)

COURSE MATERIAL:

Korean for Non-Native Speakers (Student Book 1B) Korean Language Education Center, Sogang University

BCN 101	**CHINESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Chinese language, Chinese culture and heritage

To impart knowledge on Chinese lifestyle and heritage.

COURSE OUTCOMES (COs)	
CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Chinese lifestyle
CO5	Will gain confidence to survive in a global environment

CO6	Will have attained to survive and adopt change in a foreign culture

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT 1 RISE OF DIALECTS 9

History, Origins, Old and middle Chinese, Rise of northern dialects

UNIT II VARIETIES 9

Influences 3 Varieties of Chinese. 1.Classification 2.Standard Chinese and 3.Nomenclature

UNIT III CHARACTERS 9

Chinese characters, Homophones, Phonology

UNIT IV TRANSCRIPTIONS 9

Tones, Phonetic transcriptions, Romanization, Other phonetic transcriptions

UNIT V GRAMMAR 9

Grammar and morphology, Vocabulary, Loanwords, Modern borrowings and loanwords

REFERENCES:

1. Hannas, William C. (1997), Asia's Orthographic Dilemma, University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-1892-0" 978-0-8248- 1892-0.
2. Qiu, Xigui (2000), Chinese Writing, trans. Gilbert Louis Mattos and Jerry Norman, Society for the Study of Early China and Institute of East Asian Studies, University of California, Berkeley, ISBN HYPERLINK http://en.wikipedia.org/wiki/Special:BookSources/978-1-55729-071-7,978-1-55729-071-7.
3. Ramsey, S. Robert (1987), The Languages of China, Princeton University Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-691-01468-5" 978-0-691-01468-5.
4. Schuessler, Axel (2007), ABC Etymological Dictionary of Old Chinese, Honolulu: University of

Hawaii Press, ISBNHYPERLINK
"http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-2975-9"978-0-8248-2975-9.
5. R. L. G. " Language borrowing Why so little Chinese in English?" The Economist. June 6, 2013.

BME 102	**ENGINEERING GRAPHICS - C**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – +2 Level Maths + Physical Science				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

- To develop graphical skills in students for communication of concepts, design ideas of engineering products, and expose them to existing standards related to technical drawings.
- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science

COURSE OUTCOMES (COs)

CO1	To visualize two dimensional graphic representation of three dimensional objects and buildings
CO2	To produce two dimensional graphic representation of three dimensional objects and buildings
CO3	To comprehend and visualize 3D views of objects.
CO4	To understand and generate the different curves used in engineering applications.
CO5	To learn and write program in "C".
CO6	**:** To introduce the fundamental of CAD Graphics used in design.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H											H
	CO2	M	H										M
	CO3			L									M
	CO4						L		H	H			L
	CO5			L						H			L
	CO6			L							H		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI BASIC CURVES, PROJECTION OF POINTS AND STRAIGHT LINES 9

Conics-construction of ellipse, parabola and hyperbola by eccentricity method-construction of involutes of square and circle-Drawing of tangent and normal to the above curves-Scales-Basic drawing conventions and standards- Orthographic projection principles-Principal planes-First angleprojection-Projectionofpoints.Projectionofstraightlines(only first angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method.

UNIT II PROJECTIONS OF PLANES AND SOLIDS 9

Projection of planes (Polygonal and circular surfaces) inclined to both the principal planes. Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method

UNIT III ORTHO GRAPHIC PROJECTIONS, ISOMETRIC PROJECTIONS & FREEHANDSKETCHING 9

Orthographic projection of Simple parts from 3Ddiagram-Principles of isometric projection and isometric view-isometric scale- Isometric projections of simple solids and truncated solids-Prisms, pyramids, cylinders, cones.

UNIT IV PROJECTIONOFSECTIONEDSOLIDS AND DEVELOPMENT OF SURFACES 9

Sectioning of solids in simple vertical position when the cutting lane is inclined to the one of the principal planes and perpendicular to the other-obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids-Prisms, pyramids cylinders and cones.

UNIT V PERSPECTIVE PROJECTION, BUILDING DRAWING AND COMPUTER AIDED DRAFTING 9

Perspective projection of cubes and cylinders by visual ray method .Introduction-components of simple residential or office building-specifications-plan and elevation of different types of Residential buildings and office buildings. Introduction to drafting packages and basic commands used in AUTO CAD. Demonstration of drafting packages.

TEXT BOOKS:

1. N.D.Bhatt and V.M.Panchal, "Engineering drawing", charotar publishing house, 50th edition,2010.
2. K.V.Natarajan "A Textbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai,2009.

REFERENCES:

1. K.R.Gopalakrishna, "Engineering drawing", (Vol-I&II combined) Subhas stores, Bangalore, 2007.
2. K.Venugopal and V.Prabhu Raja, "Engineering Graphics", New Age International Private limited, 2008.

3. Luzzader, Warren.J.,and Duff, John.M.,, "Fundamentals of Engineering Drawing with an introduction to Interactive computer graphics for design and production", Eastern economy edition, Prentice Hall of India Pvt Ltd, New Delhi,2005

BEE 101	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Engineering Mathematics, Engineering Physics-I & II				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To understand the laws of electrical engineering.

COURSE OUTCOMES (COs)

CO1	Students will gain knowledge regarding the various laws and principles associated with electrical systems.
CO2	Students will gain knowledge regarding electrical machines and apply them for practical problems.
CO3	Students will gain knowledge regarding various types semiconductors.
CO4	Student will gain knowledge digital electronics.
CO5	Student will gain knowledge on electronic systems.
CO6	Students will acquire knowledge in using the concepts in the field of electrical engg. projects and research.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L			
	CO2		H	M			L		L	L			
	CO3		H	M			L		L				
	CO4	M	H	M			L		L	L			
	CO5	M	H	M			L		L				
	CO6		H				L		L	H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ELECTRIC CIRCUITS 6

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem –Thevenin's and Norton's Theorem -Problems.

UNIT II ELECTRICAL MACHINES 6

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT III BASIC MEASUREMENT SYSTEMS 6

Introduction to Measurement Systems, Construction and Operating principles of PMMC, Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method – and Energy meter.

UNIT IV SEMICONDUCTOR DEVICES 6

Basic Concepts of semiconductor devices – PN Junction Diode Characteristics and its Applications – HWR, FWR –Zener Diode – BJT (CB, CE, CC) configuration & Characteristics.

UNIT V DIGITAL ELECTRONICS 6

Number system – Logic Gates – Boolean Algebra– De-**Morgan's Theorem –** Half Adder & Full Adder – Flip Flops.

TEXT BOOKS:

1. N.Mittal "Basic Electrical Engineering". Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
3. Jacob Millman and Christos C-Halkias, "Electronic Devices and Circuits", Tata McGraw Hill

REFERENCE BOOKS:

1. Edminister J.A. "Theory and Problems of Electric Circuits" Schaum's Outline Series. McGrawHill Book Compay, 2nd Edition, 1983.
2. Hyatt W.H and Kemmerlay J.E. "Engineering Circuit Analysis", McGraw Hill International Editions, 1993.
3. D. P. Kothari and I. J. Nagrath" Electric Machines"Tata McGraw-Hill Education, 2004
4. Millman and Halkias, "Integrated Electronics", Tata McGraw Hill Edition, 2004.

BCS 1L2	**COMPUTER PRACTICE LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	1
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Department of Computer Science &Engineering				
OBJECTIVES: To impart basic computer knowledge					
COURSE OUTCOMES (COs)					
CO1	Demonstrate major algorithms and data				
CO2	Implementation of array operations				
CO3	Implementation of binary tree.				
CO4	Implementation of linked list				

CO5	Students will able to do analyse data using spread sheet												
CO6	Student will able to understand the basics of C programming.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	H		H		L		H	H	H
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

A) WORD PROCESSING **6**

Document creation, Text manipulation with Scientific Notations. Table creation Table formatting and Conversion. Mail merge and Letter Preparation. Drawing-Flow Chart

B) SPREAD SHEET **9**

Chart-Line Xy Bar and Pie – Formula-Formula Editor-Spread sheet-Inclusion of Object, Picture and Graphics Protecting the document and sheet-Sorting and Import/Export features.

C) SIMPLE C PROGRAMMING* **15**

Data types, Expression Evaluation, Condition Statement. Arrays structures and Unions – Functions

D) SIMPLE C++PROGRAMMING **15**

-Classes and Objects

-Constructor and Destructor

***For Programming exercises Flow chart and Pseudo code are essential.**

BEE1L1	**BASIC ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Basic Electrical and Electronics Engineering				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To enhance the student with knowledge on electrical and electronic equipments.													
COURSE OUTCOMES (COs)													
CO1	Students will able to handle basic electrical equipments.												
CO2	Students will able to do staircase wiring.												
CO3	Students will able to understand domestic wiring procedures practically.												
CO4	Student will able to assemble electronic systems.												
CO5	Students will understand all the fundamental concepts involving electrical engineering												
CO6	Students will understand all the fundamental concepts involving electronics engineering												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	
	CO5	M	H	M			L		L		M	H	
	CO6		H				L		L	H		H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

I LIST OF EXPERIMENTS FOR ELECTRICAL ENGINEERING LAB

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

II LIST OF EXPERIMENTS FOR ELECTRONICS ENGINEERING LAB

1. Study of electronic components and equipments.
   a. Resistor colour coding using digital multi-meter.
   b. Assembling electronic components on bread board.
2. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

BPC 1L1/2L1	**PHYSICS AND CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				

OBJECTIVES: To impart knowledge to the students in practical physics and chemistry

COURSE OUTCOMES (COs)

CO1	Students will understand the concept of hall effect
CO2	Students will understand the concept of semiconductors. .
CO3	Student will understand the working of spectrometer.
CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method

9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS1L7/BSS2L7 YOGA FOREMPOWERMENT

L	T	P	C
0	1	2	1

OBJECTIVE:

Providing Value Education to improve the Students' character - understanding yogic life and physical health - maintaining youthfulness - Measure and method in five aspects of life

UNIT I PHYSICAL HEALTH 6

Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment.

Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.

Yogasanas 1: Pranamasana - Hastha Uttanasana - Pada Hasthasana - Aswa Sanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana.

Pranayama: Naddi suddi - Clearance Practice - Benefits.

Simplified Physical Exercise - Kayakalpa Practices - Meditation Practices.

UNIT II LIFE FORCE 6

Reasons for Diseases: Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)

Philosophy of Kaya kalpa: Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind.

Maintaining youthfulness: Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid - Measure and method in five aspects of life - Controlling undue Passion.
Kayakalpa practice: Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

UNIT III MENTAL HEALTH 6
Mental Frequencies: Beta, Apha, Theta and Delta wave - Agna Meditation explanation-benefits.
Shanti meditation: Shanthi Meditation explanation-benefits
Thuriya Meditation: Thuriya Meditation explanation-benefits
Benefits of Blessing: Self blessing(Auto suggestion) - Family blessing - Blessing the others - World blessing - Divineprotection

UNIT IV VALUES 6
Human Values: Self control - Self confidence - Honesty Contentment - Humility - Modesty Tolerance – Adjustment - Sacrifice - Forgiveness
Purity(Body,Dress,Environment) - Physicalpurity-Mentalpurity - Spiritual purity

Social Values :
Non violence - Service Patriotism - Equality
Respectforparentsandelders - careandprotection - Respectforteacher Punctuality - TimeManagement

UNIT V MORALITY (virtues) 6
Importance of Introspection: I - Mine (Ego, Possessiveness)
SixEvilTemperaments-Greed-Anger - Miserliness-Immoralsexualpassion - InferiorityandsuperiorityComplex - Vengeance
Maneuvering of Six Temperaments: Contentment - Tolerance - Charity - Chastity – Equality - Pardon (Forgiveness)
FiveessentialQualitiesacquiredthroughMeditation:Perspicacity – Magnanimity – Receptivity - Adaptability - Creativity(ImprovedMemoryPower)

Total periods: 30

REFERENCE BOOKS:

1. Yoga for modern age - ThathuvagnaniVethathiri Maharishi
2. Simplified Physical Exercises - ThathuvagnaniVethathiri Maharishi
3. Kayakalpam - Thathuvagnani VethathiriMaharishi
4. Thirukkural -Rev.Dr.G.U.pope
5. Mind-ThathuvagnaniVethathiriMaharishi
6. SoundHealththroughyoga-Dr.Chandrasekaran
7. Light on yoga -BKS.lyenger
8. உணவுமுறை – தத்துவஞானிவேதாத்திரிமகரிஷி

BEN 201	**ENGLISH II**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – English I				
	Course Designed by – Department of English				

OBJECTIVES	
Students will be able to actively participate in group discussions. Students will have Telephonic Skills, Giving Directions and Information Transfer	
COURSE OUTCOMES (COs)	
CO1	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)
CO2	To make students comprehend the habit of intelligent Reading as well as Computer- based competitive exams glob
CO3	To achieve a reasonably good level of competency in Report Writing.
CO4	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)
CO5	To achieve a reasonably good level of competency in group discussions
CO6	To achieve a reasonably good level of competency in public speaking

	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	M	L	H	L	M			H		M	L	
	CO2			H	L				H		M	L	
	CO3			H	L	M			H		H	L	
	CO4			H	L	M			H		M	L	
	CO5			H	L	M			H		M	L	
	CO6			H	L	M			H		M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ORIENTATION 12

Numerical adjectives - Meanings in context - Same words used as different parts of speech -Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II ORAL SKILL 12

Listening to audio cassettes - C.Ds , News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - and Giving Instructions - Reading Comprehension answering questions. Inferring meaning.

UNIT III THINKING SKILL 12

Self- introduction describing –Group Discussion – Debate –Role play- Telephone- Things- etiquette- Recommendation and Sequencing jumbled sentences to make a suggestions-paragraph-advertisement and notice, Designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV WRITING SKILL 12

Definitions - Compound nouns - Abbreviations and acronyms – (a) business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) Letters to the editor (giving suggestions on an issue) .

UNIT V FORMAL INFORMATION 12

Editing – Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

TEXT BOOK:

1. Meenakshi Raman, Sangeetha Sharma , Technical English for Communication: Principle and Practice, OUP, 2009.

REFERENCE BOOKS:

1. Sumanth , English for Engineers, Vijay Nicole , Imprints Pvt ltd.2013.
2. Meenakshi Raman and SangeethaSharma , Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binod M ishra , Communication skills for engineers and scientists , PHI Learning Pvt Ltd, New Delhi, 2010.

BMA 201	**MATHEMATICS – II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – Mathematics I				
	Course Designed by – Department of Mathematics				

OBJECTIVES

Ability to apply these principles of mathematics in projects and research works.

COURSE OUTCOMES (COs)

CO1	Student shall be able to Solve differential equations, simultaneous linear equations, and some special types of linear equations related to engineering.
CO2	Relate the use of mathematics in applications of various fields namely fluid flow, heat flow, solid mechanics, electrostatics, etc.
CO3	Ability to test hypothesis
CO4	Find intensity of degree of relationship between two variables and also bring out regression equations.
CO5	Understand to solve matrix problems related to real life problems.
CO6	Formulate mathematical models

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		L									
	CO2		H				H		L	L		M	
	CO3		H				H		L	L		M	
	CO4					M						M	

	CO5										M	M	
	CO6										M		
3	Category	Humanities & Social Studies		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
				√									
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I ORDINARY DIFFERENTIAL EQUATION 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters **– Cauchy's** and L**egendre's linear equations** - simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient, divergence and curl –Directional derivatives –Irrotational and solenoidal vector fields – vector integration**– Green's theorem in a plane , Gauss divergence theorem and** S**toke's theorem (**without proofs) **–** simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable **–** Analytic functions **–** Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) **–** Harmonic and orthogonal properties of analytic functions **–** Harmonic conjugate **–** construction of analytic functions **–** conformal mapping: W= Z+C, CZ, 1/Z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration **– Statement and application of Cauchy's integral theorem and Cauchy's integral formula –**Taylor and Laurent expansions **–** Singular points **–** Residues **–** Residue theorem **–** Application of Residue theorem to evaluate real integrals **–** Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V STATISTICS 12

Mean, Median, Mode **–** Moments **–**Skewness and Kurtosis **–** Correlation **–** Rank Correlation **–** Regression **–**Chi square test for contingency tables.

TEXT BOOK:

1. R.M.Kannan and B.Vijayakumar" Engineering Mathematics–II "2nd Edition, SRB Publication, Chennai 2007.
2. Bali.N.P and Manish Goyal , "Engineering Mathematics", 3rd Edition, Laxmi Publications (P) Lltd, 2008 .
3. Grewal .B/S "Higher Engineering Mathematics", 40th Editon, Khanna Publications, Delhi, 2007

REFERENCES :

1. Ramana.B.V, "Higher Engineering Mathematic", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Gupta SC, and VK.Kapoor, "Fundamentals Mathematical Statistics", 11th edition, Sultan Chand Sons, New Delhi, 2014.

BPH201	ENGINEERING PHYSICS -II	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING PHYSICS -I				
	Course Designed by – Department of Physics				

OBJECTIVES

- To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications
- To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

COURSE OUTCOMES (COs)

CO1	Understand about properties and advancements of conducting materials.
CO2	Understand the principle and properties semiconducting materials.
CO3	Acquire Knowledge on Magnetic and dielectric Materials.
CO4	To Know about the creation of new materials with novel properties
CO5	To Understand the impact of modern materials in technical uses.
CO6	Learn new engineering materials and its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L								
	CO5		L	L									
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications.

TEXT BOOKS:

1. Jayaraman D Engineering Physics II. Global Publishing House, 2014.
2. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
3. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

REFERENCES:

1.Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4 http://ocw.mit.edu/courses/find-by-topic
5 http://nptel.ac.in/course.php?disciplineId=122
6 https://en.wikipedia.org/wiki/Engineering_physics

BCH 201	**ENGINEERING CHEMISTRY-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING CHEMISTRY –I				
	Course Designed by – Department of Chemistry				
OBJECTIVES To impart a sound knowledge on the principles of chemistry involving application oriented topics required for all engineering branches.					
COURSE OUTCOMES (COs)					

CO1	Students will understand the concepts and further industrial applications of surface chemistry
CO2	To impart knowledge about the Industrial importance of Phase rule and alloys
CO3	To make the students to be conversant with Analytical techniques of chemistry and their importance
CO4	To have an idea and knowledge about the Chemistry of Fuels and
CO5	Understanding of engineering materials
CO6	All about bonding and molecular structures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L		H		H				M	
	CO2		H			H		H					
	CO3	H		L		H		H				M	
	CO4			L		H		H					
	CO5			L		H		H					
	CO6			L		H		H		H		M	

3	Category	Humanities & Social Studies	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I SURFACE CHEMISTRY 9

Introduction **:** Adsorption , absorption , desorption , adsorbent, adsorbate and sorption **–** (definition only) Differences between adsorption and absorption Adsorption of gases on solids **–** factors affecting adsorption of gases on solids **–** Adsorption isotherms **–**Frendlich adsorption isotherm and Langmuir adsorption isotherm Role of adsorbents in catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II PHASE RULE AND ALLOYS 9

Introduction **:**Statement of Phase Rule and explanation of terms involved **–** one component system **–** water system **–** Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) **–** eutectic temperature **–** eutectic composition **–** Pattinsons Process of desilverisation of Lead Alloys: Importance, ferrous alloys **–**nichrome and stainless steel **–** 18/8 stainless steel -heat treatment of steel **–** annealing **–** hardening **–** tempering normalizing **–** carburizing - nit riding . Non- ferrous alloys: Brass and Bronze

UNIT III ANALYTICAL TECHNIQUES 9

Introduction: Type of Spectroscopy - Atomic spectroscopy **–** molecular spectroscopy - Explanation IR spectroscopy **–** principles **–** instrumentation (block diagram only) **–** applications - finger print region UV-visible spectroscopy **—** principle **–** instrumentation (block diagram only) **–** Beer-**Lambert's law**- **–** estimation of iron by colorimetry**–** Atomic absorption spectroscopy- principle

- instrumentation (block diagram only) - estimation of Nickel by Atomic absorption spectroscopy Flame photometry– principles – instrumentation (block diagram only) - estimation of sodium ion by Flame photometry

UNIT IV FUELS 9

Introduction **:** Calorific value – types of Calorific value - gross calorific value – net calorific value Analysis of Coal –- Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only) Flue gas analysis – importance - Orsat apparatus

UNIT V ENGINEERING MATERIALS 9

Introduction: Refractory's – classification – acidic, basic and neutral refractory's – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Manufacture of Refractory's: alumina bricks and Magnesite bricks, Abrasives – natural and synthetic abrasives Natural type : Siliceous - quartz ; Non –siliceous – diamond Synthetic Abrasives : silicon carbide and boron carbide. Lubricants: Liquid lubricants - Properties – viscosity index, flash and fire points, cloud and pour points, oiliness, Solid lubricants – graphite and molybdenum sulphide

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand &Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub. Co.Ltd, New Delhi,(2008)
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Spectroscopy

BCS 202	INTERNET PROGRAMMING	L	T	P	C
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Dept of Information Technology				

OBJECTIVES

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science.

COURSE OUTCOMES (COs)

CO1	To enable the student to learn the major components of a computer system.

CO2	To know the correct way of solving problem.
CO3	To identify efficient way of solving problem.
CO4	To learn to use office automation tools.
CO5	To implement office automation tools
CO6	To learn and write program in "C".

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BASIC INTERNETCONCEPTS 6

Internet principles-IPaddressing-Internet Service Provider (ISP)-URL-Basic web concepts-World WideWeb (WWW)-Intranet and Extranet-Internet Protocols: HTTP, TCP, UDP, FTP, Telnet-Domain Name System(DNS)-E mail-Next generation internet.

UNITII WEBDESIGNBASICS 6

Introduction to HTML–Structureof HTMLDocument– Tags-Headings–Links–Images–Lists–Tables –Forms–Frames-Style sheets andits types.

UNITIII DYNAMIC HTML 6

Introduction to DynamicHTML-Object modeland collections-Event model-Filters and transition-Data binding-Data control-Activexcontrol.

UNITIV CLIENT ANDSERVERSIDEPROGRAMMING 6

VBScript&JavaScript:Introduction-Operators–Data type-Control structures-Looping–Classes andObjects–Arrays-Functions-Events-Exampleprograms.

UNITV INTERNETAPPLICATIONS 6

Onlinedatabase-functionsofonlinedatabase-MeritsandDemerits-InternetInformationSystems (IIS)-EDIapplications inbusiness and its types-Internet commerce-Types and Applications

.

TEXT BOOKS:

1. Deitel, Deitel and Nieto, ''Internet and World Wide Web- How to program'', Pearson Education Publishers, 5th edition, 2008.
2. Elliotte Rusty Harold, ''Java Network Programming'', O'Reilly Publishers, 2010
3. Java Script: A Beginners Guide John Pollock 4thEdition, TMH Edition (2013)
4. VB Script Beginners Guide, Jyoti B. Giramkar, Create Space Independent Publishing (2014)

REFERENCES:

1... Krishnamoorthy & S.Prabhu, ''Internet and Java Programming'', New Age International Publishers, 2010.
2. Thomno A.Powell, ''The Complete Reference HTML and XHTML'', fourth edition, Tata McGraw Hill, 2001
3. E Commerce Kamlesh K.Bajaj, DebjaniNag, Tata McGraw Hill, Second edition, 2010

BSS201	**PERSONALITY DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	1	1	0	2
	Prerequisite – +2 Level Knowledge				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To make students groom their personality and prove themselves as good Samaritans of the society.

COURSE OUTCOMES (COs)	
CO1	Individual or in-group class presentations pertaining to the applications of conce theories or issues in human development..
CO2	Scores obtained from essay and or objective tests.
CO3	Attendance, classroom participation, small group interactions.
CO4	Research and write about relevant topics.
CO5	Design and complete a research project that can take the form of a developme interview, an observation or assessment through service learning.
CO6	Develop and maintain a Reflection

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	L		H				M					
	CO2		H	H				M					
	CO3							M	H				
	CO4									H	H		
	CO5							M			H	H	
	CO6							M					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 6

The concept personality- Dimensions of theories of Freud & Erickson- personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analyses.

UNIT II ATTITUDE & MOTIVATION 6

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III SELF-ESTEEM 6

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV OTHER ASPECTS OF PERSONALITY DEVELOPMENT 6

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics –Good manners and etiquette.

UNIT V EMPLOYABILITY QUOTIENT 6

Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TEXT BOOKS:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition, Prentice Hall.

REFERENCE BOOKS:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003

4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

BBT202	**BIOLOGY FOR ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – Basic Science				
	Course Designed by – Department of Industrial Bio Technology				

OBJECTIVES

Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system**.**

COURSE OUTCOMES (COs)

CO1	Graduates within the first five years will be able to grasp and apply biological engineering principles, procedures needed to solve real-world problems.
CO2	To understand the fundamentals of living things, their classification, cell structure and biochemical constituents
CO3	To apply the concept of plant, animal and microbial systems and growth in real life situations
CO4	To comprehend genetics and the immune system
CO5	To know the cause, symptoms, diagnosis and treatment of common diseases
CO6	To give a basic knowledge of the applications of biological systems in relevant industries

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M					
	CO2		H							H			
	CO3			H							M		
	CO4										H		
	CO5												
	CO6						H						M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI INTRODUCTION TO LIFE 6

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell-Introduction to biomolecules: definition-general classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome.

UNIT II BIODIVERSITY 6

Plant System: basic concepts of plant growth-nutrition-photosynthesis and nitrogen fixation-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions-Microbial System: history-types of microbes-economic importance and control of microbes.

UNIT III GENETICS AND IMMUNE SYSTEM 6

Evolution: theories of evolution-**Mendel's** cell division–mitosis and meiosis-evidence of e **laws of inheritance**-variation and speciation- nucleic acids as a genetic material-central dogma immunity-antigens-antibody-immune response.

UNIT IV HUMAN DISEASES 6

Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis

UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION 6

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines-cloning-drug discovery-biological neural networks-bioremediation-biofertilizer-biocontrol-biofilters-biosensors-biopolymers-bioenergy-biomaterials-biochips-basic biomedical instrumentation.

TEXT BOOKS:

1. A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

REFERENCE BOOKS

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
3. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

BME201	BASIC MECHANICAL ENGINEERING	L	T	P	C
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

- The program educational objectives (PEOs) for the mechanical-engineering program are

to educate graduates who will be ethical, productive, and contributing members of society.

- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- The ability to apply principles of engineering, basic science, and mathematics to design and realize physical systems, components, or processes

COURSE OUTCOMES (COs)

CO1	an ability to apply knowledge of mathematics
CO2	an ability to apply knowledge of science, and engineering
CO3	Ability to design and conduct experiments, as well as to analyze and interpret data.
CO4	an ability to function on multi-disciplinary teams
CO5	ToprovidebasicKnowledgeofbasicmanufacturingprocess.
CO6	ability to identify, formulate, and solve engineering problems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I ENERGY RESOURCESANDPOWER GENERATION 6

RenewableandNon-renewableresources-solar,wind,geothermal,steam,nuclearandhidepowerplants-Layout,
majorcomponentsandworking.ImportanceofEnergystorage,Environmentalconstraintsofpowergeneration usingfossil fuelsandnuclearenergy.

UNIT II IC ENGINES 6

Classification,workingprinciplesof petrol anddiesel engines-twostroke andfourstroke cycles,functionsofmain componentsofI.Cengine.Alternatefuelsandemissioncontrol.

UNIT III REFRIGERATION AND AIR-CONDITIONINGSYSTEM 6

Terminologyof Refrigerationand Air-Conditioning,PrincipleofVaporCompression& Absorptionsystem- Layoutoftypicaldomesticrefrigerator-window&Splittyperoomairconditioner.

UNITIV MANUFACTURING PROCESSES 6

BriefdescriptionofMouldmakesandcastingprocess,Metalforming,Classification typesofforging, forging operations, Briefdescription ofextrusion,rolling,sheetforging,anddrawing.Briefdescription ofwelding,brazing andsoldering.Principalmetalcuttingprocessesandcuttingtools,Brief descriptionofCentrelatheandradial drillingmachine.

UNITV MECHANICALDESIGN 6

Mechanicalpropertiesofmaterial-Yieldstrength,ultimatestrength,endurancelimitetc.,Stress-Strain curvesof materials.Stresses inducedinsimpleelements.Factorofsafety-Design ofShaftsandbelts. Typesofbearingsand itsapplications.Introductionto CAD/CAM/CIM&Mechatronics.

TEXTBOOKS:

1. T.J.Prabhuetal, "BasicMechanicalEngineering", SciTechPublications(p)Ltd,2000

REFERENCES:

1. NAGPAL,G.R,"PowerplantEngineering",KhannaPublishers,2004.
2. RAO.P.N,"ManufacturingTechnology",TataMcGraw-HillEducation,2000.
3. Kalpakjian,"ManufacturingEngineeringandTechnology",AdissoWesleypublishers,1995.
4. Ganesan.V,"Internalcombustionengines",TataMcGraw-HillEducation,2000.
5. C.P.Arora,"RefrigerationandAir Conditioning",TataMcGraw-HillEducation,2001.
6. V.B.Bhandari,"DesignofMachineelements",TataMcGraw-HillEducation,2010.

BCE 201	**BASIC CIVIL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Civil Engineering				

OBJECTIVES: Understand the basic concepts of civil engineering.

COURSE OUTCOMES (COs)

CO1	Will gain knowledge in Design, concept preparation
CO2	Loading calculation
CO3	Structural component design
CO4	Drawing and chart preparation
CO5	Will understand the components of buildings.
CO6	Will learn the engineering aspects to dams , water supply and sewage disposal.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	*COs/POs*	*a*	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*	*l*
2	CO1	H	H			H		L					
	CO2					H	H						
	CO3							H	L				

	CO4									L			
	CO5										H	L	
	CO6												
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I CIVIL ENGINEERING MATERIALS 8

Introduction – Civil Engineering – Materials – Stones – Bricks – Sand – Cement – Plain Concrete – Reinforced Cement Concrete – Steel Sections – Timber – Plywood – Paints – Varnishes (simple examples only)

UNIT II SURVEYING 5

Surveying – objectives – classification – principles of survey-Measurement of distances – Chain survey – Determination of areas – Use of compass – Use of leveling Instrument – (simple examples only)

UNIT III FOUNDATION FOR BUILDING 5

Bearing Capacity of Soil – Foundation – Functions – Requirement of good foundations – Types of foundations – Merits & Demerits.

UNIT IV SUPERSTRUCTURE 7

Stone Masonry – Brick Masonry – Columns – Lintels – Beams – Roofing – Flooring – Plastering– White Washing (Simple examples only)

UNIT V MISCELLANEOUS TOPICS 5

Types of Bridges –Dam- purpose – selection of site - Types of Dams – Water Treatment & Supply sources – standards of drinking- distribution system. – Sewage Treatment (simple examples only)

TEXT BOOKS:

1. Raju.K.V.B, Ravichandran .P.T, "Basics of Civil Engineering", Ayyappa Publications, Chennai, 2012.
2. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, (1st ed. 2005).
3. Dr.M.S.Palanisamy, "Basic Civil Engineering" (3rded. 2000), TUG Publishers, New Delhi/Tata McGrawHill Publication Co., New Delhi

REFERENCE BOOKS:

1. Rangwala.S.C, "Engineering Materials", Charotar Publishing House, Anand, 41st Edition: 2014.
2. National Building Code of India, Part V, "Building Materials", 2005
3. Ramesh Babu"A Textbook on Basic Civil Engineering" (1998). Anuradha Agencies,

Kumbakonam.
4. RamamruthamS., “Basic Civil Engineering”, DhanpatRai Publishing Co. (P) Ltd. (1999).

BCS2L1	INTERNET PRACTICES LABORATORY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Internet Programming				
	Course Designed by – Dept of Information Technology				

OBJECTIVES

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying con science.

COURSE OUTCOMES (COs)

CO1	To enable the student to learn the major components of a computer system.
CO2	To know the correct and efficient way of solving problem.
CO3	To identify and implement the correct and efficient way of solving problem.
CO4	To learn to use office automation tools.
CO5	To infer from use office automation tools.
CO6	To learn and write program in “C”.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. HTML (Hypertext Mark-up Language):

Basics of HTML.

How to create HTML Document
Steps for creating a simple HTML Program.
a) Favorite Personality
b) Resume Preparation

2. ADVANCED HTML: Advanced Topics of HTML
a) Time Table
b) Table Creation

3. JAVASCRIPT:
Script Basics.
Incorporating JavaScript into Web page.
a) Star Triangle
b) Temperature Converters
Script Basics.
Incorporating JavaScript into Web page.
a) Star Triangle
b) Temperature Converters

4. VBSCRIPT:
VBScript Basics.
Incorporating VBScript into HTML.
a) Changing Background Color
b) Simple Calculator

5. WEB DESIGN:
Inserting External Media in the Web Page.
a) Forms and Links
b) Frames with Links and Lists
To export a Dream weaver Document as XML File, checking entries, working in frames, windows control, the java script URL.

BCM1L1	**BASIC CIVIL & MECHANICALENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Department of Mechanical Engineering& Civil Engineering				

OBJECTIVES
To provide exposure to the students with hands on experience on various basic Civil & Mechanical Engineering practices.

COURSE OUTCOMES (COs)

CO1	Learn Basic concepts
CO2	Students will get exposure regarding pipe connection for pumps & turbines and to study the joint used in roofs, doors, windows and furniture's.
CO3	Students will get exposure regarding smithy, foundry operations and in latest welding operations such as TIG, MIG, CO2, spot welding etc.,
CO4	Students will get hands on experience on basic welding techniques, machining and sheet metal works.
CO5	Students will get hands on experience on basic machining techniques

CO6	Students will get hands on experience on basic sheet metal techniques

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H	L										
	CO2				H								
	CO3					H	L	L					
	CO4		H				M		L			H	
	CO5		H				M		L			H	
	CO6		H				M		L			H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

I. CIVILENGINEERINGPRACTICE

Buildings:

a) Studyofplumbingandcarpentrycomponentsofresidentialandindustrialbuildings.Safetyaspects.

PlumbingWorks:

a) Studyofpipelinejoints,itslocationandfunctions:valves,taps,couplings,unions,reducers,elbowsin householdfittings.

b) Studyofpipeconnectionsrequirementsforpumpsandturbines.

c) Preparationofplumbinglinesketchesforwatersupplyandsewageworks.

d) Hands-on-exercise:Basicpipeconnection ofPVCpipes&G.I.Pipes–Mixedpipematerialconnection–Pipe connectionswithdifferentjoiningcomponents.

e) Demonstrationofplumbingrequirementsofhigh-risebuildings.

CarpentryusingHandtoolsandPowertools:

a) Studyofthejointsinroofs,doors,windowsandfurniture.

b) Hands-on-exercise: Woodwork,jointsbysawing,planningandcutting.

c) Preparationofhalfjoints,MortiseandTenonjoints.

II MECHANICALENGINEERINGPRACTICE

Welding:

a) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

BasicMachining:

a) Simple Turning and Taper turning

b) Drilling Practice

SheetMetalWork:

a) Forming&Bending:

b) Modelmaking–Trays,funnels, etc.
c) Differenttypeofjoints
d) Preparationofair-conditioningducts
e) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

Machineassemblypractice:

a) Assembling,dismantlingand Studyofcentrifugalpump
b) Assembling,dismantlingand Studyofairconditioner
c) Assembling,dismantlingandStudyoflathe

Moulding:

a) Mouldingoperationslikemouldpreparationfor gearandstepconepulleyetc

Fitting:

a) Fitting Exercises–Preparationofsquarefittingandvee–fittingmodels.

Demonstration:

a) Smithyoperations,upsetting,swaging,settingdownandbending.Example–Exercise–Productionofhexagonalheaded bolt.
b) Gaswelding.

REFERENCES:

1. K. Jeyachandran, S. Nararajan& S, Balasubramanian, "A Primer on Engineering Practices Laboratory" ,Anuradha Publications, (2007).
2. T.Jeyapoovan, M. Saravanapandian& S. Pranitha, "Engineering Practices Lab Manual",Vikas Publishing House Pvt. Ltd. (2006)
3. H. S. Bawa, "Workshop Practice", Tata McGraw–Hill Publishing Company Limited, (2007).
4. A. Rajendra Prasad & P. M. M. S Sarma, "Workshop Practice", Sree Sai Publication, (2002).
5. P. Kannaiah& K.L. Narayana, "Manual on Workshop Practice", Sci tech Publication, (1999).

	PHYSICS AND CHEMISTRY LABORATORY	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
BPC 1L1/2L1	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				

OBJECTIVES: To impart knowledge to the students in practical physics and chemistry

COURSE OUTCOMES (COs)

CO1	Students will understand the concept of hall effect
CO2	Students will understand the concept of semiconductors. .
CO3	Student will understand the working of spectrometer.
CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	F	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS 1L5 / 2L5 NSS PRACTICAL L T P C

0 1 2 1

OBJECTIVES

1. Understand the community in which they work and their relation
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop capacity to meet emergencies and natural disasters
4. Practice national integration and social harmony and
5. Utilize their knowledge in finding practical solutions to individual and community problems.

1. Regular Activities Programme

1) Traffic regulation
2) Working with Police Commissioner's Office
3) Working with Corporation of Chennai
4) Working with Health Department
5) Blind assistance
6) Garments collection
7) Non-formal education
8) Environmental Education, Awareness and Training (EEAT)
9) Blood donation

2.Special camp Programme

A) Legal awareness
B) Health awareness
C) First-aid
D) Career guidance
E) Leadership training - cum - Cultural Programme
F) Globalization and its Economic Social Political and Cultural impacts.

REFERENCE BOOKS:

1. National Service Scheme Manual, Government of India.
2. Training Programme on National Programme scheme, TISS.
3. Orientation Courses for N.S.S. Programme officers, TISS.
4. Case material as Training Aid for field workers, Gurmeet Hans.
5. Social service opportunities in Hospitals, Kapil K.Krishan,TISS.
6. Social Problems in India, Ram Ahuja.

BMA301	MATHEMATICS – III	L	T	P	C
	Total Contact Hours - 75	**4**	**0**	**0**	**4**
	Prerequisite – Mathematics II				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To introduce Fourier series analysis this is central to many applications in engineering apart from its use in solving boundary value problems.
2. To acquaint the student with Fourier transform techniques used in wide variety of situations.
3. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes

4. To develop Z transform techniques for discrete time systems.	
COURSE OUTCOMES (COs)	
CO1	To learn the problem solving methods in linear differential equations
CO2	To learn Dirichlet's condition and operations using Fourier series
CO3	To have a clear understanding about 2nd order equations and wave equations
CO4	Properties of Laplace transform and problem solving using it
CO5	Properties of Fourier transform and problem solving using it

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M											
	CO2		M	H		H							
	CO3		M		H								
	CO4	H			M								
	CO5	H			M	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core	Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT 1 PARTIAL DIFFERENTIAL EQUATIONS 9+6

Formation – Solution of Standard types of first order equations – Lagrange's equation – Linear partial differential equations of second and higher order with constant coefficients

UNIT II FOURIER SERIES 9+6

Dirichlet's conditions – General Fourier series- Half range sine and cosine series – Parse Val's identity – Harmonic analysis

UNIT III BOUNDARY VALUE PROBLEMS 9+6

Classification of second order linear partial differential equations – solution of one – dimensional wave equations, one dimensional heat equations.

UNIT IV LAPLACE TRANSFORMS 9+6

Transforms of simple functions – basic operational properties – transforms of derivatives and integrals – initial and final value theorems – inverse transforms – convolution theorem – periodic functions – applications of Laplace transforms for solving linear ordinary differential equation up to second order with constant coefficients and simultaneous equations of first order with constant coefficients.

UNIT V FOURIER TRANSFORMS 9+6

Statement of Fourier integral theorem – Fourier transform pairs – Fourier sine and cosine transforms – properties – transforms of simple functions – convolution theorem – Parse Val's identity

TEXT BOOKS:

1. Kandasamy, P., Thilakavathy, K. and Gunavathy.K. "Engineering Mathematics ", Vol II& III (4^{th} revised edition) S Chand and co. , New Delhi, 2001.
2. Narayanan.S , Manicavachangam pillay ,.T.K., Ramanaiah, G. " Advanced Mathematicsfor Engineering Students ", Vol II & III (2^{nd} Edition), S.Viswanathan (Printers and Publishers Pvt Ltd) 1992.
3. Venkatraman, M.K. " Engineering Mathematics" Vol III – A&B , 13^{th}Edition National Publishing Company , Chennai 2002

BCS301	DATA STRUCTURES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisites –Fundamental of Computing and Programming.				
	Course Designed by – Dept. of Computer Science & Engineering				

OBJECTIVES

This course demonstrates familiarity with major algorithms and data structures and analyzes performance of algorithms. It is used to choose the appropriate data structure and algorithm design method for a specified application and determine which algorithm or data structure to use in different scenarios.

COURSE OUTCOMES (COs)

CO1	Explain the basic data structures and its operations.
CO2	Explain the concept of time complexity and space complexity.
CO3	Identify an appropriate data structure for a problem.
CO4	Make use of basic data structures to solve problems.
CO5	Summarize various searching and sorting algorithms.
CO6	Explain the concept of various data representation.

UNIT- I INTRODUCTION 9

Data objects and structures- The linear list data structure-Array Representation- Vector Representation – Performance analysis- Space complexity – Time complexity.

UNIT- II DATA REPRESENTATION 9

Singly linked list– Circular lists- Doubly liked list – Stacks – Abstract Data Type – Array Representation – Linked representation – Queues.

UNIT- III BINARY AND OTHER TREES 9

Trees – Binary trees – Properties of binary trees – Representation of binary trees – Binary tree traversal – Priority queues- Linear lists – Heap – Binary search tree- Binary search tree implementations –AVL trees -Graph – Graph search Methods.

UNIT- IV THE GREEDY METHOD 9

Optimization problems – Greedy method – Applications – Divide and conquer - The method – Applications – Lower bounds on complexity.

UNIT- V DYNAMIC PROGRAMMING 9

The method – Applications – Backtracking - The method – Applications – Branch and bound - The method – Applications.

TEXT BOOK:

1. SartajSahni, "Data Structures, Algorithms and Applications in C++", Second Edition, Universities Press.2005.

REFERENCES:

1. Horowitz, Sahni, Mehta, "Fundamentals of Data Structures in C++", 2nd Edition, Universities Press, 2007.
2. A.V.Aho, Hopcroft, Ullman, "Data Structures & Algorithms", Pearson Education, 2005.
3. http://lib.mdp.ac.id/ebook/Karya%20Umum/Dsa.pdf

BCS302	SYSTEM MODELLING AND SIMULATION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Engineering Mathematics I, II and III, Fundamental of Computing and Programming.				
	Course Designed by – Dept. of Computer Science & Engineering				

OBJECTIVES

The overall aim of the course is to provide an understanding of Methods, techniques and tools for modeling, simulation and performance analysis of complex systems such as communication and computer networks.

COURSE OUTCOMES (COs)

CO1	Define basic concepts in modeling and simulation (M&S)
CO2	Classify various simulation models and give practical examples for each category
CO3	Construct a model for a given set of data and motivate its validity
CO4	Generate and test random number varieties and apply them to develop simulation models.
CO5	Analyze output data produced by a model and test validity of the model.
CO6	Explain the concept of output analysis of single model.

UNIT I INTRODUCTION TO SIMULATION 9

Advantages and disadvantages of simulation, areas of application, System environment, Components of a system. Discrete and continuous systems, model of a system. Types of models. Steps in a simulation study, simulation examples: simulation of queuing systems, simulation of inventory systems. Discrete event simulation, general principles and computer simulation languages. FORTRAN, SIMSCRIPT, GPSS.

UNIT-II STATISTICAL MODELS IN SIMULATION 9

Review of terminology and concepts. Useful statistical models, discrete distributions, continuous distributions. Poisson process, Empirical distributions, Queuing models: Characteristics of queuing systems, queuing notations. Transient and steady state behaviour of

queues, steady-state behaviour of infinite population, Markovan models, Steady state behaviour of finite population models.

UNIT-III INVENTORY SYSTEMS 9

Measures of effectiveness, inventory policies, deterministic systems probabilistic systems, simulation in inventory analysis.Random number generation.Properties of random numbers.Generation of pseudo-random numbers.Tests for random numbers. Random variate generation: Inverse transform technique, Direct transform for the normal distribution, convolution method. Acceptance-Rejection technique.

UNIT-IV INPUT DATA ANALYSIS 9

Data Collection, Identifying the distribution, Parameter estimation, Goodness-of-fit tests, Verification and validation of simulation models: Models Building, calibration and validation of models.

UNIT-V OUTPUT ANALYSIS FOR A SINGLE MODEL 9

Stochastic nature of 0/1 data, types of simulations with respect to O/P analysis, Measures of performance and their estimation, O/P analysis for terminating simulations, O/P analysis for steady-state simulations.

TEXT BOOKS

1.Jerry Banks, Carson. J.S., and Nelson B.L., "Discrete Event System Simulation", Prentice Hall of India, New Delhi, 2006.

2.Karian, Z. A., Dudewicz, E. J. (112121), "Modern statistical systems, and GPSS simulation: the first course", W. H. Freeman and Company, New York, 2005.

REFERENCES

1. System Modelling and Simulation, V.P.Singh, New Age International Publishers,2009.

2.https://shamsulsarip.files.wordpress.com/2015/07/system-modelling-and-simulation.pdf

BCS303	**COMPUTER ORGANIZATION AND ARCHITECTURE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Fundamental of Computing and Programming.				
	Course Designed by – Dept. of Computer Science & Engineering				

OBJECTIVES

To have a thorough understanding of the basic structure and operation of a digital computer. To discuss in detail the operation of the arithmetic unit including the algorithms & implementation of fixed-point and floating-point addition, subtraction, multiplication & division.

COURSE OUTCOMES (COs)

CO1	Explain the organization and working principle of computer hardware components.
CO2	Explain the hierarchical memory system and data transfer with in a digital computer.
CO3	Outline the operation of arithmetic unit.
CO4	Summarize the execution sequence of an instruction through the processor
CO5	Explain the ways of communication between a processor and I/O devices.
CO6	Explain the concept of Parallel Architecture.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
CO1	M	H	H	H	M	M		M			M	H
CO2			H		H	M						
CO3	M				H							
CO4		H	M	M				M				
CO5	L		H		H	M					M	M
CO6			M	M	H	L		L			M	H
Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
						√						
Approval	37th Meeting of Academic Council, May 2015											

UNIT-I ARCHITECTURE FUNDAMENTALS 9

Functional units – CPU Registers–CPU Organization-Different Types of Memory-Memory Hierarchy- Memory operations –Instruction Format – Addressing modes – Basic I/O operations-Evaluating CPU Performance.

UNIT-II CPU ARCHITECTURE 9

Instruction sets of different machines –Parallel Processing- Flynn's Classification- Pipelining-Arithmetic Pipeline-Instruction Pipeline- -Pipelining Hazards- CISC Vs RISC - Super Scalar Architecture.

UNIT-III MEMORY SYSTEM 9

Basic concepts – Semiconductor RAMs – ROMs – Speed – size and cost –Cache Memory-Mapping Techniques-Virtual memory-Evaluating Memory Performance-Secondary Storage-Multiprocessor.

UNIT-IV I/O ORGANIZATION 9

Input-Output, Interface-I/O Performance Measures-I/O Modes of Transfer-Direct Memory Access-Input Output Processor-Interfacing to different types of I/O devices.

UNIT-V PARALLEL ARCHITECTURE 9

Data flow –Static Dataflow-Dynamic Dataflow-Dataflow Graph-Vector Processors – CRAY-1 Vector Processor-EPIC.

TEXT BOOKS:

1.David A. Patterson and John L. Hennessy, "Computer Architecture-A Quantitative Approach", Elsevier, a division of reed India Private Limited, 5thedition, 2012

2. M. Mano, "Computer System Architecture", Third Edition, Pearson Education,2008.

REFERENCE BOOKS:

1. Carl Hamacher, ZvonkoVranesic, SafwatZaky, “Computer Organization”,McGraw-Hill, 5th Edition, Reprint 2012.
2. Ghosh T. K., “Computer Organization and Architecture”, Tata McGraw-Hill,3rd Edition, 2011
3. John P. Hayes, “Computer Architecture and Organization”, Tata McGraw Hill,3rd Edition, 1998
4. BehroozParahami, “Computer Architecture”, Oxford University Press, 8th Impression, 2011.
5. http://www.ece.umd.edu/~manoj/350/notes/book.pdf

BCS304	DIGITAL COMPUTER FUNDAMENTALS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Mathematics-I, Mathematics -II, Fundamental of Computing and Programming.				
	Course Designed by – Dept. of Computer Science & Engineering				

OBJECTIVES

- To get a basic understanding of how circuits and systems are designed with digital electronic circuit elements.
- To be able to analyze and design circuits and systems made from digital electronic circuit elements such as gates and flip-flops.
- To master basic design and programming of simple computers.

COURSE OUTCOMES (COs)

CO1	Perform arithmetic operations in any number system.
CO2	Understand the hierarchical memory system and data transfer with in a digital computer.
CO3	Use Boolean simplification techniques to design a combinational hardware circuit.
CO4	Understand the concept of number system.
CO5	Learn the various gates like AND, OR, NOT, XOR.
CO6	Learn the concept of synchronous and asynchronous sequential circuits.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	M	M	M	H	H	M		M	H
	CO2	M	H	M	H						M		
	CO3	M		H	H	H	L	H	M			M	M
	CO4	H	M							M	M	H	M
	CO5	H		H	M		H	M	M			M	
	CO6	M	H	M		M				L	L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT-I NUMBER SYSTEMS AND CODES 9

Review of binary, octal and Hexa decimal representations of numbers and their conversion, Binary arithmetic; conversion algorithms.Weighted binary codes.Non weighted binary codes error-detecting and error-correcting codes-Alphanumeric codes.

UNIT-II BOOLEAN ALGEBRA 9

Introduction to Boolean algebra- The AND, OR and not operations. Laws of Boolean algebra.of Boolean expressions. Boolean expressions and logic diagrams.Universal building blocks.Negative logic.

UNIT-III COMBINATIONAL LOGIC 9

Truth tables and maps.Sum of products and product of sums; Map reduction hybrid functions.Incompletely specified functions.Multiple- Output minimization. Variable- Entered maps. Tabular minimization.analysis of logic schematics.Synthesis of combinational functions.

UNIT-III LOGIC FUNCTION RELIZATION WITH MSI CIRCUITS 9

Multiplexers, De-multiplexers,Decoders and code converters. Arithmetic circuits, Adder, Number complements. Subtracting positive binary numbers with adders.Signed number addition and subtraction.

UNIT-IV SYNCHORONOUS SEQUENTIAL CIRCUITS 9

Basic latch circuits, De-bouncing switch. Flip-flops, truth table and excitation table. Shift registers. Asynchronous and synchronous counters. Shift counters.

UNIT-V ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Analysis and Design of Asynchronous Sequential Circuits , Reduction of State and Flow Tables ,Race-free State Assignment, Hazards.

TEXT BOOKS:

1. T. L Floyd & Jain, "Digital fundamentals", Pearson Education,3rd edition,2011.
2. Morris Mano M., "Digital Logic and Computer Design", Pearson Education,2010.

REFERENCE BOOKS:

1. Heiser Man, "Digital IC applications", Pearson Education,2007.
2. Raj Kamal, "Digital Systems Principles and Design", Pearson Education, First Edition, 2007.
3.CharlesH.Roth, Jr. and Larry L. Kinney, "Fundamentals of Logic Design", CL Engineering, 7th Edition, 2013.
4.WilliamH.Gothmann, "Digital electronics: an introduction to theory and practice",Prentice-Hall,2006 .
5. http://www.b-u.ac.in/sde_book/digi_com.pdf

BEC305	ELECTRONICS CIRCUITS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Electrical and Electronics Engineering.				

	Course Designed by – Dept. of Electronics and Communication Engineering

OBJECTIVES

An understanding of basic EE abstractions on which analysis and design of electrical and electronic circuits and systems are based, including lumped circuit, digital and operational amplifier abstractions.

COURSE OUTCOMES (COs)

CO1	Learn how to develop and employ circuit models for elementary electronic components, e.g., resistors, sources, inductors, capacitors, diodes and transistor.
CO2	Become adept at using various Methods of circuit analysis, including simplified Methods.
CO3	Learn series-parallel reductions, voltage and current dividers, and the node method
CO4	An ability to formulate and solve the differential equations describing time behavior of circuits containing energy storage elements.
CO5	Explain the various gates like AND, OR, NOT, XOR.
CO6	Explain the concept of capability to use abstractions to analyze and design simple electronic circuits.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		H	M	M	M	M	M	L	H	M
	CO2	H	H	M	H	H	M				M		H
	CO3	H	M		H				M				
	CO4	H	H	M				H	L	M	M	M	M
	CO5	H	H		H	H	M						
	CO6	H	M		H	H	M	M	M	M	L	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT- I INTRODUCTION 9

Electronic Devices-Semi conductor- PN junction diode -BJT-FET IC fabrication.

UNIT- II AMPLIFIER CIRCUITS AND SYSTEMS 9

Basic amplifier stages of Low frequencies - Frequency response of amplifiers-Concept of feedback-Properties of negative feedback amplifiers.

UNIT- III OPERATIONAL AMPLIFIER 9

Architecture and characteristics - Parameters-Basic Operational amplifier applications- BIFET - BIMOS and MOS operational amplifier.

UNIT- IV WAVE FORM GENERATOR AND WAVE SHAPING 9

Sinusoidal Oscillators-Crystal Oscillators - Multivibrators - Comparators-Schmitt Trigger-square wave and triangular wave generation-Pulse generation-555 IC timer-Modulation of a square wave-Series regulator- Monolithic Voltage regulator.

UNIT –V SIGNAL CONDITIONING AND DATA CONVERSION 9

Signals and signal processing-Sample and Hold systems-Analog MUX and DEMUX-D/A converter-A/D converters-Integrator and Differentiator-Electronic Analog computations-Active RC filter- Butterworth and Chebyschev filter-Analog multiplier.

TEXT BOOKS:

1. Milman and Halkias, "Integrated Electronics", McGraw Hill, 2010.
2. Electronic Devices and Circuits by Anil K.Maini,VarshaAgarwal,Wiley Publications,2009
3. Allen Mottershed, "Electronic Devices and Circuits ", Prentice-Hall of India,1996.

REFERENCES:

1. Electronic Fundamentals: Circuits,Devices and its Application by Thomas L.Floyd,United states Edition,2006.
2. http://www-mdp.eng.cam.ac.uk/web/library/enginfo/electrical/hong1.pdf

BCS3L1	**DATASTRUCTURES USING C LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	3	2
	Prerequisite –Fundamental of Computing and Programming, Data Structures, C Programming.				
	Lab Manual Prepared by – Dept. of Computer Science & Engineering				

OBJECTIVES

This course demonstrates familiarity with major algorithms and data structures and analyzes performance of algorithms. It is used to choose the appropriate data structure and algorithm design method for a specified application and determine which algorithm or data structure to use in different scenarios.

COURSE OUTCOMES (COs)

CO1	Implement various basic data structures and its operations.
CO2	Implement various sorting and searching algorithms.
CO3	Implement various tree operations.
CO4	Implement various graphs algorithms.
CO5	Develop simple applications using various data structures.
CO6	Develop algorithms using various searching and sorting techniques.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M		H	L	L	M
	CO2	H	M	M	H	H		M	M		L	L	M
	CO3				H	H				M			
	CO4	H				M							L
	CO5		M	M	H	H		M	H		L	L	M
	CO6	H			H	H		M	M	H	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS:

1. Simple Cprograms -Control Structures -Functions - Aggregate data types-File handling
2. Implementation of-Lists, Stacks, Queues (Using Arrays, linked lists)-Trees - Searching and Sorting algorithms

BEC3L2	**ELECTRONICS CIRCUITS LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic Electrical and Electronics Engineering Lab.				
	Lab Manual Designed by – Dept. of Electronics and Communication Engineering				

OBJECTIVES

An understanding of basic EE abstractions on which analysis and design of electrical and electronic circuits and systems are based, including lumped circuit, digital and operational amplifier abstractions.

COURSE OUTCOMES (COs)

CO1	Learn how to develop and employ circuit models for elementary electronic components, e.g., resistors, sources, inductors, capacitors, diodes and transistor.
CO2	Become adept at using various Methods of circuit analysis, including simplified Methods.
CO3	Learn series-parallel reductions, voltage and current dividers, and the node method
CO4	An ability to formulate and solve the differential equations describing time behavior of circuits containing energy storage elements.
CO5	Explain the various gates like AND, OR, NOT, XOR.
CO6	Explain the concept of capability to use abstractions to analyze and design simple electronic circuits.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		H	M	M	M	M	M	L	H	M
	CO2	M	H	M	H	H	M				M		H
	CO3		M		H				M				
	CO4	H	H	M				H	L	M	M	M	M
	CO5		H		H	H	M						
	CO6	M	M		H	H	M	M	M	M	L	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS:

1.Verification of Boolean Theorems-Implementation of Boolean Function - Adders/ Subtractors- Decoders -Encoders - Multiplexers -Demultiplexers - Comparators - Parity Checker/ Generator.
2. Registers - Counters - Shift Registers - General purpose shift registers - Data transmission.
3. Project - A mini project involving clocked sequential networks design.

BCS3L2	**OBJECT ORIENTED PROGRAMMING LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	3	2
	Prerequisite –Fundamental of Computing and Programming, Object Oriented Programming using C++,C.				
	Lab Manual Prepared by – Dept. of Computer Science & Engineering				

OBJECTIVES: This lab manual demonstrates familiarity with various concepts of OOPS.

COURSE OUTCOMES (COs)

CO1	Demonstrate class object concepts by using C++.
CO2	Develop programs using inheritance and polymorphism.
CO3	Demonstrate the significance of constructors and destructor.
CO4	Implement function and operator overloading using C++.
CO5	Construct generic classes using template concepts.
CO6	Implement the concept of file handling.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	H		H	M	M	M	H	H	H	H
	CO2									M			
	CO3		H	H	M	M		H		H		H	H
	CO4	M					L		M		M		
	CO5			M		H		M		M		M	M
	CO6	L	M	M		M	M		L	M	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS:

1. Programs Using Functions
- Functions with default arguments
- Implementation of Call by Value, Call by Address and Call by Reference
2. Simple Classes for understanding objects, member functions and Constructors
- Classes with primitive data members
- Classes with arrays as data members
- Classes with pointers as data members – String Class
- Classes with constant data members, Classes with static member functions
3. Compile time Polymorphism
- Operator Overloading including Unary and Binary Operators, Function Overloading
4. Runtime Polymorphism
- Inheritance ,Virtual functions
- Virtual Base Classes, Templates
- File Handling-Sequential access, Random access.

BMA402	**NUMERICAL METHODS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 75	3	2	0	4
	Prerequisite – Engineering Mathematics-I, Engineering Mathematics –II, Engineering Mathematics-III				
	Course Designed by – Dept. of Mathematics				

OBJECTIVES

- To explore complex systems, physicists, engineers, financiers and mathematicians require computational Methods since mathematical models are only rarely solvable algebraically
- Linear algebra underlying systems of equations, ordinary differential equations to simulate systems, and stochastic simulation under random influences.
- Explicit schemes to solve ordinary differential equations; random numbers; stochastic system simulation.

COURSE OUTCOMES (COs)

CO1	Solve a set of algebraic equations representing steady state models formed in engineering problems.
CO2	Fit smooth curves for the discrete data connected to each other or to use interpolation Methods over these data tables.
CO3	Find the trend information from discrete data set through numerical differentiation and Summary information through numerical integration.
CO4	Predict the system dynamic behavior through solution of ODEs modeling the system.
CO5	Solve PDE models representing spatial and temporal variations in physical systems Through numerical Methods.
CO6	Have the necessary proficiency of using MATLAB for obtaining the above solutions.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	M			M				H
	CO2	H	H										
	CO3	H	H	L	M	M							M
	CO4	M	M						M				
	CO5	H	H	L	H	H							
	CO6	M	M						H				H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT – I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+6

Linear interpolation Methods (method of false position) – Newton's method – Statement of fixed point theorem – Fixed point iteration: x=g(x) method – Solution of linear system by Gaussian elimination and Gauss-Jordon Methods - Iterative Methods: Gauss Jacobi and Gauss-Seidel Methods - Inverse of a matrix by Gauss Jordon method – Eigen value of a matrix by power method.

UNIT -II INTERPOLATION AND APPROXIMATION 9+6

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulas.

UNIT-III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+6

Derivatives from difference tables – Divided differences and finite differences –Numerical integration by trapezoidal and Simpson's 1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulas – Double integrals using trapezoidal and Simpsons's rules.

UNIT-IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+6

Single step Methods: Taylor series method – Euler and modified Euler Methods – Fourth order Runge – Kutta method for solving first and second order equations – Multistep Methods: Milne's and Adam's predictor and corrector Methods.

UNIT- V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIALEQUATIONS 9+6

Finite difference solution of second order ordinary differential equation – Finite difference solution of one dimensional heat equation by explicit and implicit Methods – One dimensional wave equation and two dimensional Laplace and Poisson equations.

TEXT BOOKS:

1. C.F. Gerald and P.O. Wheatley, 'Applied Numerical Analysis', Sixth Edition, PearsonEducation Asia, New Delhi, 2002.

2. E. Balagurusamy, 'Numerical Methods', Tata McGraw Hill Pub.Co.Ltd, New Delhi, 1999.

REFERENCES:

1. P. Kandasamy, K. Thilagavathy and K. Gunavathy, 'Numerical Methods', S.Chand Co. Ltd., New Delhi, 2003.
2. R.L. Burden and T.D. Faires, 'Numerical Analysis', Seventh Edition, Thomson Asia Pvt. Ltd., Singapore, 2002.
3.https://www.math.ust.hk/~machas/numerical-Methods.pdf

BCS401	**DATABASE MANAGEMENT SYSTEM**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Fundamental of Computing and Programming, Object Oriented Programming using C++				
	Course Designed by – Dept. of Computer Science & Engineering				

OBJECTIVES

- Most of the organizations depend on databases for storing the data and to share the data among different kinds of users for their business operations
- Persistent storage required and several users must be able to safely access the same data concurrently.
- Hence this course discusses about the problems with the file processing system and how it can be handled effectively in Database Systems through various design tools, design techniques and algorithms.

COURSE OUTCOMES (COs)

CO1	Define the fundamental elements of database management systems.
CO2	Explain the basic concepts of relational data model and entity-relationship model.
CO3	Outline relational database design, relational algebra and database language SQL.
CO4	Explain the basic concepts of query processing, transaction management and file storage.
CO5	Develop a database for a given problem.
CO6	To know

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			S									S
	CO2		M	M		H	L		M	M	L		S
	CO3		S	S	M			M					M
	CO4					M							
	CO5			S						M	M		M
	CO6	M	S		L	M			M			M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT-I INTRODUCTION 9

Introduction – Database System Applications-Purpose of Database Systems- View of Data- Data Abstraction- Instances and Schemas- Data Models-Database Languages -Relational Databases-Database Design- The Entity-Relationship Model - Data Storage and Querying - Transaction Management - Database Architecture -Database Users and Administrators.

UNIT-II RELATIONAL DATABASES 9

Introduction to Relational model - Structure of Relational Databases - Database Schema - Keys - Schema Diagrams - Relational Query Languages - Relational Operations -Relational algebra - Introduction to SQL - Overview of the SQL Query Language - SQL Data Definition - Basic Structure of SQL Queries - Formal Relational Query Languages- The Relational Algebra-Relational calculus- Relational database design-Normal Forms- Functional dependency.

UNIT-III DATA STORAGE AND QUERYING 9

Storage and File Structure - File Organization - Indexing and Hashing- Ordered Indices- Static Hashing- Dynamic Hashing- Query Processing- Overview- Measures of Query Cost-Selection-Sorting- Join Operation- Evaluation of Expressions- Query Optimization- Overview-Transformation of Relational Expressions- Estimating Statistics of Expression Results- Choice of Evaluation Plans.

UNIT-IV TRANSACTIONS 9

Transactions-Transaction Concept-A Simple Transaction Model-Storage Structure-Transaction Atomicity and Durability-Transaction Isolation-Serializability-Transaction Isolation and Atomicity-Transaction Isolation Levels-Transactions as SQL Statements-Concurrency Control-Lock-Based Protocols-Deadlock Handling-Multiple Granularity-Time Stamp-Based Protocols-Validation Based Protocols-Hierarchical model - Basic Concepts - Data-Structure Diagrams-Network model.

UNIT-V OBJECT-BASED DATABASES 9

Overview-Complex Data Types-Structured Types and Inheritance in SQL-Table Inheritance-Array and Multiset Types in SQL-Object-Identity and Reference Types in SQL-Implementing O-R Features- Persistent Programming Languages-Object-Relational Mapping-Object-Oriented versus Object-Relational - Data warehousing and Data Mining - Decision-Support Systems-Data Warehousing- Data Mining-Classification-Association Rules-Other Types of Associations-Clustering-Other Forms of Data Mining.

TEXT BOOKS:

1. Abraham Silberschatz, Henry. F. Korth and S. Sudharshan, “Database System Concepts”, 6th Edition, Tata McGraw Hill, 2011.
2. RamezElmasri, Shamkant B. Navathe, “Fundamentals of Database Systems", 6th Edition, Addison-Wesley,2010.

REFERENCE BOOKS:

1.PakhiraMalay.K, “Database Management System”,PHI publication,2012.

2.NarainGehani, “The Database Book – Principles and Practice Using MySQL”, Universities Press,2008.
3. Hector Garcia - Molina, Jeff Ullman and Jennifer Widom, “Database systems: The Complete Book” 2nd Edition, Pearson Education,2008.
4. C. J. Date, A. Kannan and S. Swamynathan, “An Introduction to Database Systems”, Pearson Education, 8thEdition,2006.
5. Database%20Management%20Systems%203Rd%20Edition.pdf

BCS402	DESIGN AND ANALYSIS OF ALGORITHM	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Fundamental of Computing and Programming, Object Oriented Programming using C++,Data Structures				
	Course Designed by – Dept. of Computer Science & Engineering				

OBJECTIVES

- Design algorithms for various computing problems.
- Analyze the time and space complexity of algorithms.
- Critically analyze the different algorithm design techniques for a given problem.
- Modify existing algorithms to improve efficiency.

COURSE OUTCOMES (COs)

CO1	Explain the basic concepts of time and space complexity, divide-and-conquer Strategy, dynamic programming, greedy and approximate algorithms.
CO2	Describe the methodologies of how to analyze an algorithm
CO3	Describe the data structures of graph coloring and back tracking
CO4	Design a better algorithm to solve the problems.
CO5	Know about branch and bound techniques.
CO6	To know the concept Travelling Salesman Problem.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	M	M
	CO2	H	M	M	H	H		M		M			M
	CO3				H	H			M				
	CO4	M										M	L
	CO5		M	M	H	H		M			M		M
	CO6	L			H	H		M		M			M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT- I ANALYZING ALGORITHMS 9

Introduction: Efficiency of algorithms – average and worst case asymptotic notation – the order of - other asymptotic notations. Analysis of Algorithms: Analyzing control structures – solving recurrences – homogeneous recurrences – inhomogeneous recurrences.

UNIT- II DIVIDE AND CONQUER METHOD 9

Divide And Conquer Method: Binary search – merge sort – quick sort – strassen's matrix multiplication. Greedy Method: Knapsack problem – Prim's algorithm – Kruskal's algorithm – Dijkstra's algorithm – Huffman trees.

UNIT- III DYNAMIC PROGRAMMING 9

Dynamic Programming: Principle of optimality – computing binomial co-efficient – Warshall's and Floyd's algorithms – optimal binary search tree – knapsack problem – traveling salesman problem.

UNIT- IV BACKTRACKING 9

Backtracking: n queen's problem – sum of subsets – graph coloring – Hamiltonian cycle – knapsack problem.

UNIT- V TRAVELLING SALESMAN PROBLEM 9

Branch and Bound: Knapsack problem – traveling salesman problem – assignment problem Introduction to NP Completeness: easy vs. hard – the class NP – NP complete problems**.**

TEXT BOOKS

1. AnanyLevitin, Introduction to Design and Analysis of Algorithms, Pearson Education Inc., 2005.
2. Ellis Horowitz, SartajSahni and S. Rajasekaran, Fundamentals of Computer Algorithms ,Galgotia Publications, 2nd Edition, New Delhi, 2003.

REFERENCES

1. Aho.A.V, Hopcroft.J.E and Ullman.J.D, Design and analysis of Algorithms, Pearson education, 3rd edition, 2000.
2. Mark Allen Weiss, Data structures and algorithm analysis in C, Pearson Education, 2nd Edition, 2003
3. Thomas.H.Cormen, Charles E. Leiserson, Ronald L.Rivest, Introduction to Algorithms, Prentice Hall of India Pvt. Ltd,3rd Edition,2009.
4. https://www.cs.umd.edu/users/samir/2012lecnotes.pdf

BCS403	SYSTEM SOFTWARE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Fundamental of Computing and Programming, Computer Organization and Architecture, Operating System				
	Course Designed by – Dept. of Computer Science & Engineering				

OBJECTIVES

The objective of this course is some of the major tasks of the system software of a computer system, focusing on internal working of the Hardware and Software interface of a typical system.

COURSE OUTCOMES (COs)	
CO1	An ability to understand Addressing modes and Instruction formats.
CO2	Understand the functionality of Assemblers.
CO3	Understand the Concept of Linkers and Loaders.
CO4	Abilityunderstands the concept of Macroprocessors.
CO5	Summarize the concepts of Debuggers and implementation of editors.
CO6	An ability to apply design and development principles in the construction of software systems of varying complexity.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		H								H
	CO2	H	H	H	H				M		M		
	CO3	M	H	H	M							M	
	CO4	H	H	H	H		L				M		M
	CO5	L	H	H	H								
	CO6			M	M								M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT –I INTRODUCTION TO SYSTEM SOFTWARE 9

Introduction, System Software and Machine Architecture, Simplified Instructional Computer (SIC) - SIC Machine Architecture, SIC/XE Machine Architecture, SIC Programming Examples-Instruction formats - Addressing modes -Typical Architectures.

UNIT- II ASSEMBLERS 9

Functions - Features - Machine dependent - Machine independent - Design options - One pass - Multipass - Implementation – Examples-Basic Assembler Function - A Simple SIC Assembler, Assembler Algorithm and Data Structures, Machine Dependent Assembler Features - Instruction Formats & Addressing Modes, Program Relocation.

UNIT- III LINKER AND LOADER 9

Basic Loader Functions - Design of an Absolute Loader, A Simple Bootstrap Loader, Machine-Dependent Loader Features – Relocation, Program Linking, Algorithm and Data Structures for a Linking Loader; Machine-Independent Loader Features - Automatic Library Search, Loader Options, Loader Design Options - Linkage Editor, Dynamic Linkage, Bootstrap Loaders, Implementation Examples - MS-DOS Linker.

UNIT –IV TEXT EDITORS AND MACRO PROCESSOR 9

Text Editors - Overview of Editing Process, User Interface, Editor Structure, Interactive Debugging Systems - Debugging Functions and Capabilities, Relationship With Other Parts Of

The System, User-Interface Criteria Functions - Macro parameters - Using labels - Conditional macro expansion -Recursive macro expansion – General purpose macro processors -Examples.

UNIT- V COMPILER AND UTILITIES 9

Introduction to Compilers- Different phases of a compiler-Simple one pass compiler - Code optimization techniques - System Software tools -Implementation of editors – Debuggers-Lex and Yacc - The Simplest Lex Program, Recognizing Words With LEX, Symbol Tables, Grammars, Parser-Lexer Communication, The Parts of Speech Lexer, A YACC Parser, The Rules Section.

TEXT BOOKS:

1. L. Beck, "System Software - An Introduction to System Programming", 3rd Edition, Pearson Education, 2005.
2. John.R.Levine, Tony Mason and Doug Brown: Lex and Yacc, O'Reilly, SPD, 1998.

REFERENCES:

1. D.M. Dhamdhere, "System Programming and Operating Systems", Tata McGraw Hill Company, 1999.
2. http://uotechnology.edu.iq/ce/Lectures/Dr-Shaima-Sys-Prog/lec1-2-3-4.pdf
3. https://books.google.co.in/books?id=s7zgF7InxIgC&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

BCS405	OPERATING SYSTEMS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Fundamental of Computing and Programming, Internet Programming, Computer Organization and architecture.				
	Course Designed by – Dept. of Computer Science & Engineering				

OBJECTIVES

Every computer professional should have a basic understanding of how an operating system controls the computing resources and provide services to the users. This course provides an introduction to the operating system functions, design and implementation.

COURSE OUTCOMES (COs)

CO1	Illustrate the operating system concepts and its functionalities.
CO2	Apply various CPU scheduling algorithms for problems.
CO3	Outline the needs and applications of process synchronization.
CO4	Identify the issues in deadlock and memory management.
CO5	Illustrate various file and disk management strategies.
CO6	Learn the basic concept of LINUX.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		H			H	L		M	L	M	H
	CO2		H	H		H	M						H
	CO3						H		M				M
	CO4		M	H	H	M	H	M			M	H	H

	CO5	M	M	H			M			M			M
	CO6		M	M					H			M	L
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)	
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT- I INTRODUCTION TO OPERATING SYSTEM 9

Introduction: What operating systems do? – Computer System Organization - Computer System Architecture – Single processor systems - Multiple processor systems – Clustered Systems – Operating System Structure – Operating System Operations – Special purpose systems: Real Time Embedded Systems, Multimedia Systems and Handheld Systems. Operating System Services: System Calls – System Programs –Virtual Machines - Operating System Design and Implementation.

UNIT- II PROCESS MANAGEMENT 9

Process Management: Process Concept – Process Scheduling – Operation on Process – Cooperating Processes and Inter-process Communication. Threads: Overview – Multithreading Models. Process Synchronization: The Critical Section Problem – Synchronization Hardware – Semaphores – Classical Problems of Synchronization. Deadlocks: System Model – Deadlock Characterization – Methods for handling Deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection –Recovery from Deadlock.

UNIT- III CPU SCHEDULING 9

CPU Scheduling: Basic Concepts – Scheduling Criteria – Scheduling Algorithms. Memory Management: Background – Swapping –Contiguous Memory Allocation –Paging - Segmentation – Segmentation with paging. Virtual Memory: Demand paging – Page Replacement – Thrashing – Allocation of Frames.

UNIT-IV FILE HANDLING 9

File Systems: File Concepts - Access Methods – Directory Structure – File System Mounting – File Sharing – Protection. File System Structure – File System Implementation – Allocation Methods - Free-Space Management – Directory implementation – Recovery.

UNIT- VLINUX 9

Secondary Storage Management: Disk Structure – Disk Scheduling – Disk Management – Swap Space management-Case Study: Linux System – Components of Linux Systems – Process Management – Process Scheduling – Security.

TEXT BOOKS:

1. Silberschatz, Galvin, Gagne, "Operating System Concepts", 8thedition, John Wiley & Sons, Inc., 2009.
2. William Stallings, "Operating Systems", Pearson Education, 6th Edition. 2006.

REFERENCS:

1. D.M.Dhamdhere, "Operating Systems: A Concept-Based Approach", 2nd Edition, Tata McGraw Hill, 2006.
2. Andrew S. Tanenbaum, "Modern Operating Systems", Pearson Education, 3rd Edition.2005.
3. https://it325blog.files.wordpress.com/2012/09/operating-system-concepts-7-th-edition.pdf.

BCE406	ENVIRONMENTAL STUDIES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Physical Sciences				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To study the nature and facts about environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context
CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1						H	H	H				H
	CO2						H	H	M				M
	CO3							M	H				H
	CO4							H	H				H
	CO5						H		M				M
	CO6							M	H				

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance, Need for public awareness.

Natural Resources : Renewable And Non – Renewable Resources

Natural resources and associated problems

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.

c) Mineral resources : Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes caused by agriculture and overgrazing , effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 8

Concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-

Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III BIODIVERSITY AND ITS CONSERVATION 7

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega-diversity nation, Hot-spots of biodiversity -Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution 7

Definition, Causes, effects and control measures of ;- Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management : floods earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8

From Unsustainable to Sustainable development, Urban problems related to energy, nuclear accident and holocaust, case studies, wasteland reclamation, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection Act, Forest Conservation Act, Issues involved in enforcement of environmental Legislation, public awareness –

Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel –oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes – Noise produced by fire crackers – Noise pollution – Noise level standards for fire crackers – Intensity of sound – Impact on hearing – Safety measures.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations, population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXTBOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
3. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, 1989.
4. Benny Joseph, "Environmental Studies"., TATA McGraw Hill, 2010

REFERENCES

1. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, EnviroMedia 2009
2. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
4. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno Science Publications 2013
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB),2001.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
8. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
9. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publish Co. Pvt. Ltd. 345p.
12. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut.
13. http://eng.mft.info/uploadedfiles/gfiles/c8e31c9e52d84c3.pdf

BCS4L1	DBMS LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	3	2
	Prerequisite –Database Management System				
	Lab Manual Designed by – Dept. of Computer Science and Engineering				

OBJECTIVES: The main objective isstudents gain knowledge about databases for storing the data and to share the data among different kinds of users for their business operations.

COURSE OUTCOMES (COs)

CO1	Develop database modeling for a problem.
CO2	Design a database using normalization.
CO3	Implement a data base query language.
CO4	Develop GUI using front end tool.
CO5	Develop a connection between frontend and database.
CO6	Implement a Data Manipulation Language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			S									S
	CO2		M	M		H	L		M	M	L		S
	CO3		S	S	M			M					M
	CO4					M							
	CO5			S						M	M		M
	CO6	M	S		L	M			M			M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS

1. Data Definition, Manipulation of base tables and views
2. High level programming language extensions.
3. Front end tools.
4. Forms-Triggers-Menu Design.
5. Reports.
6. Database Design and implementation
7. An exercise using Open Source Software like MySQL.

BCS4L2	OPERATING SYSTEM LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	3	2

	Prerequisite –Operating Systems
	Lab Manual Designed by – Dept. of Computer Science and Engineering

OBJECTIVES The main objective is students gain knowledge about various Operating System Memory management and Commands using in Operating system.

COURSE OUTCOMES (COs)

CO1	Demonstrate Unix / Linux commands.
CO2	Implement various commands using shell programming.
CO3	Implement various CPU scheduling algorithms.
CO4	Implement various disk scheduling algorithms.
CO5	Implement memory management techniques.
CO6	Implement Synchronization and Semaphores.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H	H		H				M			H
	CO2		H	H		H							
	CO3		H	H		M							M
	CO4		M			H							H
	CO5		H	M		M							
	CO6		H	M		M				M			H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Working with basic Unix/ Linux commands.
2. Shell Programming.
3. Programs using the following system calls of Unix / Linux operating system: fork, exec, getpid, exit, wait, close, stat, opendir, readdir
4. Programs using the I/O system calls of UNIX operating system (open, read, write)
5. Simulations of Unix / Linux commands like ls, grep, etc.
6. Simulation of scheduling algorithms (CPU and Disk).
7. Implementation of synchronization problems using Semaphore.
8. Simulation of basic memory management schemes.
9. Simulation of virtual memory management schemes.
10. Simulation of file systems.

BCS4L3	COMPUTER GRAPHICS AND MULTIMEDIA LABORATORY	L	T	P	C

	Total Contact Hours - 30	0	0	3	2
	Prerequisite –Multimedia Systems.				
	Lab Manual Designed by – Dept. of Computer Science and Engineering				

OBJECTIVES The main objective is students gain knowledge about multimedia concepts, 2D and 3D Transformations.

COURSE OUTCOMES (COs)

CO1	Explain line drawing using programming language.
CO2	Explain 2D and 3D transformations
CO3	Demonstrate simple 2D animations using animation software.
CO4	Prepare simple scenes using image editing software.
CO5	Explain the linking between web and multimedia.
CO6	Model a simple multimedia application.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H	H		H							H
	CO2		H	M		H							
	CO3		H			M							M
	CO4		M	H		H							H
	CO5		H	M		M							
	CO6		H	M		H							H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF LAB EXPERIMENTS:

1. To implement Line, Circle and ellipse Attributes
2. To implement line drawing algorithms DDA line algorithm, Bresenham's line algorithm
3. To perform 2D and 3D transformations
4. To perform animation using any Animation software (Create Frame by Frame Animations using multimedia authoring tools)
5. To perform basic operations on image using any image editing software
6. To develop a presentation for a product using techniques like Guide Layer, masking and onion Skin using authoring tools.
7. To create a Jpeg image that demonstrates the various features of an image editing tool.

BMA501	DISCRETE MATHEMATICS	L	T	P	C

	Total Contact Hours - 60	4	0	0	4
	Prerequisite –Engineering Mathematics-I, Engineering Mathematics-II, Engineering Mathematics-III, Numerical Methods.				
	Course Designed by – Dept. of Mathematics.				

OBJECTIVES

- ❖ Reason Mathematically about basic data types and structures (such as numbers, sets, graphs, and trees) used in computer algorithms and systems.
- ❖ Distinguish rigorous definitions and conclusions from merely plausible ones; synthesize elementary proofs, especially proofs by induction.
- ❖ Model and analyze computational processes using analytic and combinatorial Methods.

COURSE OUTCOMES (COs)

CO1	Understand the theory and techniques of logic, graphs and trees, and algebraic systems.
CO2	Apply the knowledge and skills obtained to investigate and solve a variety of discrete mathematical problems.
CO3	Communicate Mathematical Ideas.
CO4	Make effective use of appropriate technology.
CO5	Learn the concept about graphs.
CO6	Understand the concept of Lattices.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		H								M
	CO2	H	H		H								
	CO3	H	M		H						M		
	CO4	H	H		H								M
	CO5	M											
	CO6	H			M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT-I LOGIC 12

Statements - Truth Tables - Connectives - Normal forms - Properties calculus - Inference theory for statement Calculus and Predicate Calculus.

UNIT-II COMBINATORIES 12

Review of Permutation and Combination - Mathematical Induction - Pigeon hole Principle - Principle of inclusion and exclusion - Generating function -Recurrence relations.

UNIT-III GROUPS 12

Semigroups- Monoids-Groups-Permutation group-Consets-Lagrange's theorem - Group homomorphism- Kernal - Rings and Fields (Definitions and Examples only)

UNIT-IV LATTICES 12

Partial ordering - Posets - Hasse diagram - Lattices - Properties of Lattices - Sub Lattices - Special Lattices - Boolean, Algebra

UNIT-V GRAPHS 12

Introduction of Graphs - Graph terminology - Representation of Graphs - Graph Isomorphism- Connectivity- Euler and Hamilton Paths.

TEXT BOOKS:

1. Tremblay J.P and Manohar R, "Discrete Mathematical Structures with Application to Computer Science", McGraw Hill Book Company, International Edition, 1987, Sections 1 2,1 to 1-2,4; 1-2, 6 to 1-2,14; 1-3,1 to 1-3,5; 1-4,1 to 1-4,3; 1-5,- to 1-5,5:1-6, 4 and 1-6,5 for logic. Section 3:- 1,1 to 3-2, 3; 3-5,1 to 3-5, 5 for Groups Rings and Fields. Sections: 2, 3-8 and 2-3, 9; 4-1, 1 to 4-2, 2 for Lattices.
2. Kenneth H. Rosen, "Discrete Mathematics and its applications", McGraw Hill Book Company 1999, Section 3, 3, 4, 3, 6, 1, 6, 2, 6, 4, 6, 5, 7, 1-7, 5, 8, 1-8, 5

REFERENCE BOOKS:

1. Ralph P., Grimaldi, "Discrete and Combinatorial Mathematics", Pearson Education, Fifth Edition,2008
2. Venkataraman M.K, Discrete Mathematics", The National Publishing Company 2000.
3. Iyengar S. N, Chandrasekaran V. M, Venkatesan K.A. and Arunachalam PS., "Discrete Mathematics", Vikas Publishing House Pvt. Ltd,2003.
4. http://www.cse.iitd.ernet.in/~bagchi/courses/discrete-book/fullbook.pdf

BCS501	**SOFTWARE ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Fundamentals of Computing and Programming, Computer Organization and Architecture.				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

This course is intended to provide the students with an overall view over Software Engineering discipline and with insight into the processes of softwaredevelopment.

COURSE OUTCOMES (COs)

CO1	Outline the features of different lifecycle models.
CO2	Explain the principles involved in gathering and validating software requirements
CO3	Make use of suitable models through analysis of requirements and arrive at an appropriate software design.
CO4	Appreciate the quality assurance procedures during software development
CO5	Explain software project management and software maintenance practices.
CO6	Explain the Concept of Software Testing.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	H	H	H	M		M	H	M	H	H
	CO2		H			H							
	CO3			H	H				H	M	H	M	M
	CO4					M							
	CO5	M	M	M	M		M		M	H		H	
	CO6		M	H		H				H	M		H
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT- I INTRODUCTION 9

Software Engineering Process paradigms - Project management - Process and Project Metrics – software estimation - Empirical estimation models - Planning - Risk analysis - Software project scheduling.

UNIT- II REQUIREMENTS ANALYSIS 9

Requirement Engineering Processes – Feasibility Study – Problem of Requirements – Software Requirement Analysis – Analysis Concepts and Principles – Analysis Process – Analysis Model- Software Prototyping – Selecting the Prototyping Approach – Prototyping Methods and Tools – Specification – Software Requirement Specification – Specification Review.

UNIT- III SOFTWARE DESIGN 9

Software design - Abstraction - Modularity - Software Architecture - Effective modular design - Cohesion and Coupling - Architectural design and Procedural design - Data flow oriented design.

UNIT- IV USER INTERFACE DESIGN AND REAL TIME SYSTEMS 9

User interface design - Human factors - Human computer interaction - Human - Computer Interface design - Interface design - Interface standards. Programming languages and coding - Language classes – Code documentation - Code efficiency - Software Configuration Management.

UNIT- V SOFTWARE QUALITY AND TESTING 9

Software Quality Assurance - Quality metrics - Software Reliability - Software testing - Path testing – Control Structures testing - Black Box testing - Integration, Validation and system testing - Software Maintenance - Reverse Engineering and Re-engineering. CASE tools - projects management, tools - analysis and design tools - programming tools - integration and testing tool - Case studies.

TEXT BOOK:

1. Roger Pressman S., “Software Engineering: A Practitioner's Approach”, 7th Edition, McGraw

Hill, 2010.

REFERENCE BOOKS:

1. I. Sommerville, "Software Engineering", Eighth Edition, Pearson Education, 2007
2. Pfleeger, "Software Engineering-Theory & Practice", 3rd Edition, Pearson Education, 2009
3. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli, "Fundamentals of Software Engineering", Pearson Education, 2003.
4. http://www.vumultan.com/Books/CS605-Software%20Engineering%20Practitioner%E2%80%99s%20Approach%20%20by%20Roger%20S.%20Pressman%20.pdf

BEC501	**MICROPROCESSOR AND ITS APPLICATIONS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Fundamentals of Computing and Programming, Digital Computer Fundamentals.				
	Course Designed by – Dept. of Electronics and Communication Engineering.				

OBJECTIVES

Become proficient in the functional and technological characteristics of microprocessor architectures.
Understand and write assembly language programs.
Learn about memory components, peripheral support devices and their interface logic.

COURSE OUTCOMES (COs)

CO1	Identify the basic functions of a microprocessor and explain the instruction sets of 8085 and 8086 microprocessors.
CO2	Make use of the instruction set of 8085 microprocessor and develop assembly code to Solve problems.
CO3	Illustrate the use of various general purpose interfacing devices.
CO4	Develop skills to write programs using 8086 processor development tools.
CO5	Compare the architecture of 8085, 8086 and 8051 microcontroller.
CO6	Explain the Concept Assembly Languages.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		M	M	H							
	CO2		M										
	CO3							M					
	CO4	M				M	L						
	CO5				M								
	CO6	M	L	L									

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT-I INTRODUCTION TO MICROPROCESSOR 9

Evolution of microprocessors-Comparison of many computers with mini and large computers-Advantages and limitations of microprocessors based system design. Architecture and Organization: CPU-Registers-ALU Decoders-Bus system- Tri-state logic-Data Flow-Intel architecture 8085 microprocessor-Function of various block and signals- Organization of a micro-computer-Brief Introduction to Z80, MC 6800 and Intel 8086.

UNIT-III INSTRUCTIONSET 9

The origin of software-program execution - Addressing modes-Instruction format- and classifications - Intel 8085 Instruction set- Stack and subroutine-Instruction-Timing and operation status.

UNIT-III BASIC PATTERNS OF MEMORY SYSTEMS 9

Memory devices: ROM, RAM, EPROM-Interfacing memory sections-Methods of data transfer - Programmed data transfer schemes and DMA method of transfer-8257 programmable DMA controller-Parallel I/O interfacing-Interfacing of ADC and DAC-Intel 8085 I/O-structure.

UNIT-IV INTERRUPT STRUCTURES 9

Need for interrupt structures-Handling of specific sources of interrupts-Software interrupts-hardware interrupt – Multiple interrupt -polling and vectoring-8259 programmable interrupt controller - 8255 programmable peripheral interface-8253/8254 programmable interval timer-Interfacing of 7 segment display.

UNIT-V ASSEMBLY LANGUAGES PROGRAMMING 9

Assembly Language programming-Mnemonics-Assemblers-Simple programs-List of arrays-Arithmetic character manipulation-Flow chart-Subroutines –Debugging-Testing-Typical programs using Intel 8085-Applications to temperature control and speed control of stepper motor-Traffic light control-Microprocessor based data acquisition systems.

TEXT BOOKS:

1. RameshS.Gaonkar, “Microprocessor Architecture, Programming and Applications with the 8085”,6th edition, Penram International Publishing (India) Pvt. Ltd., 2013

REFERENCE BOOKS:

1. A.P.Mathur, “Introduction to Microprocessors”, Third Edition, Tata McGraw Hill,2006
2. Rafiquzzaman, “Microprocessors and Microcomputer Development Systems: Designing Microprocessor-Based Systems”, John Wiley & Sons Inc,2005
3. N.K. Srinath, “8085 Microprocessor: Programming and Interfacing”, PHI Learning, 2010.
4.https://inspirit.net.in/books/academic/8085%20Microprocessor%20-%20Ramesh%20Gaonkar.pdf

BCS502	COMPUTER NETWORKS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Fundamental of Computing and Programming, Internet Programming				
	Course Designed by – Dept. of Computer Science & Engineering				

OBJECTIVES

Computer Networking is the vital part of any organization these days. This course provides a foundation to understand various principles, protocols and design aspects of Computer Networks and also helps to achieve the fundamental purpose of computer networks in the form of providing access to shared resources.

COURSE OUTCOMES (COs)

CO1	Explain data communication system, components and the purpose of layered architecture.
CO2	Illustrate the functionality of each layer of OSI and TCP/IP reference model.
CO3	Explain the data link layer and network layer protocols.
CO4	Outline the functions of transport layer protocols.
CO5	Summarize application layer protocols.
CO6	Learn the Functionalities of Application layer.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	F		H	H	M	L	M	M	M	L	M	S
	CO2			H	H		M		M			M	
	CO3	M		M	H				M				M
	CO4			H	H	H		H		M		M	
	CO5			M	M		M		H		M		
	CO6	L		H	H								M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

4	Approval	37th Meeting of Academic Council, May 2015

UNIT- I INTRODUCTION TO NETWORKS 9

Introduction: The uses of computer networks - Network hardware - Network software - Reference models - Example of networks- Network standardization.

The Physical Layer: The theoretical basis for data communication – Guided Transmission media - Wireless transmission – PSTN - Mobile telephone - Communication satellite.

UNIT- II DATALINK LAYER 9

The Data Link Layer: Data link layer design issues - Error detection and correction - Elementary data link protocols - Sliding window protocols - Example of data link protocols- ETHERNET – 802.11, 802.16, Bluetooth- Data link layer Switching.

UNIT- III NETWORK LAYER 9

The Network layer: Network layer design issues - Routing algorithms - Congestion control algorithms -Approaches to Congestion Control-Traffic-Aware Routing-Admission Control-Traffic Throttling-Load Shedding - Internetworking- Network layer in Internet.

UNIT –IV TRANSPORT LAYER 9

The Transport layer: Transport layer design issues-Addressing,Connection Establishment-Connection Release-Error Control and Flow Control - Transport protocols - Simple transportprotocol - Internet transport protocols UDP, TCP.

UNIT- V APPLICATION LAYER 9

The Application layer: Domain name system - Electronic mail - World wide web-Architectural Overview-Static Web Pages-Dynamic Web Pages and Web Applications-HTTP—The Hypertext Transfer Protocol-The Mobile Web-Web Search – Multimedia – Cryptography, Digital signature- Communication Security.

TEXT BOOKS:

1. Andrew S. Tanenbaum, "Computer Networks", Pearson Education, 5th edition 2010.
2. Behrouz A. Forouzan, "Data and Computer Communications", 4th Edition, McGraw Hill,2007.

REFERENCE BOOKS:

1.WilliamStallings,"Data and Computer Communications",8th Edition, Pearson Education,2006

2. Douglas E. Comer, "Internetworking with TCP/IP, Volume-I", 6th Edition, Pearson Education, 2013.

3.http://tocs.ulb.tu-darmstadt.de/49378155.pdf

BCS5L1	NETWORKING LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	3	2
	Prerequisite –Computer Networks				
	Lab Manual Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The main Objective of this course is student know about Networking Concepts and Protocols.

COURSE OUTCOMES (COs)

CO1	Develop knowledge to implement client server applications.
CO2	Develop skills in UNIX socket programming.
CO3	Develop skills to use simulation tools.
CO4	Analyze the performance of network protocols.
CO5	Analyze the network traffic.
CO6	Establish a Connection using TCP/IP Protocol.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	H	M	L	M	M	M	L	M	S
	CO2			H	H		M		M			M	
	CO3	M		M	H				M				M
	CO4			H	H	H		H		M		M	
	CO5			M	M		M		H		M		

	CO6	L		H	H									M	
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)	Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)		Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
							√								
4	Approval	37th Meeting of Academic Council, May 2015													

LIST OF EXPERIMENTS:

1. Implement a simple TCP client-server where in a server acts as a time and date server.
2. Print a client address at server end.
3. Write a program in which a process is made to handle posix signals.
4. Program an echo UDP Server.
5. Create a daemon.
6. Create a simple Chat Program.
7. Create a simple out of band Sending and Receiving program.
8. Program to capture each packet and examine its checksum field.

BEC5L2	**MICROPROCESSOR LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	3	2
	Prerequisite –Microprocessor and its Applications.				
	Lab Manual Designed by – Dept. of Electronics and Communication Engineering.				

OBJECTIVES

The Main objective of this Lab manual is Create the Assembly Language Programming.

COURSE OUTCOMES (COs)

CO1	Make use of the microprocessor trainer kit to execute 8085 programs.
CO2	Develop assembly language program for 8085to solve simple programs.
CO3	Make use of interfacing devices for a specified application.
CO4	Develop simple assembly language program for 8086.
CO5	Develop assembly language program for 8086 using BIOS/DOS Calls
CO6	Develop assembly language Conversion Program BCD to Hexa and Vice Versa.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		M	M	H							
	CO2		M										
	CO3							M					
	CO4	M		H		M	L						
	CO5				M								
	CO6	M	L	M									

3	Category	Humanities & Social Studies (HSS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

EXPERIMENTS ON 8085:

1. Study of 8085 Microprocessor Simulator
2. 8 bit Addition, Subtraction, Multiplication
3. 16 bit Addition, Subtraction, Multiplication and Division.
4. BCD to Hexa and Hexa to BCD code Conversion.

BCS 5L2	**SOFTWARE ENGINEERING LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	3	2
	Prerequisite –Software Engineering ,Database Management System				
	Lab Manual Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The Main objective of this Software Engineering Lab is known about various phases in software development.

COURSE OUTCOMES (COs)

CO1	Analyze the problem and do project planning.
CO2	Identify project scope, objectives, and perform data modeling.
CO3	Identify the deliverables in various phases of SDLC.
CO4	Implement solutions using modern tools.
CO5	Explain test plan, perform validation testing, coverage analysis.
CO6	Testing and Maintenance the applications.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	H	H	H	M		M	H	M	H	H
	CO2		H			H							
	CO3			H	H				H	M	H	M	M
	CO4					M							
	CO5	M	M	M	M		M		M	H		H	
	CO6		M	H		H				H	M		H

3	Category	Humanities & Social Studies (HSS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

1. Problem Analysis and Project Planning

Thorough study of the problem – Identify project scope, Objectives, infrastructure

2. Software Requirement Analysis

Describe the individual Phases/ modules of the project, Identify deliverables

3. Data Modeling

Use work products – data dictionary, use case diagrams and activity diagrams, build and test lass diagrams, sequence diagrams and add interface to class diagrams.

4. Software Developments and Debugging

5. Software Testing

Prepare test plan, perform validation testing, coverage analysis, memory leaks, develop test case hierarchy, Site check and site monitor.

LIST OF EXPERIMENTS

1. Library System
2. Course Registration System
3. Quiz System
4. Student marks analyzing system
5. Online ticket reservation system
6. Stock maintenance

BCS5C1	**COMPREHENSION I**	**L**	**T**	**P**	**C**
	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses up to fifth semester				
	Course Designed by – Dept. of Computer Science and Engineering				

OBJECTIVES

- To provide a complete review of Computer Science and Engineeringtopics covered up to fifth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to fifth semester.

BCS601	**DATA WAREHOUSING AND DATA MINING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Data Structures, Design and Analysis of Algorithm.				
	CourseDesigned by – Dept. of Computer Science and Engineering.				

OBJECTIVES

- Dramatic advances in data capture, processing power, data transmission, and storage capabilities are enabling organizations to integrate their various databases into data warehouses.
- Data mining is primarily used by the companies with a strong consumer focus. It enables these

companies to determine the factors such as price, product positioning, or staff skills, and economic indicators, competition, and customer demographics.	
COURSE OUTCOMES (COs)	
CO1	Provide efficient distribution of information and easy access to data.
CO2	Create user friendly reporting environment.
CO3	Find the unseen pattern in large volume of historical data that helps to manage an organization efficiently.
CO4	Understand the concepts of various data mining Techniques.
CO5	Explain the Architecture of Data warehousing.
CO6	Understand the concept of Web Mining.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	H		H							H
	CO2	M		H			M						H
	CO3			H	M	H				H		H	H
	CO4	M	M	H		H	M						H
	CO5					H							M
	CO6					M				M		H	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT- I DATAWAREHOUSE 9

Data Warehouse Roles and Structures – What is a Data Warehouse? – Multi Dimensional Data Model- Data Stores, Warehouses and Marts - The Data Warehouse Environment – Data Warehouse Characteristics - The Data Warehouse Architecture – Meta Data, Metadata Extraction - Implementing the Data Warehouse - OLAP Engine - Data Warehouse Backend Process – Data Warehouse Project Success Factors.

UNIT- II INTRODUCTION TO DATA MINING 9

Basic Data Mining Tasks, Data Mining versus Knowledge Discovery in Data Bases, Data Mining Issues, Data Mining Metrics. Social Implications of Data Mining.Data Mining from a Database Perspective.

Data Mining Techniques - Introduction – A Statistical Perspective on Data Mining – Similarity Measures – Decision Trees – Neural Networks – Genetic Algorithms.

UNIT-III CLASSIFICATION 9

Introduction - Statistical Based Algorithms- Distance Based Algorithms – Decision Tree Based Algorithms - Neural Networks Based Algorithms – Rule Based Algorithms – Combining Techniques.

UNIT IV ASSOCIATION RULES 9

Introduction-Large Itemsets- - Methods to Discover Association Rules - Apriori Algorithm - Partition Algorithm.

Clustering Techniques

Introduction – Outliers – Clustering Paradigms –Hierarchical Algorithms, Partitional Algorithms - Clustering Large Databases.

UNIT-V WEB MINING 9

Introduction-Web Mining – Web Content Mining –Crawlers,Harvest System,Virtual Web View - Web Structure Mining –Page Rank, Web Usage Mining-Preprocessing, Data structures, Pattern Discovery and Pattern Analysis.

TEXT BOOKS

1. ArunK.Pujari.,"Data Mining Techniques", Universities Press,2013.
2. Margaret H. Dunham ,S.Sridhar, "Data Mining Introductory and Advanced Topics", Pearson Education,2006.
3. K.P.Soman,ShyamDiwakar,V.Ajay,"*Data Mining*: *Theory And Practice" ,* PHI Learning Pvt. Ltd., 2006.

REFERENCE BOOKS

1. "Express Learning - Data Warehousing and Data Mining", ITL ESL,Pearson Education, 2012.
2. N.Venkatesan,S.Prabhu,"Data Mining and WareHousing", New Age International (P) Limited, 2010.
3. George M. Marakas, "Modern Data Warehousing, Mining and Visualization: Core concepts", Pearson Education,2003.
4.http://www.essi.upc.edu/~aabello/publications/11.IGIBook1.pdf

BSS601	**VALUE EDUCATION AND PROFESSIONAL ETHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Nil				
	Course Designed by – Dept. of Management Studies				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health.
- To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)

CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their

	curing
CO4	To learn more of Engineer as Responsible Experimenter.
CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To learn more of Responsibilities and Rights as Professional and facing Global Challenges

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE) 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.

UNIT III MIND CULTURE & TENDING PERSONAL HEALTH 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelizing the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS'SRESPONSIBILITIES FOR SAFETY 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Challenger, case study. Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies.

UNIT V ENGINEERS'S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership.

TEXT BOOKS:

1. Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata Mcgraw Hill, Newyork 2005 (Units IV & V)

REFERENCES:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004(for Units IV-V)

BCS602	**DISTRIBUTED COMPUTING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Fundamentals of Computing and Programming, Internet Programming, Computer Networks.				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

- The differences among: concurrent, networked, distributed, and mobile.
- Resource allocation and deadlock detection and avoidance techniques.
- Distributed Transaction Processing system
- Cryptography and Domain Name system.

COURSE OUTCOMES (COs)

CO1	Explain the distributed environment.
CO2	Explain the functionalities of file management system.
CO3	Organize processes in distributed systems.
CO4	Demonstrate the access of remote objects for the service.
CO5	Explain the Concept of Domain Name Distributed Locks.
CO6	Explain the Concept of Distributed Transaction Processing

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H	M	M	M						H	
	CO2			H					M	M			H
	CO3	M											
	CO4		M	M								H	
	CO5				M	M							M
	CO6	M	M	H					M			M	
3	Category	Humanities & Social Studies		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT- I INTRODUCTION 9

Characterization of Distributed Systems – Examples – Resource Sharing and the Web – Challenges – System Models – Architectural and Fundamental Models – Networking and Internetworking – Types of Networks – Network Principles – Internet Protocols – Case Studies.

UNIT –II PROCESSES AND DISTRIBUTED OBJECTS 9

Inter–process Communication – The API for the Internet Protocols – External Data Representation and Marshalling – Client –Server Communication – Group Communication – Case Study – Distributed Objects and Remote Invocation – Communication Between Distributed Objects – Remote Procedure Call – Events and Notifications – Java RMI – Case Study.

UNIT- III OPERATING SYSTEM ISSUES 9

The OS Layer – Protection – Processes and Threads – Communication and Invocation – OS Architecture – Security – Overview – Cryptographic Algorithms – Digital Signatures – Cryptography Pragmatics – Case Studies – Distributed File Systems – File Service Architecture – Sun Network File System – The Andrew File System.

UNIT- IV DOMAIN NAME SYSTEM AND LOCKS 9

Name Services – Domain Name System – Directory and Discovery Services – Global Name Service – X.500 Directory Service – Clocks – Events and Process States – Synchronizing Physical Clocks – Logical Time And Logical Clocks – Global States – Distributed Debugging – Distributed Mutual Exclusion – Elections – Multicast Communication Related Problems.

UNIT –V DISTRIBUTED TRANSACTION PROCESSING 9

Transactions – Nested Transactions – Locks – Optimistic Concurrency Control – Timestamp Ordering – Comparison – Flat and Nested Distributed Transactions – Atomic Commit Protocols – Concurrency Control in Distributed Transactions – Distributed Deadlocks – Transaction Recovery – Overview of Replication And Distributed Multimedia Systems.

TEXT BOOKS

1. George Coulouris, Jean Dollimore and Tim Kindberg, “Distributed Systems Concepts and Design”, 3rd Edition, Pearson Education, 2002.

2. Andrew S. Tanenbaum, Maartenvan Steen, Distributed Systems, “Principles and Pardigms”, Pearson Education, 2002.

REFERENCES

1.SapeMullender, “Distributed Systems”, 2nd Edition, Addison Wesley, 1993.
2.Albert Fleishman, Distributes Systems, “Software Design and Implementation”, Springer, Verlag, 1994.
3.M. L. Liu, “Distributed Computing Principles and Applications”, Pearson Education, 2004.
4.MugeshSinghal, Niranjan ,GShivaratri, “Advanced Concepts in Operating Systems”, Tata McGraw Hill Edition, 2001.
5. http://read.pudn.com/downloads119/ebook/506473/Distributed%20Computing%20Principles,%20 Algorithms,%20and%20Systems%20-%20[Cambridge%20University %20Press].pdf

BCS603	PRINCIPLES OF COMPILER DESIGN	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Data Structures, Discrete Mathematics.				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The purpose of this course is to impart concepts of Compiler Design.

COURSE OUTCOMES (COs)

CO1	Explain various phases of a compiler.
CO2	Design token recognizer using modern tools.
CO3	Design Top-down and Bottom-up parsing Techniques.
CO4	Translate given input to intermediate code.
CO5	Identify various types of optimizations on intermediate code and generate assembly code.
CO6	Explain the concept Code generation.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	F	H		H								H
	CO2	H	H	H	H								
	CO3	M	H	H	M								
	CO4	H	H	H	H								M
	CO5	L	H	H	H								
	CO6			M	M								M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship

					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I INTRODUCTION 9

Compilers: Introduction-Language Processing System –Analysis of the source program –Cousins of compiler-Grouping of phases-Compiler construction tools-computer language representation-Introduction-Elements of a Formal Language Grammar-Derivation-Reduction - Parse Trees.

UNIT – II LEXICAL ANALYZER 9

Role of a Lexical Analyzer-Issues in Lexical Analysis-Tokens, Patterns and lexemes –Attributes for Tokens- Error recovery-Specification and Recognition of tokens-finite Automata-Non Deterministic Automata-Deterministic Finite Automata-Conversion of an NFA into a DFA-Regular Expression to an NFA-Regular Expression to a DFA-Minimizing the number of states of a DFA-Use of a tool for Generating Lexical Analyzer.

UNIT – III SYNTAX ANALZER 9

Role of Parser-Error Recovery strategies-Context Free Grammar-Top down Parsing-Recursive descent parser-Predictive parser-Bottom Up Parsing-Stack implementation of shift reduce parsing-Operator precedence parsing-precedence Functions- LR Parser- Parser generator.

UNIT – IV INTERMEDIATE CODE GENERATION 9

Intermediate Languages-Intermediate Representations-Implementation of three address statements-Declaration-Declarations in procedure-Declarations in Nested procedures-Assignment Statements-Boolean expressions-Numerical Representation-Control flow translation of Boolean expressions- Flow Control statements-Back Patching.

UNIT – V CODE GENERATION 9

Introduction to Optimization Techniques –The principle sources of optimization- Issues in the Design of a Code generator- Run Time Storage Management –Static allocation-Stack allocation-Design of a Simple code generator

TEXT BOOK

1. A. V. Aho, Ravi Sethi, J.D. Ullman, “Compilers: Principles, Techniques & Tools”, Pearson Education, Second Edition. 2008.

REFERENCES

1. Allen I. Holub, “Compiler Design in C”, PHI Learning. 2009
2. Fisher Leblanc, “Crafting a Compiler with C”, Pearson Education.
3. Jean. Paul Trembley& Paul G. Sorenson, “Compiler Writing – Theory and Practice”, B.S. Publications, 2005.
4.http://dcs.uni-pannon.hu/heckl/web/digszam/Addison%20Wesley%20-%20Aho,%20Sethi,%20Ullman%20Compilers%20Principles,%20Techinques,%20And%20Tools.pdf

BCS6L1	DATA WAREHOUSING AND DATA MINING LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	3	2
	Prerequisite –Data ware Housing and Data mining				

	Lab Manual Designed by – Dept. of Computer Science and Engineering.

OBJECTIVES

Data mining is primarily used by the companies with a strong consumer focus. It enables these companies to determine the factors such as price, product positioning, or staff skills, and economic indicators, competition, and customer demographics

COURSE OUTCOMES (COs)

CO1	Provide efficient distribution of information and easy access to data
CO2	Create user friendly reporting environment.
CO3	Find the unseen pattern in large volume of historical data that helps to manage an organization efficiently.
CO4	Understand the concepts of various data mining Techniques.
CO5	Understand the concepts of Preprocessing.
CO6	Explain the concept of Data mining.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	H		H							H
	CO2	M		H			M						H
	CO3			H	M	H				H		H	H
	CO4	M	M	H		H	M						H
	CO5					H							M
	CO6					M				M		H	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS:

1. Listing applications for mining
2. File format for data mining
3. conversion of various data files
4. Training the given dataset for an application
5. Testing the given dataset for an application
6. Generating accurate models
7. Data pre-processing – data filters
8. Feature selection
9. Web mining
10. Text mining
11. Design of fact & dimension tables
12. Generating graphs for star schema.

BCS6L2	C# AND .NET LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	3	2
	Prerequisite –Object Oriented Programming using C++,Java Programming				
	Lab Manual Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The main Objective of this course is student know about windows, Web and Console Applications.

COURSE OUTCOMES (COs)

CO1	Display proficiency in C# by building stand-alone applications in the .NET framework using C#.
CO2	Create distributed data-driven applications using the .NET Framework, C#, SQL Server and ADO.NET
CO3	Create web-based distributed applications using C#, ASP.NET, SQL Server and ADO.NET
CO4	Utilize DirectX libraries in the .NET environment to implement 2D and 3D animations and game-related graphic displays and audio.
CO5	Utilize XML in the .NET environment to create Web Service-based applications and components.
CO6	Understand the concept of Web Applications.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H	H		H			H			H	
	CO2		H	H		H			H			H	
	CO3		H	H		H			H			H	
	CO4		H	H		H			H			H	
	CO5		M									M	
	CO6			H		M			M			H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS

1. Classes and objects
2. Inheritance
3. Operator overloading
4. Threading
5. Events and delegates
6. Working with windows forms controls
7. Validating data

8. Creating custom dialog box
9. Designing an MDI application with menu
10. Retrieving data from a SQL database
11. Manipulating data in a connected environment
12. Manipulating data in a disconnected environment

BCS6L3	PROGRAMMING IN JAVA LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	3	2
	Prerequisite –Fundamentals of Computing and Programming, Object Oriented Programming Using C++				
	Lab Manual Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The Main objective of this Lab manual is Develop CUI and GUI application using Java Programming.

COURSE OUTCOMES (COs)

CO1	Identify classes, objects, members of a class and the relationships among them for a Specific problem.
CO2	Develop programs using appropriate packages for Inter –thread Communication and Synchronization.
CO3	Develop GUI applications to handle events.
CO4	Develop client server based applications.
CO5	Design, develop, test and debug Java programs using object-oriented principles in Conjunction with development tools including integrated development environments.
CO6	Develop Applets Programs.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H	H	H	H				H		H	M
	CO2												
	CO3	M	M	H	H	H			M		M	H	
	CO4									H			H
	CO5		H	H	M								
	CO6	L	H	M		M			H	M		M	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

JAVA PROGRAMS USING FOLLOWING CONCEPTS

1. Classes& Objects.
2. Constructors & Destructors.
3. Methods Overloading.
4. Inheritance.
5. Interface.
6. Multithreading.
7. Package.
8. Creating Java Applets.

BCS701	**GRID AND CLOUD COMPUTING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Networks, Distributed Computing, Data ware Housing and Data Mining.				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

- Identify the technical foundations of cloud systems architectures.
- Analyze the problems and solutions to cloud application problems.
- Apply principles of best practice in cloud application design and management.
- Identify and define technical challenges for cloud applications and assess their importance.

COURSE OUTCOMES (COs)

CO1	Understand the fundamental principles of distributed computing.
CO2	Understand how the distributed computing environments known as Grids can be built from lower level services.
CO3	Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
CO4	Analyze the performance of Cloud Computing.
CO5	Understand the concept of Cloud Security.
CO6	Learn the Concept of Cloud Infrastructure Model.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H	M	M	M						H	
	CO2			H					M	M			H
	CO3	M											
	CO4		M	M								H	
	CO5				M	M							M
	CO6	M	M	H					M			M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT- I GRID COMPUTING 9

Introduction - Definition and Scope of grid computing, Computational and Data Grids, Current Grid Activities – Overview of Grid Business Areas, Grid Applications, Grid Computing Anatomy- Concept of Virtual Organization, Grid Architecture- Fabric layer, Connectivity layer, Resource Layer, Collective Layer, Application Layer, Layered Grid Architecture

UNIT-II CLOUD ARCHITECTURE AND MODEL 9

Technologies for Network Based system-System Models for Distributed and Cloud Computing-NIST Cloud Computing Reference Architecture Cloud models: Characteristics-Cloud Services-Cloud Models (IaaS, PaaS, SaaS)-Public vs. Private Cloud-Cloud Solutions-Cloud ecosystem-Service Management-Computing on demand.

UNIT-III CLOUD INFRASTRUCTURE 9

Architectural Design of compute and Storage Clouds-Layered Cloud Architecture Development-Design Challenges-Inter Cloud Resource Management-Resource Provisioning and Platform Deployment-Global Exchange of Cloud Resources.

UNIT-IV PROGRAMMING MODEL 9

Parallel and Distributed Programming Paradigms-Map Reduce-Twister and Iterative Map Reduce-Hadoop Library from Apache-Mapping Applications-Programming Support-Google App Engine, Amazon AWS-Cloud Software Environments-Eucalyptus, Open Nebula, Open Stack, Aneka, CloudSim.

UNIT-V SECURITY IN THE CLOUD 9

Security Overview-Cloud Security Challenges and Risks-Software-as-a-Service-Security Security Governance-Risk Management-Security Monitoring-Security Architecture Design-Data Security-Application Security-Virtual Machine Security-Identity Management and Access Control-Autonomic Security.

TEXTBOOKS:

1. Joshy Joseph & Craig Fellenstein, "Grid Computing", PHI, PTR-2003(UNIT I)
2. Kai Hwang, Geoffrey C Fox,Jack G Dongarra "Distributed and Cloud Computing ,From parallel processing to the Internet of Things" Morgan Kaufmann Publishers,2012(Unit-II to Unit-V)

REFERENCE BOOKS:

1. John W.Rittinghouse and James F.Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, 2010
2. Toby Velte, Anthony Velte, Robert Elsenpeter,"Cloud Computing, A Practical Approach", TMH, 2009.
3. Kumar Saurabh,"Cloud Computing –Insights into New-Era Infrastructure ", Wiley India, 2011
4. George Reese, "Cloud Applications Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly.
5. https://benzology.files.wordpress.com/2013/05/grid-computing-joshy-joseph-ebook.pdf

6.http://cloudipedia.com/files/2009/11/cloud_computing_made_easy.pdf

BCS702	MOBILE AND PERVASIVE COMPUTING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Networks, Distributed Computing, Data ware Housing and Data Mining.				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

This course discuss about knowledge and skills about a new trend in mobile Computing.

COURSE OUTCOMES (COs)

CO1	Explain the concepts and features of mobile networks.
CO2	Explain the working of wireless communication protocols.
CO3	Compare the routing protocols of mobile networks.
CO4	Explain the transport and application layer protocols of mobile networks.
CO5	Outline the basics of pervasive computing.
CO6	Learn the Concept of GSM,GPRS.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		H									M
	CO2	M		H									
	CO3			H					M				
	CO4			H									M
	CO5	M		M									
	CO6								M				

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I MOBILE NETWORKS 9

Cellular Wireless Networks–GSM–Architecture–Protocols–connection establishment–FrequencyAllocation–Routing–Mobility Management–Security–GPRS.

UNIT II WIRELESS NETWORKS 9

Wireless LANs and PANs–IEEE 802.11 Standard–Architecture–Services–Network–HiperLAN–BlueTooth-Wi-Fi–WiMAX.

UNIT III ROUTING 9

Mobile IP–DHCP–AdHoc– Proactive and Reactive Routing Protocols–MulticastRouting.

UNIT IV TRANSPORT AND APPLICATION LAYERS 9

Mobile TCP–WAP–Architecture–WWW Programming Model–WDP –WTLS–WTP–WSP–WAE–WTAArchitecture–WML–WMLScripts.

UNIT V PERVASIVE COMPUTING 9

Pervasive computing infrastructure applications- Device Technology - Hardware, Human machineInterfaces, Biometrics, and Operating systems– Device Connectivity–Protocols, Security, and DeviceManagement-pervasive Web Application architectureAccess from PCs and PDAs - Access via WAP.

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", PHI, Second Edition, 2003.
2. Jochen Burkhardt, Pervasive Computing: Technology and Architecture of MobileInternet Ap plications, Addison Wesley Professional; 3rd edition 2007.

REFERENCES:

1.Frank Adelstein, Sandeep KS Gupta, Golden Richard, Fundamentals of Mobile andPervasive C omputing, McGraw-Hill 2005

2. Debashis Saha, Networking Infrastructure for Pervasive Computing: EnablingTechnologies, Kluwer Academic Publisher, Springer; 1st edition, 2002

3. Introduction to Wireless and Mobile Systems by Agrawal and Zeng, Brooks/ Cole(Thomson Learning),1st edition, 2002

4.Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, Principlesof Mobile Computing, Springer, New York, 2003.

5.http://media.techtarget.com/searchMobileComputing/downloads/Mobile_and_pervasive_comp uting_Ch06.pdf

BCS 703	**WEB TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Networks, Distributed Computing, Internet Programming				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

This course discuss about various concepts using to develop web programming.

COURSE OUTCOMES (COs)

CO1	To understand the concepts of common gateway interface (CGI) programming.
CO2	To Learn about socket program.
CO3	Implementation of on-line applications.
CO4	Explain About Server Side Programming.
CO5	To Learn about XML Concepts.
CO6	Learn the Concept of Socket Programming.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H									
	CO2	M		H		M							M
	CO3			H									
	CO4			H									M
	CO5	M				H							
	CO6	L		M		M							M
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT- I INTRODUCTION 9

Internet principles – Basic Web concepts – Client/Server model – Retrieving data from Internet – HTML and Scripting Languages – Standard Generalized Markup language-Next Generation Internet - Protocols and applications.

UNIT- II COMMON GATEWAY INTERFACE PROGRAMMING 9

HTML forms – CGI concepts – HTML tags Emulation – Server-Browser communication – Different Types of Browsers- E-mail generation – CGI client side Applets – CGI Server side Applets – Authorization and Security.

UNIT- III SOCKET PROGRAMMING 9

Streaming – Networking Principles – Sockets – Protocols handlers – Content handlers – Multicasting – Remote method invocation.-Activation-Serialization-Marshal streams.

UNIT- IV SERVER SIDE PROGRAMMING 9

Dynamic Web content – Cascading Style Sheets, XML – Structuring Data-VRML-Server side includes- communication – Active and Java Server Pages.-Firewalls-Proxy Servers-XML with HTML.

UNIT –V ON-LINE APPLICATIONS 9

Simple applications – On-line Databases – Monitoring user events – Plugins – Database Connectivity-Internet information Systems-EDI application in business-Internet commerce-Customization of Internet commerce.

TEXT BOOKS:

1. Paul Deitel, "Internet & World Wide Web: How to Program", Prentice Hall, 4th Edition, 2007.
2. E-Business and E-Commerce Management : S: Strategy, Implementation and Practice by Dave Chaffey, Pearson Education,2013.

REFERENCE BOOKS:

1. Jeff Frantzen and Sobotka, "Java Script", Tata McGraw Hill, 2002.
2. Eric Ladd, Jim O'Donnell, "Using HTML 4, XML and JAVA", Prentice Hall of India – QUE, 1999.
3. N.P.Gopalan&J.Akilandeswari, "Web Technology: A Developer's Perspective", PHI Learning,2008.
4. http://www.icrar.org/__data/assets/pdf_file/0010/1439686/Web-Technology.pdf

BCS704	ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS	L	T	P	C
	Total Contact Hours - 45	4	0	0	4
	Prerequisite –Data Structures, Design and Analysis of Algorithm.				
	CourseDesigned by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The purpose of this course is to impart concepts of Artificial Intelligence and Expert System.

COURSE OUTCOMES (COs)

CO1	Describe the modern view of AI as the study of agents that receive percepts from the Environment and perform actions.
CO2	Demonstrate awareness of informed search and exploration Methods.
CO3	Explain about AI techniques for knowledge representation, planning and uncertainty Management.
CO4	Develop knowledge of decision making and learning Methods.
CO5	Describe the use of AI to solve English Communication problems.
CO6	Explain the concept Knowledge Representation.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H		H								
	CO2	M			H		M						M
	CO3				H		M	M					
	CO4		M		H								M
	CO5	M			H		H						
	CO6	L	M		M		M						H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT- I PROBLEMS AND SEARCH 12

What is artificial intelligence? - Problems, problem spaces and search – Searching strategies- Uninformed Search- breadth first search, depth first search, uniform cost seart, depth limited search, iterative deepening search, bidirectional search - Informed Search- Best first search ,Greedy Best first search , A* search – Constraint satisfaction problem , Local searching strategies.

UNIT- II REASONING 12

Symbolic Reasoning Under Uncertainty- Statistical Reasoning - Weak Slot-And-Filler-Structure - Semantic nets – Frames- Strong Slot-And-Filler Structure-Conceptual Dependency-Scripts-CYC.

UNIT- III KNOWLEDGE REPRESENTATION 12

Knowledge Representation - Knowledge representation issues - Using predicate logic - Representing Knowledge Using Rules. Syntactic- Semantic of Representation – Logic & slot and filler - Game Playing – Minimal search- Alpha beta cutoffs –Iteratic deepening planning – component of planning system – Goal stack planning.

UNIT- IV NATURAL LANGUAGE PROCESSING 12

Natural Language Processing –Syntactic processing, semantic analysis-Parallel and Distributed AI-Psychological modeling- parallelism and distributed in reasoning systems – Learning - Connectionist Models – Hopfield networks, neural networks

UNIT- V EXPERT SYSTEMS 12

Common Sense –qualitative physics, commonsense ontologies- memory organization -Expert systems –Expert system shells- explanation – Knowledge acquisition -Perception and Action – Real time search- robot architecture.

TEXT BOOKS

1. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3/e, Tata McGraw Hill, 2009.
2. Russell , " Artificial intelligence :A modern Approach , Pearson Education ,3rd edition,2013

REFERENCE BOOKS

1.Artificial Intelligence and Expert system by V.Daniel hunt, Springer press,2011.
2. Nilsson N.J., "Principles of Artificial Intelligence", Morgan Kaufmann.1998.
3**.** http://www.ggu.ac.in/download/Class-Note13/Artificial%20Intelligence%20and%20Expert%20System24.10.13.pdf

BCS7L1	GRID AND CLOUD COMPUTING LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	3	2
	Prerequisite –Distributed Computing, Operating Systems, Grid and Cloud Computing.				
	Lab Manual Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

Be exposed to tool kits for grid and cloud environment.

- Be familiar with developing web services/Applications in grid framework
- Learn to run virtual machines of different configuration.

COURSE OUTCOMES (COs)

CO1	Use the grid and cloud tool kits.
CO2	Design and implement applications on the Grid.
CO3	Design and Implement applications on the Cloud.
CO4	Connect Multiple System Using Zonal Server and JVishwa
CO5	Implement the Theorem using Naive Bayes Approach.
CO6	Implement the Virtual Machine.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H	M	M	M						H	
	CO2			H					M	M			H
	CO3	M											
	CO4		M	M								H	
	CO5				M	M							M
	CO6	M	M	H					M			M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Connecting Zonal Server with JVishwa.
2. Find the Prime Number for largest interval using Grid Computing.
3. Calculate the Matrix multiplication using Grid Computing.
4. Find procedure to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time Find the missing dataset using hadoop and map reduce.
5. Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine Classification using Naïve bayes approach.
6. Install a C++ compiler in the virtual machine and execute a sample program.
7. Show the virtual machine migration based on the certain condition from one node to the other.
8. Find procedure to install storage controller and interact with it.
9. Write a word count program to demonstrate the use of Map and Reduce tasks.

BCS7L2	WEB TECHNOLOGYLABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	3	2

	Prerequisite –Internet Programming ,Fundamental of Computing and Programming
	Lab Manual Designed by – Dept. of Computer Science and Engineering.

OBJECTIVES

Demonstrate the role of languages like HTML, DHTML, CSS, XML, Javascript, ASP and protocols in the workings of the web and web applications.

COURSE OUTCOMES (COs)

CO1	Develop web pages using HTML, DHTML and Cascading Styles sheets
CO2	Develop web pages using HTML, DHTML and Cascading Styles sheets.
CO3	Develop a dynamic web pages using JavaScript (client side programming).
CO4	Develop an interactive web applications using ASP.NET.
CO5	Build and consume web services.
CO6	Develop a Program using XML.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H									
	CO2	M		H		M							M
	CO3			H									
	CO4			H									M
	CO5	M				H							
	CO6	L		M		M							M

3	Category	Humanities & Social Studies	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS

1. Create a HTML page, which has properly aligned paragraphs with image along with it.
2. Write a program to display list of items in different styles.
3. Create both client side and server side image maps.
4. Create your own style sheets and use them in your web page.,
5. Create a form with various fields and appropriate front and validations using any one of the scripting languages.
6. Write a program to store the form fields in a database, use any appropriate Server Slide Scripting.
7. Create a web page using XML.
8. Write a program to connect a XML web page to any database engine.

BCS7P1	TERM PAPAER	L	T	P	C
	Total Contact Hours - 60	0	0	4	2
	Prerequisite –Mini Project				
	Lab Manual Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

To teach the student the procedures and methodologies for understanding the literature survey and preparation for research paper.

COURSE OUTCOMES (COs)

CO1	To identify the area of research.
CO2	To prepare list of literatures in the relevant area.
CO3	Compile the abstract from the literatures.
CO4	Focus the search to a well-defined theme and title.
CO5	Make and exhaustive report by compiling all the literatures that student surveyed.
CO6	To prepare a research paper for publications in journal/conference proceedings.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H	M	M	M	H	H		M	H
	CO2		H	H	H	H			H	H			H
	CO3		H	M	H	M			H	H		M	H
	CO4	M	M	M	H	M	H	L	H	H			M
	CO5		H		H	M			M	M		H	H
	CO6	M	M	H	H	H	M	M	H	H		M	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
									√
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF TASKS

1. **PREPARING PROPOSAL**
   Proposed Research Topic
   Purposes
   Background
   Method: (suggested Methods – develop your own to suit your research topic)

2. **CONDUCTING LITERATURE REVIEW**
   Exploring and Sharpening your Topic
   Evaluating Information

Taking Notes and Keeping Records

3. **COMPLETING ANNOTATED BIBLIOGRAPHY**
   Citing Your Sources and Avoiding Plagiarism
   Writing and Annotated Bibliography

4. **IDENTIFYING PROBLEM STATEMENT**
   Meeting the Challenges of Research
   Developing New Information

5. **COMPLETING OUTLINE FOR THE RESEARCH**
   Organizing Your Project into an outline
   Pick up your critique paper and begin editing and incorporate the suggestions from guide

6. **SUBMITTING FIRST DRAFT**
   Drafting your Project
   Entering Conversations and Supporting Your Claims

7. **SUBMITTING WORKS CITED**
   Create the individual citations
   Apply the formatting rules

8. **SUBMITTING FULL PAPER**
   Revising, Editing, and Proofreading
   Designing and Presenting Your Project
   Conducting Research in the Disciplines
   Documenting Sources

REFERENCES:

1. Website.
2. Printed Journals.

BCS8C1	**COMPREHENSION II**	**L**	**T**	**P**	**C**
	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses upto eighth semester				
	Course Designed by – Dept. of Computer Science &Engineering				

OBJECTIVES

- To provide a complete review of Computer Science &Engineering topics covered up to eighth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to eighth semester.

BCS8P1	PROJECT WORK	L	T	P	C
	Total Contact Hours –18 hours per week	0	0	18	9
	Prerequisite –Term paper				
	Course Designed by – Dept. of Computer Science &Engineering.				

OBJECTIVES

- Learn to work as a member of a project team.
- Understand project management tasks.
- Develop a hardware / software solution for a real-time, industry relevant problem.

COURSE OUTCOMES (COs)

CO1	Apply knowledge of basic science and engineering to Computer Science &Engineering problems
CO2	Implement the simple applications and verify using modern simulation tools.
CO3	Identify, formulate, and model engineering equipment
CO4	Recognize the real world applications and to solve with core engineering knowledge.
CO5	Analyze and work on multidisciplinary tasks
CO6	Choose latest tools, software and equipment to solve real world problems

CORE ELECTIVE – I

BCS001	PARALLEL COMPUTING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Organization and Architecture, Operating Systems				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

- To know about the components and building block hypothesis of Genetic algorithm.
- To understand the features of neural network and its applications.

COURSE OUTCOMES (COs)

CO1	Be able to reason about ways to parallelize a problem.
CO2	Be able to evaluate a parallel platform for a given problem.
CO3	Become familiar with programming with MPI and Vector processor.
CO4	Given a problem, develop an efficient parallel algorithm to solve it.
CO5	Have knowledge of sufficient theoretical background to be able to reason about the behaviour of neural networks.
CO6	Describe different parallel architectures; inter-connect networks, programming models, and algorithms for common operations such as matrix-vector multiplication.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H		H								H
	CO2		H	M	H								
	CO3	L	M		H								M
	CO4												
	CO5		M	H	M								

	CO6	M		M	H									H
3	Category	Humanities & Social Studies		Basic Sciences &Maths		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
									√					
4	Approval	37th Meeting of Academic Council, May 2015												

UNIT-I PARALLEL COMPUTING MODELS &PROGRAM 9

The State of Computing. Multiprocessors & Multi computers, Multi vector & SIMD Computers, PRAM&VLSI Models, Architectural Development Tracks, Conditions of Paralleling Programming, Partitioning & Scheduling, Programming flow mechanism. Systems interconnect Architecture.

UNIT-II PARALLEL COMPUTER PERFORMANCE 9

Performance Metrics & Measures, Parallel Processing Application, Speedup performance laws, Scalability analysis &approaches.Processors& memory hierarchy.Advanced processor technology. Superscalar & Vector processes, Memory hierarchy technologies. Virtual Memory Technology.

UNIT-III BUS, CACHE, MEMORY & PIPELINING TECHNIQUES 9

Backup bus system, Cache memory organization. Shared memory organization, Sequence & Weak consistency models. Linear pipeline processes - nonlinear pipeline processes. Instruction pipeline design, arithmetic pipeline design, Superscalar & Super pipeline design.

UNIT-IV MULTIPROCESSORS & MULTI COMPUTERS 9

Multiprocessor system interconnects. Cache coherence & synchronous mechanisms, Three generation of multi computers.Message-passing mechanism.Principles of multithreading, Fine-grained multi' computers, Callable& Multithreaded architecture, Dataflows Hybrid architecture.

UNIT-V SOFTWARE FOR PARALLEL PROGRAMMING 9

Parallel programming models, parallel layers & compilers, dependency analysis of data arrays, code optimization & scheduling, Loop parallelization & pipelining, Multiprocessor mix design goals.

TEXTBOOKS:

1. Kai Hwang, "Advanced Computer Architecture, Parallel Scalability Programmability"- Tata McGraw Hill,2012.
2. Parallel computing: theory and practice, Michael Quinn, TMH Edition, 2002.
3. **http://www-users.cs.umn.edu/~karypis/parbook/Lectures/GK-CS5451/Chapter%202%20-%20Parallel%20Programming%20Platforms.pdf**

BCS002	DATA SCIENCE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3

	Prerequisite –
	Course Designed by – Dept. of Computer Science and Engineering.

OBJECTIVES

Develop in depth understanding of the key technologies in data science and business analytics: data mining, machine learning, visualization techniques, predictive modeling, and statistics.

COURSE OUTCOMES (COs)

CO1	Demonstrate knowledge of statistical data analysis techniques utilized in business decision making.
CO2	Apply principles of Data Science to the analysis of business problems
CO3	Use data mining software to solve real-world problems.
CO4	Employ cutting edge tools and technologies to analyze Big Data.
CO5	Demonstrate use of team work, leadership skills, decision making and organization theory.
CO6	Recognize and analyze ethical issues in business related to intellectual property, data security, integrity, and privacy.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M		H				M		H	H
	CO2								M				
	CO3	M				H				M		H	H
	CO4		M	H						M			
	CO5					M							M
	CO6	L	M	H		H			M	H		M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			

4	Approval	37th Meeting of Academic Council, May 2015

UNIT- I INTRODUCTION TO DATA SCIENCE 9

Data Science - Data Scientist- scope of Data Science: the open data movement, science, business, government, education, and sport-Introduction to the R data analysis environment-Formulating data-centric answers to scientific, business and social questions-Best practices: organizing projects, managing collaborations and expectations.

UNIT –II DATA MANAGEMENT 9

Database SQL, data cleaning, normalization, feature selection -creation spectral-decompositions and dimensionality reduction. Exploratory Data Analysis- Data scraping-cleaning and summarization-Visualization I: visualizing to explore-Exploration in scale: introduction to map reduce.

UNIT-III COMPUTATIONAL AND STATISTICAL DATA ANALYSIS 9

Descriptive-dataquality-Exploratory-statistics-correlation-ANOVA-Inferential-theoryof generalization-sampling-statistical-testing-Predictive-supervised-unsupervised-machine learning-exploration to inference- quantifying variation and uncertainty- Linear modeling- regression and prediction- visualizing inferences and uncertainty

UNIT- IV HASHING AND ASSOCIATION RULES 9

Introduction - Frequent item sets and Association rules - Locality Sensitive Hashing - Theory of Locality Sensitive Hashing - Dimensionality Reduction: SVD and CUR - Web spam and Trust Rank, Random Walks with Restarts - Large-Scale Machine Learning: Support Vector Machines - Large-Scale Machine Learning: Decision

UNIT-V GRAPH TEXT MINING AND CLUSTERING 9

Methods and tools for pre-processing- indexing-querying-retrieval -ranking of text at the document - collection levels- Algorithms for text Foriented application in web and social network- Methods and tools for pre-processing graphs- Community mining methods-graph clustering methods(MinFcut, Spectral, Clustering).

TEXTBOOKS:

1. 1. Introduction to Data Science, with Introduction to R Jeffrey Stanton 2012.
2. Georg Hager, Gerhard Wellein, Introduction to High Performance Computing, CRC Press, 2011.

REFERENCES:

1. Wagner, S., Steinmetz, M., Bode, A., Müller, M.M. (Eds.),, High Performance Computing in Science and Engineering, Garching/Munich, Springer Verlog, 2010.

2. https://ischool.syr.edu/media/documents/2012/3/DataScienceBook1_1.pdf

BCS003	SOFTWARE RELIABILITY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Software Engineering				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

- To explain how system reliability can be measured and how reliability growth models can be used for reliability prediction.
- To describe safety arguments and how these are used.
- To discuss the problems of safety assurance.
- To introduce safety cases and how these are used in safety validation.

COURSE OUTCOMES (COs)

CO1	To understand the software reliability and its various model.
CO2	To understand the metrics used for software reliability and maintainability.
CO3	To understand the fault detection and correction approaches used in developing quality software.
CO4	To understand the design principles for achieving higher reliable software system.

CO5	Apply reliability estimation methods.
CO6	Review the basics of software reliability

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	H	H	H	M		M	H	M	H	H
	CO2		H			H							
	CO3			H	H				H	M	H	M	M
	CO4					M							
	CO5	M	M	M	M		M		M	H		H	
	CO6		M	H		H				H	M		H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			

4	Approval	37th Meeting of Academic Council, May 2015

UNIT- I INTRODUCTION TO RELIABILITY 9

Reliability - Repairable and Non Repairable systems - Maintainability and Availability - Designing for higher reliability - Redundancy - MTBF - MTTF MDT - MTTR- k out of in systems.

UNIT- II SOFTWARE RELIABILITY 9

Software reliability - Software reliability Vs Hardware reliability - Failures and Faults - Classification of Failures - Counting - System Configuration - Components and Operational Models - Concurrent Systems - Sequential Systems - Standby Redundant systems.

UNIT- III FAULT DETECTION 9

Fault Avoidance - Passive Fault detection - Active Fault Detection - Fault Tolerance - Fault Recovery - Fault Treatment.

UNIT –IVSOFTWARE RELIABILITY MODELLING 9

Introduction to Software Reliability Modeling - Parameter Determination and Estimation - Model Selection - Markovian Models - Finite and Infinite failure category Models - Comparison of Models - Calendar Time Modeling

UNIT- V SPECIAL TOPICS IN SOFTWARE RELIABILITY 9

Management Techniques for reliability - Organization and Staffing - Programming Languages and Reliability - Computer Architecture and Reliability - Proving Program correctness & Reliability Design - Reliability Testing - Reliability Economics.

TEXT BOOKS:

1. John D. Musa, "Software Reliability", McGraw Hill, 1985

2. Glenford J. Myers, "Software Reliability", Wiley Interscience Publication, 1976
3. Michael Berthold, David J. Hand," Intelligent Data Analysis", Springer, 2007.

REFERENCES:

1. Patric D. T.O Connor, "Practical Reliability Engineering", 4th Edition, John Wesley & sons, 2003.
2.*http://2014.issre.net/sites/2014.issre.net/files/Tutorial_Williams_Slides.pdf*

CORE ELECTIVE – II

BCS004	**VHDL**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Digital Computer Fundamentals, System Modelling and Simulation.				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The At the end of this course, students should be able to:

- Code in VHDL for synthesis.
- Decompose a digital system into a controller (FSM) and datapath, and code accordingly.
- Write VHDL test benches.
- Synthesize and implement digital systems on FPGAs.
- Understand behavioral, non-synthesizable VHDL and its role in modern design.

COURSE OUTCOMES (COs)

CO1	Understand and use major syntactic elements of VDHL - entities, architectures, processes, functions, common concurrent statements, and common sequential statements.
CO2	Design combinational logic in a variety of styles including: structural VHDL, and behavioral VHDL, as well as demonstrate an awareness of timing and resource usage associated with each approach.
CO3	Create a VDHL test bench and use it to test/verify a sequential VHDL design of moderate complexity.
CO4	Draw for a given commented VHDL code of moderate complexity, a corresponding RTL level block diagram.
CO5	Create Combinational logic design - Schematic and VHDL.
CO6	Use of test benches, timing constraints, optimization trade-offs.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H		H								H
	CO2		H	M	H		M						
	CO3	L	M		H				M	M			M
	CO4							L					
	CO5		M	H	M		L				M		
	CO6	M		M	H								H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT- IINTRODUCTION TO VHDL **9**

Introduction to VHDL - VHSIC Program - VHDL as a standard - Learning VHDL - VHDL Terms - Traditional Design Methods - Behavioral Modeling -Introduction - Transport verses Inertiai Delay - Simulation Deltas - Drivers -Sequential Processing Process Statement - Signal Assignment versus Variable Assignment - Sequential statements - Wait statements Concurrent Assignment Problem - Passive Processes.

UNIT- II DATA TYPES **9**

Data Types - Object Types - Data types - File type caveats Subprograms and packages - Subprograms - Packages Predefined Attributes - Value kind attributes - Function kind attributes - Signal kind attributes - type kind attributes - Range kind attributes.

UNIT- III CONFIGURATIONS **9**

Configurations - Default Configurations - Component Configurations -Mapping Library Entities - Generic in Configurations - Generic value specification in Architecture - Generic specification in Configurations - Board socket - chip analogy - Block configurations Architecture configurations - Advanced Topics- Register Transfer level description- Constraints-Attributes - Technology Libraries-Synthesis-VHDL Synthesis.

UNIT -IV DESIGN FLOW AND SIMULATION **9**

High Level Design Flow- RTL Simulation -VHOL Synthesis functional Gate Level Verification - Place and Route - Post Layout Timing Simulation Static Timing - Top Level System.
Design - CPU Design - Top - Level system Operation - instructions - sample Instruction Representation - CPU -Top - Level Design.

UNIT- V VITAL ARCHITECTURE **9**

CPU: Synthesis Description - ALU, Comp, Control, Reg. Register array Shift, TRIREG-CPU: RTL Simulation-Test benches - CPU Simulation - CPU: Synthesis Results - Place and Route process-placing and routing the Device-CPU: VITAL Simulation - VITAL Library - VITAL Simulation Overview- VITAL Implementation Simple VITAL Model -VITAL Architecture - SDF File – Back - Annotated Simulation.

TEXT BOOKS:

1. Douglas Perry, “VHDL”, McGraw Hill, 3rd Edition, 1999
2. J. Bhasker, “A VHDL Primer”, Pearson Education, 3rd Edition, 2005.

REFERENCE:

1. http://www.edutechlearners.com/download/books/A%20VHDL%20Primer%20-%20Jayaram%20Bhasker.pdf

BCS005	BIG DATA ANALYTICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Data Structures, Data Ware Housing and Data Mining				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The basics of Analytics – Concepts, Data preparation – merging, managing missing numbers sampling, Data visualization, Basic statistics.

COURSE OUTCOMES (COs)

CO1	Be able to analyze a problem for NN solution in terms of these Methods.
CO2	Have an awareness of the computational theory underlying NN.
CO3	Have a working knowledge of a typical neural network simulation
CO4	Experience in programming NN applications from scratch.
CO5	Have knowledge of sufficient theoretical background to be able to reason about the behaviour of neural networks.
CO6	Have knowledge of sufficient theoretical background to be able to reason about the behaviour of neural networks.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H		H							H
	CO2		M									M	
	CO3		M			H							H
	CO4	M					H					M	
	CO5			M		M							M
	CO6					H							M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			

4	Approval	37th Meeting of Academic Council, May 2015

UNIT- IINTRODUCTION TO BIG DATA **9**

Analytics – Nuances of big data – Value – Issues – Case for Big data – Big data options Team challenge – Big data sources – Acquisition – Nuts and Bolts of Big data. Features of Big Data - Security, Compliance, auditing and protection - Evolution of Big data – Best Practices for Big Data Analytics - Big data characteristics - Volume, Veracity, Velocity, Variety – Data Appliance and Integration tools – Greenplum – Informatica.

UNIT- II DATA ANALYSIS **9**

Evolution of analytic scalability – Convergence – parallel processing systems – Cloud computing –grid computing – map reduce – enterprise analytic sand box – analytic data sets – Analytic Methods –analytic tools – Cognos – Micro strategy - Pentaho. Analysis approaches – Statistical significance –business approaches – Analytic innovation – Traditional approaches – Iterative

UNIT- III STREAM COMPUTING 9

Introduction to Streams Concepts – Stream data model and architecture - Stream Computing, Sampling data in a stream – Filtering streams – Counting distinct elements in a stream – Estimating moments – Counting oneness in a window – Decaying window – Real time Analytics Platform(RTAP)applications IBM Infosphere – Big data at rest – Infosphere streams – Data stage – Statistical analysis– Intelligent scheduler – Infosphere Streams.

UNIT- IV PREDICTIVE ANALYTICS AND VISUALIZATION 9

Predictive Analytics – Supervised – Unsupervised learning – Neural networks – Kohonen models –Normal – Deviations from normal patterns – Normal behaviours – Expert options – Variable entry -Mining Frequent itemsets - Market based model – Apriori Algorithm – Handling large data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques –Hierarchical – K- Means – Clustering high dimensional data Visualizations - Visual data analysistechniques, interaction techniques; Systems and applications.

UNIT- V FRAMEWORKS AND APPLICATIONS 9

IBM for Big Data – Map Reduce Framework - Hadoop – Hive - – Sharding – NoSQL Databases - S3 -Hadoop Distributed file systems – Hbase – Impala – Analyzing big data with twitter – Big data for Ecommerce– Big data for blogs.

TEXT BOOKS:

1. Frank J Ohlhorst, "Big Data Analytics: Turning Big Data into Big Money", Wiley and SAS BusinessSeries, 2012.
2. Colleen Mccue, "Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis",Elsevier, 2007
3. Michael Berthold, David J. Hand," Intelligent Data Analysis", Springer, 2007.

REFERENCES:

1. AnandRajaraman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge UniversityPress, 2012.
2. **http://www.mosaic.geo-strategies.com/wp-content/uploads/2013/10/Big-Data-for-Dummies.pdf**

BCS006	SOFTWARE QUALITY ASSURANCE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Software Engineering				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The Objective of this Course is covers the foundations of software quality assurance and the development of appropriate quality assurance strategies via the application of current standards, models and measurement techniques.

COURSE OUTCOMES (COs)	
CO1	Understand standards, models and techniques aimed at achieving quality assurance in a variety of software development environments.
CO2	Research, consolidate and present large amounts of information related to appropriate quality assurance techniques and be able to make recommendations for management strategies.
CO3	Propose and defend innovative solutions to software quality assurance and measurement problems in the context of various software development environments.
CO4	Critically evaluate different software development environments and contexts with respect to the application of appropriate standards and models.
CO5	Evaluate leading edge approaches in software development and attendant quality assurance methodologies, presenting the research using Harvard referencing.
CO6	Understand and apply key quality assurance techniques tailored for specific software development environments.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	H	H	H	M		M	H	M	H	H
	CO2		H			H							
	CO3			H	H				H	M	H	M	M
	CO4					M							
	CO5	M	M	M	M		M		M	H		H	
	CO6		M	H		H				H	M		H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			

4	Approval	37th Meeting of Academic Council, May 2015

UNIT –I INTRODUCTION TO SQA 9

Introduction to software quality – Software modelling – Scope of the software quality program – Establishing quality goals – Purpose, quality of goals – SQA planning software – Productivity and documentation.

UNIT- II SOFTWARE QUALITY ASSURANCE PLAN 9

Software quality assurance plan – Purpose and Scope, Software quality assurance Management – Organization – Quality tasks – Responsibilities – Documentation.

UNIT- III STANDARDS 9

Standards, Practices, Conventions and Metrics, Reviews and Audits – Management, Technical review – Software inspection process – Walk through process – Audit process – Test processes ISO, CMM compatibility – Problem reporting and corrective action.

UNIT- IV METHODOLOGIES 9

Tools, Techniques and methodologies, Code control, Media control, Supplier control, Records Collection, Maintenance and retention, Training and risk management.

UNIT- V ISO MODELS **9**

ISO 9000 model, CMM model, Comparisons, ISO 9000 weaknesses, CMM weaknesses, SPICE – Software process improvement and capability determination.

TEXT BOOKS:

1. Mordechai Ben – Meachem and Garry S.Marliss, "Software Quality – Producing Practical, Consistent Software", International Thompson Computer Press, 1997.
3. Watt. S. Humphrey, "Managing Software Process", Addison – Wesley, 1998.

REFERENCES:

1. Philip.B.Crosby, "Quality is Free: The Art of making quality certain", Mass Market, 1992.
2.http://www.cipl.net.in/courses/PDF/QA.pdf

CORE ELECTIVE – III

BCS007	COMPUTER VISION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Data Structures, Design and Analysis of Algorithm				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

- To understand Hough Transform and its applications to detect lines, circles, ellipses.
- To understand three-dimensional image analysis techniques.
- To study some applications of computer vision algorithms.

COURSE OUTCOMES (COs)

CO1	To perform shape analysis and implement boundary tracking techniques
CO2	To apply chain codes and other region descriptors.
CO3	To apply Hough Transform for line, circle, and ellipse detections.
CO4	To implement motion related techniques.
CO5	To develop applications using computer vision techniques.
CO6	To apply 3D vision techniques.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H		H								H
	CO2		H	M	H		M				M		
	CO3	L	M		H				M				M
	CO4						L			M			
	CO5		M	H	M						H		
	CO6	M		M	H								H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT –I IMAGE PROCESSING FOUNDATIONS 9

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

UNIT- II SHAPES AND REGIONS 9

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT- III HOUGH TRANSFORM 9

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform – spatial matched filtering – GHT for ellipse detection – object location – GHT for feature collation .

UNIT- IV PREDICTIVE ANALYTICS AND VISUALIZATION 9

Methods for 3D vision – projection schemes – shape from shading – photometric stereo – shape from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion – triangulation – bundle adjustment – translational alignment – parametric motion – Spline based motion – optical flow – layered motion.

UNIT –VAPPLICATIONS 9

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians.

TEXT BOOKS:

1. E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012.
2. R. Szeliski, “Computer Vision: Algorithms and Applications”, Springer 20113.
3. Simon J. D. Prince, “Computer Vision: Models, Learning, and Inference”, Cambridge University Press, 2012.

REFERENCES:

1. D. L. Baggio et al., "Mastering Open CV with Practical Computer Vision Projects", Packet Publishing, 2012.
2.http://szeliski.org/Book/drafts/SzeliskiBook_20100903_draft.pdf

BCS008	BIO INSPIRED COMPUTING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Artificial Intelligence and Expert System				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

To learn how natural and biological systems influence computational field

COURSE OUTCOMES (COs)

CO1	Be able to explain how biological systems exploit natural processes.
CO2	Be able to visualize how complex and functional high-level phenomena can emerge from low-level interactions.
CO3	Be able to understand how large numbers of agents can self-organize and adapt.
CO4	Be able to design and implement simple Bio-inspired algorithms.
CO5	Students will explain how computational processes can be derived from natural models.
CO6	Students will be able to explain basic concepts of dynamical systems.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H		H			M		M		H
	CO2		M									M	
	CO3		M			H		L		M			H
	CO4	M					H		M			M	
	CO5			M		M					M		M
	CO6					H							M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			

4	Approval	37th Meeting of Academic Council, May 2015

UNIT- IINTRODUCTION **9**

What is Life? - Life and Information - The Logical Mechanisms of Life - What is Computation? Universal Computation and Computability - Computational Beauty of Nature (fractals, L-systems, Chaos) - Bio-inspired computing - Natural computing -Biology through the lens of computer science.

UNIT- IICOMPLEX SYSTEMS & ARTIFICIAL LIFE 9

Complex Systems and Artificial Life - Complex Networks - Self-Organization and Emergent Complex Behavior - Cellular Automata - Boolean Networks - Development and Morphogenesis - Open-ended evolution.

UNIT- IIINATURAL COMPUTATION AND NEURAL NETWORKS 9

Biological Neural Networks- Artificial Neural Nets and Learning - pattern classification & linear separability - single and multilayer perceptrons, backpropagation - associative memory - Hebbian learning - Hopfield networks - Stochastic Networks – Unsupervised learning.

UNIT- IVEVOLUTIONARY SYSTEMS AND ALGORITHMS 9

Evolutionary Programming: biological adaptation & evolution - Autonomous Agents and Self-Organization: termites, ants, nest building, flocks, herds, and schools. Genetic algorithms: Schema theorem - Reproduction-Crossover-Mutation operators.

UNIT VCOMPETITION, COOPERATION AND SWARM INTELLIGENCE 9

Collective Behavior and Swarm Intelligence - Social Insects - Stigmergy and Swarm Intelligence; Competition and Cooperation - zero- and nonzero-sum games - iterated prisoner's dilemma - stable strategies - ecological & spatial models - Communication and Multi-Agent simulation – Immuno computing.

TEXT BOOKS:

1. Leandro Nunes De Castro, Fernando Jose Von Zuben, "Recent Developments in Biologically Inspired Computing", Idea Group Publishing, 2005.
2. Leandro Nunes De Castro , "Fundamentals of Natural Computing: Basic concepts, Algorithms and Applications", Chapman & Hall/ CRC Computer & Information Science Series, 2006

REFERENCES:

1. Dario Floreano, Claudio Mattiussi, "Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies", MIT Press, 2008.
2. http://www.bioinspiredcomputation.com/self-archived-bookNeumannWitt.pdf
3. http://www.dschool.ir/files/__Bio_Inspired_Artificial_Intelligence__Theories__MethodsTechnologies__Intelligent_Robotics_and_Autonomous_Agents_.pdf

BCS009	REAL TIME SOFTWARE TESTING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Software Engineering, Software Quality Assurance.				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The Objective of this course student should know basic skills in software testing by implementing various strategies of software testing in their project. They need to bring out the ways and means of controlling and monitoring testing activity.

COURSE OUTCOMES (COs)

CO1	Understand the software test life cycle.

CO2	Understands the relationship between testing, software quality and other verification techniques the theoretical limits of software testing.
CO3	Test coverage measures such as statement, branch, and path coverage.
CO4	Design patterns for test automation.
CO5	Concepts and techniques for black-box and white-box testing.
CO6	The relationship between testing, software quality and other verification techniques.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	H	H	H	M		M	H	M	H	H
	CO2		H			H							
	CO3			H	H				H	M	H	M	M
	CO4					M							
	CO5	M	M	M	M		M		M	H		H	
	CO6		M	H		H				H	M		H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
						√			

4	Approval	37th Meeting of Academic Council, May 2015

UNIT –I TESTING BASICS **9**

Testing as an engineering activity –Role of process in software quality –Testing as a process – Basic definitions –Software testing principles –The tester's role in a software development organization –Origins of defects –Defect classes – The defect repository and test design –Defect examples –Developer / Tester support for developing a defect repository.

UNIT- IITEST CASE DESIGN **9**

Introduction to testing design strategies – The smarter tester – Test case design strategies – Using black box approach to test case design – Random testing – Equivalence class partitioning – Boundary value analysis – Other black box test design approaches – Black box testing and COTS – Using white box approach to test design – Test adequacy criteria – Coverage and control flow graphs – Covering code logic – Paths – Their role in white box based test design – Additional white box test design approaches – Evaluating test adequacy criteria.

UNIT- III LEVELS OF TESTING **9**

The need for levels of testing – Unit test – Unit test planning – Designing the unit tests – The class as a testable unit – The test harness – Running the unit tests and recording results – Integration tests – Designing integration tests – Integration test planning – System test – The different types – Regression testing – Alpha, beta and acceptance tests.

UNIT- IV TEST MANAGEMENT **9**

Basic concepts – Testing, debugging goals, policies – Test planning – Test plan components – Test plan attachments – Locating test items – Reporting test results – The role of three groups in test planning and policy development – Process and the engineering disciplines – Introducing the test specialist – Skills needed by a test specialist – Building a testing group.

UNIT- V CONTROLLING AND MONITORING **9**

Defining terms – Measurements and milestones for controlling and monitoring – Status meeting– Reports and control issues – Criteria for test completion – SCM –Types of reviews – Developing a review program – Components of review plans – Reporting review results.

TEXT BOOKS:

1. Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing: Principles and Practices", Pearson 2012.
2.Aditya P. Mathur, "Foundations of Software Testing", Pearson, 2008.
3.Paul Ammann, Jeff Offutt, "Introduction to Software Testing", Cambridge University Press, 2008.

REFERENCES:

1. Paul C. Jorgensen, "Software Testing: A Craftsman's Approach", Auerbach Publications, 2008.
2.http://www.tutorialspoint.com/software_testing/software_testing_tutorial.pdf

NON MAJOR ELECTIVE-I

BET407	DIGITAL SIGNAL PROCESSSING	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Engineering Mathematics-III, Electronic Circuits.				
	Course Designed by – Dept. of Electronics and Telecommunication Engineering				

OBJECTIVES

To familiarize the concepts of transform based continuous time and discrete time analysis of signals and systems.

COURSE OUTCOMES (COs)

CO1	Understand different types of signals- continuous and discrete, odd and even, periodic and aperiodic etc.
CO2	Analyze continuous time signals and systems by using appropriate mathematical tools like Fourier Transform.
CO3	Analyze sampling process and sampling of discrete time signals.
CO4	Analyze discrete time signals and systems by using appropriate mathematical tools like Fourier Transform.
CO5	Utilize standard signals such as sine, ramp, exponential to characterize systems.
CO6	To provide a foundation to the courses like communication, digital signal processing, control systems, instrumentation, and so on, that deal with signal and system concepts directly or indirectly.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	L										

	CO2	H		M	L								
	CO3	H			M								
	CO4	H	M										
	CO5	M		M									
	CO6	H	M		M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT -I DISCRETE – TIME SIGNALS AND SYSTEMS: 9

Sampling of Analogue signals – aliasing – standard discrete time signals – classification – discrete time systems – Linear time invariant stable casual discrete time systems – classification Methods – linear and circular convolution – difference equation representation – DFS, DTFT, DFT – FFT computations using DIT and DIF algorithms. Time response and frequency response analysis of discrete time systems to standard input signals.

UNIT II INFINITE IMPULSE RESPONSE DIGITAL FILTERS: 9

Review of design of analogue Butterworth and Chebyshev Filters, Frequency transformation in analogue domain – Design of IIR digital filters using impulse invariance technique – Design of digital filters using bilinear transform – pre warping – Frequency transformation in digital domain – Realization using direct, cascade and parallel forms.

UNIT III FINITE IMPULSE RESPONSE DIGITAL FILTERS: 9

Symmetric and Antisymmetric FIR filters – Linear phase FIR filters – Design using Frequency sampling technique – Window design using Hamming, Hanning and Blackmann Windows – Concept of optimum equiripple approximation – Realisation of FIR filters – Transversal, Linear phase and Polyphase realization structures.

UNIT IV FINITE WORD LENGTH EFFECTS: 9

Quantization noise – derivation for quantization noise power – Fixed point and binary floating point number representations – Comparison – Overflow error – truncation error – coefficient quantization error – limit cycle oscillations- signal scaling – analytical model of sample and hold operations.

UNIT V SPECIAL TOPICS IN DSP: 9

Discrete Random Signals- Mean, Variance, Co-variance and PSD – Periodiogram Computation – Principle of Multi rate DSP – decimation and Interpolation by integer factors – Time and frequency domain descriptions – Single, Multi stage, polyphase structures – QMF filters – Sub band Coding.

TEXT BOOK:

1. John G. Proakis and DimitrisG.Manolakis, 'Digital Signal Processing, Algorithms and Applications ', PHI of India Ltd., New Delhi 3rd Edition 2000.

REFERENCES:

1.SanjitK.Mitra 'Digital Signal Processing', A Computer Based Approach, Tata McGraw-Hill, New Delhi, 1998.Printing, Prentice Hall of India Pvt. Ltd., New Delhi, 1999.
2.https://users.dimi.uniud.it/~antonio.dangelo/MMS/materials/Guide_to_Digital_Signal_Process.pdf

BET702	CELLULAR MOBILE COMMUNICATION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Networks				
	Course Designed by – Dept. of Electronics and Telecommunication Engineering.				

OBJECTIVES
To import knowledge of signal processing techniques for wireless communication.

COURSE OUTCOMES (COs)

CO1	To introduce advanced wireless communication systems.
CO2	To learn the wireless channel characteristics and models.
CO3	Explain the various standards Wireless Communication.
CO4	Describe different propagation models.
CO5	Classify different Equalization & diversity techniques used in wireless communication.
CO6	Apply signal processing for wireless communication.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	W											
	CO2	H	M										
	CO3	M											
	CO4	H	M		M								
	CO5												
	CO6	M			M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		

4	Approval	37th Meeting of Academic Council, May 2015

UNIT-I INTRODUCTION TO WIRELESS MOBILE COMMUNICATIONS 9
History and evolution of mobile radio systems, Types of mobile wireless services/systems – Cellular, WLL, Paging, Satellite systems, Standard, Future trends in personal wireless systems.

UNIT-II CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS 9
Cellular concept and frequency reuse, Multiple Access Schemes, Channel assignment and handoff, Interface and system capacity, Trunking and Erlang capacity calculations.

UNIT-III MOBILE RADIO PROPAGATION 9

Radio wave propagation issues in personal wireless systems, Propagation models, Multipath fading and based and impulse models, Parameters of mobile multipath channels, Antenna systems in mobile radio.

UNIT-IV MODULATION AND SIGNAL PROCESSING 9

Analog and digital modulation techniques, Performance of various modulation techniques – Spectral efficiency, Error rate, Power Amplification, Equalization/Rake receiver concepts, Diversity and Space-time processing, Speech coding and channel coding.

UNIT-V SYSTEM EXAMPLES AND DESIGN ISSUES 9

Multiple Access Techniques – FDMA, TDMA and CDMA systems, Operational systems, Wireless networking, design issues in personal wireless systems.

TEXT BOOK:

1. K. Feher, Wireless Digital Communication, Prentice Hall of India, New Delhi, 1995.

REFERENCES:

1.T.S. Rappaport, Wireless Communication; Principles and Practice, Prentice Hall, NJ, 1996.
2. W.C.Y. Lee, Mobile Communication Engineering; Theory and Application, Second Edition, McGraw-Hill International, 1998.
3. http://www.wileyindia.com/media/pdf/0471457124.pdf

BBR701	**BIOSAFETY, BIOETHICS, IPR & PATENTS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Professional Courses				
	Course Designed by – Dept. of Genetics Engineering				

OBJECTIVES

To enable understanding chemical principles governing biochemical reactions.

COURSE OUTCOMES (COs)

CO1	Understand Handling of recombinant DNA process and products.
CO2	Biosafety assessment of biotech pharmaceutical products.
CO3	Understand the moral status of animal.
CO4	Understand the intellectual property rights.
CO5	Understand the patent registration.
CO6	Understand the Intellectual Property Rights.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M					M			H		H	
	CO2												
	CO3	H	H		M	H					M		M
	CO4												

	CO5	H	M	H							H		
	CO6	M			M	H							M
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
										√			
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT- IBIO SAFETY **9**

Introduction to Biosafety. Laboratory associated infections and other hazards, assessment of biological hazards and levels of biosafety, Handling of recombinant DNA processes and products in institutions and industries, biosafety assessment procedures in India and abroad.

UNIT- II BIO ETHICS **9**

Bioethics: Legality, morality and ethics, the principles of bioethics: autonomy, human rights, beneficence, privacy, justice, equity etc. Transgenics and Bioethics: Ecological safety assessment of recombinant organisms and transgenic crops, case studies of relevance (Eg. Bt cotton). Biosafetyassessment of biotech pharmaceutical products such as drugs / vaccines etc.

UNIT –III BIOTECHNOLOGICAL STUDIES **9**

Chronology of Biotechnological studies on animals – Law & legislation on animal experimentation in India and world Moral status of animals as objects of experiments –Moral responsibility of scientists over animal experiments. Personhood – Abortion – Bioethical issues in reproduction, population explosion and control – Voluntary euthanasia & physician assisted suicide – Organ donation & Transplantation.

UNIT- IV INTELLECTUAL PROPERTY RIGHTS **9**

Intellectual property rights (IPR), sovereignty rights, CBD, bioethics and agreement on trade and tariffs Indian sui-generis system for animal variety and farmer's rights protection act. WTO with reference to biotechnological affairs, TRIPs.

UNIT- V PATENTS **9**

General Introduction: Patent claims, the legal decision, Basic Requirements of Patentability**:** Patentable subject matter, novelty and the public domain, non-obviousness Special issues in Biotechnology Patents**:** Disclosure requirements, Collaborative research, Competitive research, Recent Developments in Patent System and Patentability of biotechnological inventions.

TEXT BOOKS

1. BAREACT, Indian Patent Act 1970 Acts & Rules, Universal Law Publishing Co. Pvt. Ltd.,2007
2. Kankanala C., Genetic Patent Law & Strategy, 1st Edition, Manupatra, Information Solution Pvt. Ltd., 2007
3. S.S.Kanka Entrepreneurship Development, S.Chand and Co, New Delhi 1997

REFERENCE BOOKS

1. Beier, F.K., Crespi, R.S. and Straus, T. Biotechnology and Patent protection-Oxford and IBH Publishing Co. New Delhi.
2. Sasson A, Biotechnologies and Development, UNESCO Publications.
3. Singh K, Intellectual Property rights on Biotechnology, BCIL, New Delhi
4. Regulatory Framework for GMOs in India (2006) Ministry of Environment and Forest, Government of India, New Delhi.
5. Cartagena Protocol on Biosafety (2006) Ministry of Environment and Forest, Government of India, New Delhi.
6. **https://cld.pt/dl/download/ddb72433-6067-4e74-91de-ff3e08700b64/1%C2%BA%20Ano/Introdu%C3%A7%C3%A3o%20%C3%A0%20Engenharia%20Biol%C3%B3gica/Outros/Bioprocess%20Engineering%20Principles%20-%20Livro.pdf**

BBM405	BIOSENSORS AND TRANSDUCERS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Biology for Engineers.				
	Course Designed by – Dept. of Bio Medical Engineering.				

OBJECTIVES

- Understand the purpose of measurement, the Methods of measurements, errors associated with measurements.
- Know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications.

COURSE OUTCOMES (COs)

CO1	Describe the purpose and Methods of measurements.
CO2	Explain different display and recording devices for various applications.
CO3	Know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications
CO4	Remember and understand the concepts, types, working and practical applications of important biosensors.
CO5	Know some of the commonly used biomedical transducers.
CO6	Know the different display and recording devices.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M	H	H	M	H			L	M	
	CO2	M	H	M	H	H	M	H			L	M	
	CO3	M	H	M	H	H	M	H			L	M	
	CO4	M	H	M	H	H	M	H			L	M	
	CO5	M	H	M	H	H	M	H			L	M	
	CO6	M	H	M	H	H	M	H			L	M	

3	Category	Humanities	Basic Sciences	Engg Sciences	Professional	Core El	Non-M	Open El	Project/
							√		

4	Approval		37th Meeting of Academic Council, May 2015

UNIT – I SCIENCE OF MEASUREMENT 9

Units and Standards - calibration Methods - statics calibration - classification of errors, error analysis - statistical Methods - odds and uncertainty.

UNIT – II CHARACTERISTICS OF TRANSDUCERS 9

Static characteristics - accuracy, precision, sensitivity, linearity etc - mathematical model of transducers - zero first - order and second - order transducers - response to impulse step, ramp and sinsoidal inputs.

UNIT – III VARIABLE RESISTANCE TRANSDUCERS 9

Principle of operation, construction details, characteristics and applications of resistance potentiometers, strain gauges, resistance thermometers, thermistors, hot-wire aneometer, piezoresistive sensors and humidity sensors.

UNIT – IV BIOSENSORS - PHYSIOLOGICAL RECEPTORS - J RECEPTORS 9

Chemoreceptors, Baroreceptors, Touch receptors, Biosensors - Working Principle and Types, Applications.

UNIT – V OTHER TRANSDUCERS 9

Piezoelectric tranducers, magnetostrictive transducer, IC sensor digital transducers - smart sensor - fibre optic transducers.

TEXT BOOKS:

1. Doeblin. E. O, Measurment Systems, McGraw Hill Book Co. 1998
2. Renganathan S, Transducer Engineering, Allied Publishers, Chennai,2000.
3.https://www1.ethz.ch/lbb/Education/Biosensors/Lecture_1_overview.pdf

BBM054	**BIOINFORMATICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Biology for Engineers.				
	Course Designed by – Dept. of Bio Medical Engineering.				

OBJECTIVES

- To introduce Bioinformatics-Elementary commands and Protocols, ftp, telnet, http. Primer on information theory

COURSE OUTCOMES (COs)

CO1	To learn bioinformatics and the protocols.
CO2	To learn Strings-Edit distances two strings-string similarity local alignment gaps-parametric sequence alignments.
CO3	To have a clear view on Amino acid substitution matrices PAM and BLOSSUM.
CO4	To learn Ultrasonic trees-parsimony-Ultrametric problem-perfect phylogeny-phylogenetic alignment.
CO5	To DNA Mapping and sequencing-Map alignment-Large scale sequencing.

CO6		DNA Mapping and sequencing-Map alignment-Large scale sequencing and alignment.											
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H									
	CO2			H	H		M						
	CO3		M		H		H						
	CO4	H	M		H								`
	CO5			H		H							
	CO6												
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective	Project/Term Paper/ Seminar/ Internship (PR)		
									√				
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT – I WHAT IS BIOINFORMATICS 9

Scope of Bioinformatics-Elementary commands and Protocols, ftp, telnet, http.Primer on information theory.

UNIT – II SEQUENCING ALIGNMENT AND DYNAMIC PROGRAMMING 9

Introduction-Strings-Edit distance two strings-string similarity local alignment gaps-parametric sequence alignments-suboptimal alignments-multiple alignment-common multiple alignment Methods.

UNIT – III SEQUENCE DATABASE AND THEIR USE 9

Introduction to databases-database search-Algorithms issues in database search-sequence database searchFASTA-BLAST-Amino acid substitution matrices PAM and BLOSSUM.

UNIT – IV EVOLUTIONARY TREES AND PHYLOGENY 9

Ultrasonic trees-parsimony-Ultrametric problem-perfect phylogeny-phylogenetic alignment-connection between multiple alignment and tree construction.

UNIT – V SPECIAL TOPICS IN BIOINFORMATICS 9

DNA Mapping and sequencing-Map alignment-Large scale sequencing and alignment-Shotgun-DNA sequencing-Sequence assembly-Gene predictions-Molecular predictions with DNA strings.

TEXT BOOK:

1. R.D.Lele '"Computer in Medicine" Tata McGraw Hill, Newyork, 1999.

REFERENCES:

1. S.K.Chauhan "PC Organisation", S.K.Kataria and Sons, Delhi 2000.
2. Harold Sackamn "Bio Medical Information Technology", Academic Press, New York.
3.**https://www.lehigh.edu/~inbios21/PDF/Fall2008/Lopresti_11142008.pdf**

NON MAJOR ELECTIVE-II

BET603	TELECOMMUNICATION SWITCHING NETWORKS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Networks				
	Course Designed by – Dept. of Electronics and Telecommunication Engineering.				

OBJECTIVES

- To impart knowledge on basics of antenna theory.
- To study antenna arrays.
- To study aperture antennas.
- To learn special antennas such as frequency independent and broad band antennas.

COURSE OUTCOMES (COs)

CO1	Define various antenna parameters**.**
CO2	Analyze radiation patterns of antennas.
CO3	Evaluate antennas for given specifications.
CO4	Illustrate techniques for antenna parameter measurements.
CO5	Discuss radio wave propagation.
CO6	To understand various techniques involved in various antenna parameter measurements.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M									
	CO2	H	H	L	L								
	CO3	M	M	H	M	L							
	CO4	M		L									
	CO5	H	M										
	CO6	M		M		M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT –I SWITCHING SYSTEMS 9

Introduction-Message switching-Circuit switching-Manual switching-Functions of switching system- Strowger step by step system-Register translator-Senders-Distribution frames-Cross bar systems-General trunking-Electronic switching-Reed electronic systems-Digital switching systems.

UNIT- II TIME DIVISION SWITHING 9

Introduction-Space and time switching-Time division switching networks-grades of services-Time division switching networks-non blocking networks-synchronization.

UNIT –III TELECOMMUNICATION TRAFFIC 9

Introduction-Unit of traffic-Congestion-Traffic measurement-A mathematical model-Local call systems-Queuing systems.

UNIT –IV TELECOMMUNICATION SIGNALLING 9

Introduction-Customer line signaling- Audio frequency junction and trunk circuits-FDM carrier systems-PCM signaling- Inter register signaling- Common channel signaling principles-CCITT signaling, CCITT signaling, Digital customer line signaling.

UNIT-V TELECOMMUNICATION NETWORKS 9

Introduction-Analog networks-Integrated digital networks-Integrated service digital networks-Cellular radio networks-Intelligent networks-Private networks-numbering-charging-Routing-Network management.

TEXTBOOK:

1. J.E FLOOD, "telecommunication switching,traffic and networks" Pearson education.

REFERENCE BOOKS:

1. T.V.SWAMINATHAN, telecommunication switching system &networks, PHI.
2.**http://www.newagepublishers.com/samplechapter/000969.pdf**

BET605	TELECOMMUNICATION SWITCHING AND SYSTEM MODELLING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – System Modelling and Simulation, Computer Networks				
	Course Designed by – Dept. of Electronics and Telecommunication Engineering.				

OBJECTIVES

- To impart knowledge on basics of microwave electron beam devices and their applications in X band frequency.
- To study Microwave semiconductor devices & applications
- To become familiar with the concepts of Microwave Integrated Circuits.
- To know the concepts of Microwave Measurements.

COURSE OUTCOMES (COs)

CO1	Describe the various waveguide components.
CO2	Classify the microwave tubes (Linear beam tubes and Crossed field tubes)
CO3	Discuss the various microwave semiconductor devices as oscillators for their Performance.
CO4	Design of waveguide components and microwave transmission lines for a given set of parameters.
CO5	Identify the measurement techniques for different parameters like VSWR, impedance, frequency, power of microwave sources and loads.
CO6	Understand Microwave sources and amplifiers.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	L										
	CO2	H	M										
	CO3	M	L										
	CO4	M	H	M	L								
	CO5	H	M	M	H								
	CO6	M	M	L	M								
3	Category	Humanities & Social Studies (HS)		Basic Sciences	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
										√			
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT-I SIMULATION 9

Simulation of Random Variables and Random Process Generation of random number and sequences, Gaussian and uniform random numbers, Correlated random sequences, Testing of random numbers generators, Stationary and uncorrelatedness, Goodness of fit test.

UNIT-II MODELING OF COMMUNICATION SYSTEMS 9

Radio frequency and optical sources, Analog and Digital signals, Communication channel and models, Free space channels, Multipath channel and discrete channel noise and interference.

UNIT-III ESTIMATION OF PERFORMANCE MEASURE FOR SIMULATION 9

Quality of estimator, Estimation of SNR, Probability density function and bit error rate, Monte Carlo method, Importance sampling method, Extreme value theory.

UNIT-IV SIMULATION AND MODELING METHODOLOGY 9

Simulation environment, Modeling considerations, Performance evaluation techniques, Error source simulation Validation.

UNIT-V CASE STUDIES 9

Simulations of QAM digital radio link in a fading environment Light wave communication link and satellite system.

TEXT BOOKS:

1. MC.Jeruchim, P.Balaban and K.Samshanmugam, "Simulation of Communication Systems, Plenum press, New York, 1992.
2. Averill.M.Law and W.David Kelton, "Simulation Modeling and Analysiso, McGraw-Hill, 1991.

REFERENCES

1.Geoffrey Gorden, "System Simulation", Prentice Hall of India, 2nd Edition, 1992.

2.W.Turin, "Performance Analysis of Digital Communication Systems", Computer Science Press, New York, 1990.
3.Jerry banks and John S.Carson, "Discrete Event System Simulation", Prentice Hall of India, 1984.
4.http://publications.rwth-aachen.de/record/59063/files/Herzberg_Dominikus.pdf

BBA001	PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Management				
	Course Designed by – Department of Management Studies				

OBJECTIVES

- Familiarize the students with the fundamental concepts of Management and to highlight the approaches in organization behavior

COURSE OUTCOMES (COs)

CO1	Understanding the concepts of Management
CO2	Knowledge on Management Functions
CO3	Understanding the Organization Theory & Approach.
CO4	Knowledge on the Concepts of Motivation
CO5	Clear insight on the factors contributing to discipline
CO6	In-depth Understanding about the concepts of Group Behavior

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					H					H	
	CO2		H		M					H			
	CO3	M							M		H		
	CO4			M	H							H	
	CO5							M					
	CO6				H								L

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT -I NATURE OF MANAGEMENT 9

Definition – theory and practice – effective management – Management : Science of Art – Management in India. Development of Management thoughts – Taylor's – Henry Fayol –

Hawthrone experiment – Barnard & Social system – Herbert Simon – Peter Drucker – Various approaches – Management thoughts.

UNIT- II MANAGEMENT PROCESS 9

Co-ordination – Functions of management – Managers and environment – External and internal Business Ethics – Planning – Fundamentals – Definitions & Features – Steps in planning – types of planning – Objectives – Concepts and features – Hierarchy of objectives – role – Process of MBO – Policy & Strategy – Decision making process – Individual Vs Group Decisions.

UNIT- III ORGANIZATION STRUCTURE 9

Organizing – Theory & Approach –Authority & Responsibility – Delegation – Centralization & Decentralization – Line & Staff Relationship – Staffing – Fundamentals – System approach – Manpower Planning – Recruitment & Selection – Training and development – Performance appraisal – Direction – Fundamentals Motivation – Theories of Motivation-Maslow's Hersberg'sMaClelland's theory X,Y & Z leadership – Theories and Styles – Communication – Type – Controlling – System and Process.

UNIT- IV ORGANIZATIONAL BEHAVIOUR 9

Definition – Organization – Managerial Role and Functions – Organizational Approaches, Individual behaviour – Causes – Environmental effect – Behaviour and performance, perception – Organizational implications, Personality – Contributing factors – Dimension, Motivation – Need Theories – Process Theories – Job satisfaction, Learning and Behaviour – Learning Curves, Work Design and Approaches.

UNIT -V GROUP BEHAVIOUR 9

Groups – Contributing factors –Group Norms, types – Causes – Intergroup relations – Conflict and Resolution – Change Process –Resistance to change.

TEXT BOOKS:

1. Herald Knootz and Heinz weihrich, 'Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition, 2004.
2. Ties AF, Stoner and R. Edward Freeman, "Management" Prentice Hall of India Pvt. Ltd., New Delhi -110011, 1995.

REFERENCE BOOKS :

1. Joseph I. Massie 'Essentials of Management', Prentice Hall of India Pvt. Ltd., New Delhi -110011, 2004.
2. L.M. Prasad "Principles and Practice of Management", Sultan Chand & Sons.2001
3. Uma Sekaran, "Organizational Behaviour", Tata McGraw Hill, 2007.
4. https://www.extension.harvard.edu

BBM604	DIGITAL AND MEDICAL IMAGE PROCESSING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Mathematics-III, Computer Graphics and Multimedia Systems.				
	Course Designed by – Dept. of Bio Medical Engineering.				

OBJECTIVES

The aim of the courses to show how to extract, model, and analyze information from medical data and

application in order to help diagnosis , treatment and monitoring of diseases through computer sciences.													
COURSE OUTCOMES (COs)													
CO1	Have a Fundamental Knowledge of digital image processing with Fourier transforms.												
CO2	Acquire knowledge about the image sampling, Modeling and quantization.												
CO3	Have a fundamental knowledge of image enhancement, its process and types of filters used in image processing.												
CO4	Have knowledge about image analysis, classification and reconstruction of act and MRI image												
CO5	Acquire the skills in the transmission of biological images.												
CO6	Understand the concept of Data compression.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			S	M			M				M
	CO2		H	M									
	CO3	M			H						H		
	CO4			H		H		M					
	CO5		H	M							H		
	CO6	M				H							M
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)		Project/Term Paper/ Seminar/ Internship
									√				
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT-I DIGITAL IMAGE FUNDAMENTAL 9

Elements of digital image processing systems, Elements of Visual perception, Image formation model, Image sampling and quantization, aliasing, zooming and shrinking of digital images. Monochrome Vision Model, Colour Vision Model. Image transforms –Discrete Fourier transform, Properties of Fourier transform, Fast Fourier transform and inverse fast Fourier transform.

UNIT-II IMAGE FUNDAMENTALS 9

Image sampling and quantization, Matrix and Singular Value representation of discrete images Image pre-processing, point operation, Histogram modelling, spatial operations, transform operations.

UNIT-III IMAGE ENHANCEMENT 9

Enhancement by point processing –Simple intensity transformation –Histogram processing – Image subtraction –Image averaging.Spatial filtering –Smoothing filters, sharpening filters. Enhancements in frequency domain-Low pass filtering –High pass filtering.

UNIT-IV IMAGE ANALYSIS, CLASSIFICATION AND RECONSTRUCTION OF ACT AND MRI IMAGES 9

Image analysis, Spatial feature extraction, edge detection, Image segmentation. Image reconstruction from projections, Random transform, filter back projection algorithm, reconstruction of CT images, Imaging Methods in MF images, fourier reconstruction of MRI.

UNIT-V TRANSMISSION OF MEDICAL IMAGES 9

Medical Image, data compression of transmission, transform coding, pixel Coding, predictive coding, Interference coding.

TEXT BOOKS:

1. KavyanNajarian and Robert Splerstor "Biomedical Signals and Image Processing", CRC – Taylor and Francisn, New York, 1991.
2. John L. Semmlow, "Biosignal and Biomedical Image Processing Matlab Based applications" Marcel Dekker Inc., New York, 2004.

REFERENCES:

1. .**http://www.cs.uu.nl/docs/vakken/ibv/reader/readerINFOIBV.pdf**

BBM604	**MEDICAL INFORMATICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Computer Organization and Architecture, Computer Graphics and Multimedia Systems.				
	Course Designed by – Dept. of Bio Medical Engineering.				

OBJECTIVES

To learn about the historical information of hospitality and recent trends in the Hospital information system.

COURSE OUTCOMES (COs)

CO1	Have Knowledge about the historical information of hospital.
CO2	Have a well-founded knowledge of overview of computer hardware used in the Hospital Information system.
CO3	Have a fundamental knowledge of Hospital Information system.
CO4	Have a skill about the visual programming and multimedia information.
CO5	Acquire the skills integrated medical information system.
CO6	Understand the concept of Computer Peripheral devices.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				M			M				M
	CO2			M									
	CO3	M			H								
	CO4					H		M			H		
	CO5	M		M			M						
	CO6			M							M		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT-I BIOMEDICAL INFORMATION SYSTEM 9

Historical Highlights of health care information system-Biomedical information system-problems and pitfalls-History and evolution of Electronic resources, Multimedia components.

UNIT-II OVERVIEW OF COMPUTER HARDWARE 9

Motherboard and its logic-Memory and I/O interfacing/memory and input output mapping-I/O peripherals and Add-on cards.

UNIT-III HOSPITAL INFORMATION SYSTEM 9

Concept of HIS its position in hospital-introduction of a computerized HIS Automation of medical record-cost and Benefits of HIS-Modems and Networking in Hospitals.

UNIT-IV VISUAL PROGRAMMING AND MULTIMEDIA INFORMATION 9

Visual Basic Principles and Programming-Design, Production and Testing of Multimedia based HIS.

UNIT-V INTEGRATED MEDICAL INFORMATION SYSTEM 9

Integration of inter and intra hospital information system. Role of expert systems-web based Multimedia information system-Video-conferencing-PowerPoint Presentation.

TEXT BOOK:

1. R.D.Lele '"Computer in Medicine" Tata McGraw Hill, NewYork, 1999.

REFERENCES:

1. S.K.Chauhan "PC Organisation", S.K.Kataria and Sons, Delhi 2000.
2. Harold Sackamn "Bio Medical Information Technology", Academic Press, NewYork.
3.http://www2.hawaii.edu/~nreed/ics691BMI2/discpapers/handbookMICh7.pdf

NON MAJOR ELECTIVE-III

BET301	PRINCIPLES OF ANALOG AND DIGITAL SYSTEM	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Digital Computer Fundamentals, Electronics Circuits.				
	Course Designed by – Dept. of Electronics and Telecommunication Engineering.				

OBJECTIVES

To familiarize students with various techniques for amplitude modulation and demodulation of analog signals.

COURSE OUTCOMES (COs)	
CO1	Develop the Student's ability to determine the effects of receiver frequency and phase errors in synchronous modulation systems.
CO2	To familiarize students with techniques for generating and demodulating narrow-band and wide-band frequency and phase modulated signals.
CO3	To familiarize students with basic techniques for generating and demodulating pulse code modulated signals.
CO4	To familiarize students with issues pertaining to the transmission of digital signals over bandwidth-limited communication channels.
CO5	To familiarize students with the fundamentals of analog and digital communication systems.
CO6	Provide students with tools for communication signal analysis.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M										
	CO2	H	M	S	L								
	CO3	H	H										
	CO4	H	M	M									
	CO5	M	M										
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
							√		

4	Approval	37th Meeting of Academic Council, May 2015

UNIT-I OP-AMP FUNDAMENTALS AND APPLICATIONS 9

Introduction to op-amp : op-amp symbol - terminals - packages - specifications - block diagram representation - ideal op-amp - practical op-amp - open-loop and closed-loop configurations. Practical Limitations of op-amp circuits: Bias and offset currents / offset voltage - frequency compensation and stability - slew rate - CMRR. Op-amp applications: Instrumentation amplifier - - clipper and clamper circuits – LP HP BP and BR filters.

UNIT- II OP-AMP OSCILLATORS AND DATA CONVERSION DEVICES 9

Op-amp oscillators: positive feedback and Barkhausen criterion - Wien Bridge oscillator - phase shift oscillator - square / triangle / ramp function generator. Single-chip oscillators: VCO and its applications - 555 timer (Astable & Monostable operation) and its applications. Data converters: Performance specifications - D/A conversion circuits(R-2R & inverted R-2R Ladder D/A converters) - A/D conversion circuits (Successive approximation, dual slope and flash A/D converters).

UNIT –III DIGITAL DESIGN PRINCIPLES 9

Number systems: Binary codes: Weighted binary codes - non-weighted codes - error-detecting codes - error-correcting codes - alphanumeric codes. Boolean algebra and Logic simplification :

Basic theorems and properties of Boolean algebra – DeMorgan's theorems - canonical and standard forms - universal property of NAND & NOR gates - minimization of logic functions, SOPs & POSs representations, minimization of Boolean expressions using algebraic, k-map and tabular Methods - minimization of multiple output functions.

UNIT- IV COMBINATIONAL & SEQUENTIAL SYSTEM DESIGN 9

Arithmetic functions: Basic adders - subtractors - carry look-ahead adder - decimal adder - magnitude comparator. MSI Logic circuits : Decoders - Encoders - Multiplexers - DeMultiplexers - Code converters - Parity generators/checkers - implementation of combinational functions using MUX, DeMUX, decoders and code converters. Flip-flops: RS flip-flop - T flip-flop - D flip-flop - JK flip-flop - Master-Slave flip-flops - IC flip-flops - their truth table and excitation table. Shift Registers: SISO, SIPO, PISO and PIPO shift registers - bidirectional and universal shift registers. Counters: Asynchronous counter operation - Synchronous counter operation - up/down synchronous counter - ring counter - shift register counter.

UNIT –V MEMORY AND PLDS 9

Introduction to memories: Memory types and terminology - general memory operation. Read-only-Memory: ROM architecture - ROM types - ROM timing - ROM applications. Read/Write Memory: RAM architecture - Static RAM - Dynamic RAM - expanding word size and capacity. PLDs: Fundamentals of PLD - SPLDs - PAL - GAL - Introduction to CPLDs and FPGAs

TEXT BOOKS

1. Floyd and Jain, "Digital Fundamentals", Pearson Education, 8th edition, 2007
2. Morris Mano, "Digital Design", Pearson Education 3rd edition.
3. Ramakant A. Gayakwad, "op-amps and Linear Integrated Circuits", Pearson Education, 4th Edition

REFERENCES

1. John F. Wakerly, "Digital design - Principles and Practices", Prentice Hall International, 3rd edition, 2001
2. Ronald J.Tocci, Neal S.Widmer, "Digital Systems - Principles and Applications", Pearson Education, 8th edition, 2001
3. William I. Fletcher, "An Engineering Approach to Digital Design", Prentice Hall of India, 1980
4. Theodore F.Bogart. Jr, "Introduction to digital circuits", Tata McGraw-Hill International, 1992
5. Coughlin & Driscull, "Operational Amplifiers & Linear Integrated Circuits", Pearson Education, 6th edition, 2003.
6. **http://www.ie.itcr.ac.cr/mmunoz/Comunicaciones/IISem08/Libros%20y%20Documentaci%F3n/Modern%20Digital%20and%20Analog%20Communication%20(BP%20Lathi,3rd%20ed)%20.pdf**

BEC405	LINEAR INTEGRATED CIRCUITS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Digital Computer Fundamentals, Electronics Circuits.				
	Course Designed by – Dept. of Electronics and Communication Engineering.				

OBJECTIVES

- Analyze and design differential amplifier and current sources.
- Enable the students to analyze AC and DC characteristics of operational amplifier.

COURSE OUTCOMES (COs)

CO1	Explain the various current mirror circuits and analyze differential amplifier with active load.
CO2	Describe the characteristics, linear and nonlinear application of operational amplifier.
CO3	Analyze the internal modules of PLL, Analog Multiplier and review its applications.
CO4	Discuss the different types of data convertor architectures.
CO5	Review the special function ICs and its application.
CO6	Understand the concept and applications of ADC and DAC.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	L										
	CO2	M											
	CO3	H	M	M									
	CO4	M											
	CO5	M											
	CO6		M	M									

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective	Project/Term Paper/ Seminar/ Internship (PR)
							√		

4	Approval	37th Meeting of Academic Council, May 2015

UNIT-I BIASING CIRCUITS AND OPERATIONAL AMPLIFIER 9

Current mirror and current sources, Current sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads,Operational Characteristics- Frequency response characteristics - Stability limitations -Frequency Compensation-Slew rate.

UNIT-II APPLICATION OF OPERATIONAL AMPLIFIERS 9

Inverting and Non-inverting amplifiers - Voltage Follower - Summing amplifier - Differential amplifier-Log and antilog amplifier - Instrumentation amplifier - Integrator and Differentiator - Voltage to Current converter - Sinusoidal Oscillators - Active filters(butterworth) - Types- Sample and Hold circuit - Precision diode Half Wave and Full wave rectifiers - . Comparator - Zero crossing detector -Active peak detector, Clipper and Clamper - Square and Triangular waveform generators.

UNIT-III PHASE LOCKED LOOP AND ANALOG MULTIPLIERS 9

556 Voltage Controlled Oscillator -Basic principles of PLL - Basic components- Functional Block Schematic-. Derivations of expressions for Lock and Capture ranges- PLL Applications:

Frequency Synthesis - Frequency Translation - AM and FM detection. Analog Multipliers- Variable Trans conductance Multiplier- Log Antilog Multiplier- Time Division Multiplier- variable Conductance Multiplier.

UNIT-IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTORS 9

Digital to Analog converters - Binary weighed and R-2R Ladder types - Analog to digital converters - Continuous - Counter ramp, successive approximation, single, dual slope and parallel types - DAC/ADC performance characteristics and comparison.

UNIT-V APPLICATION OF ICs 9

555 Timer Functional block diagram and description - Monostable and Astable operation - Applications - - ICL 8038 Function generator IC - IC voltage Regulators: Three terminal Regulator, General purpose regulators-MA780, LM380 Power Amplifier- Isolation Amplifier, Optocoupler ICs

REFERENCES:

1. Roy Choudhury and Shail Jain "Linear Integrated Circuits", New Age Science, 2010.
2. Ramakant A. Gayakwad, "OP - AMP and Linear IC's ", Prentice Hall, 2002.
3. Sonde, B.S, ―Introduction to System Design using Integrated Circuits‖, Second Edition, Wiley Eastern Limited, New Delhi, 1994.
4. Michael Jacob J., "Applications and Design with Analog Integrated Circuits ", Prentice Hall of Inida, 1996.
5. Robert F Coughlin and Fedrick F Driscoll ―Operational amplifiers and linear Integrated Circuits‖, 6th edition, Prentice Hall of India, New Delhi, 2006.
6. Richard J. Higgins "Electronics with Digital and Analog Integrated Circuits‖, Prentice Hall of India, New Delhi, 1983.
7. Millman J. and Halkias C.C., " Integrated Electronics ", McGraw Hill, 2001.
8. **http://ishuchita.com/Books/Linear%20Integrated%20Circuits%20%20by%20%20Roychodhary.pdf**

BET703	SATELLITE COMMUNICATION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Digital Signal Processing				
	Course Designed by – Dept. of Electronics and Telecommunication Engineering.				

OBJECTIVES

- To enable the student to become familiar with satellites and satellite services.
- Study of satellite orbits and launching.
- Study of earth segment and space segment components
- Study of satellite access by various users.
- Study of DTH and compression standards.

COURSE OUTCOMES (COs)

CO1	Define orbital mechanics and launch methodologies.
CO2	Describe satellite subsystems.
CO3	Design link power budget for satellites.
CO4	Compare competitive satellite services.
CO5	Explain satellite access techniques.

CO6	Understand the concept of LEO,GEO and MEO.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M			H								
	CO2	M	H	M									
	CO3	H	M	M	L								
	CO4	L	M		M								
	CO5												
	CO6	M	H	M	M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
							√		

4	Approval	37th Meeting of Academic Council, May 2015

UNIT-I SATELLITE ORBITS 9

Kepler‘s Laws, Newton‘s law, orbital parameters, orbital perturbations, station keeping, geo stationary and non-Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion

UNIT-II SPACE SEGMENT AND SATELLITE LINK DESIGN 9

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command. Satellite uplink and downlink Analysis and Design, link budget, E/N calculation-performance impairments-system noise, inter modulation and interference, Propagation Characteristics and Frequency considerations- System Reliability and design lifetime.

UNIT-III SATELLITE ACCESS 9

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, Assignment Methods, Spread Spectrum communication, compression – encryption.

UNIT-IV EARTH SEGMENT 9

Earth Station Technology-- Terrestrial Interface, Transmitter and Receiver, Antenna Systems TVRO, MATV, CATV, Test Equipment Measurements on G/T, C/No, EIRP, Antenna Gain. Case study: Design an Uplink and Downlink for a typical satellite

UNIT-VSATELLITE APPLICATIONS 9

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. Direct Broadcast satellites (DBS)- Direct to home Broadcast (DTH), Digital audio broadcast (DAB)- World space services, Business TV(BTV), GRAMSAT, Specialized services – E –mail, Video conferencing, Internet.

REFERENCES:

1. Dennis Roddy, Satellite Communication', McGraw Hill international, 4th Edition, 2006. Timothy Pratt, Charles Bostian& Jeremy Allmuti, "Satellite Communications", John Wiley & Sons. Second edition 2008.
2. N.Agarwal, _Design of Geosynchronous Space Craft, Prentice Hall, 1986.
3. Bruce R. Elbert, _The Satellite Communication Applications' Hand Book, ArtechHouse Bostan London, second edition 2004.
4. **http://sedighy.ir/wp-content/uploads/2014/10/ ebooksclub.org__Introduction_ to_Satellite_Communication__Artech_House_Space_Applications_.pdf**

BBM055	TELEMEDICINE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Computer Networks				
	Course Designed by – Dept. of Bio Medical Engineering.				

OBJECTIVES

To learn Ethical and legal issues of Telemedicine - Confidentiality and the law - Patient rights and consent - Access to medical Records.

COURSE OUTCOMES (COs)

CO1	To learn introduce telemedicine advancements in telemedicine .Benefits of tele medicine, Functional Block of a telemedicine system,Tele healthcare.
CO2	To learn Mobile hand held devices and mobile communication - Internet technology and telemedicine using World Wide Web - Video and audio conferencing.
CO3	To have a clear view on medical images diagnosis and treatment - Hospital information - Doctors, paramedics, facilities available.
CO4	To learn Protein Identification Resource(PIR) - Telemedicine in Neuroscience – Telecardiology – Teledermatology – Teleneurology
CO5	To learn Telemedicine technology and Health care delivery for rural population - Use of telemedicine technology for clinical diagnostic study.
CO6	To learn Video Conferencing techniques.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M								
	CO2		H	H	M		M						
	CO3		M				H			M			H
	CO4	H			H						H		`
	CO5			H		H							
	CO6						M						M

3	Category	Humanities & Social Studies	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		

4	Approval	37th Meeting of Academic Council, May 2015

UNIT- I FUNDAMENTALS OF TELEMEDICINE 9

History and advancements in telemedicine - Benefits of telemedicine – Functional Block of a telemedicine system - Tele-healthcare and E-medicine - Use of computers in distance mode of healthcare delivery - Familiarizing with technology of telemedicine – scanner, electro stethoscope - data reception equipment - Scope for telemedicine - Cyber laws related to telemedicine - Telemedicine access to health care services - Limitations of telemedicine.

UNIT- II COMMUNICATION SYSTEMS AND NETWORKS IN TELEMEDICINE 9

Communication infrastructure for telemedicine - LAN and WAN technology - Satellite communication - Mobile hand held devices and mobile communication - Internet technology and telemedicine using World Wide Web - Video and audio conferencing - Types of information - Audio, Video, Still images, Text and data, fax - Types of communication and network - PSTN, POTS, ANT, ISDN, Internet, Wireless communication - GSM satellite, and Microwave – Signal Modulation techniques - Data compression and transfer - Capturing Medical Signals - Types of antennas depending on requirements, Integration and operational issues - System integration, store –and - forward operation, Real-time Telemedicine – Remote Sensing.

UNIT- III DATA EXCHANGE, MANAGEMENT, SECURITY AND STANDARDS IN TELEMEDICINE 9

Network Configuration - circuit and packet switching - H. 320 series (Video phone based ISBN) - T. 120, H.324 (Video phone based PSTN) - Encryption - Cryptography - Mechanisms of encryption - phases of Encryption - Protocols - TCP/IP, ISO-OSI Standard - DICOM, HL7 - Medical information storage and management for telemedicine - Patient information medical history - Test reports, medical images diagnosis and treatment - Hospital information - Doctors, paramedics, facilities available - Pharmaceutical information – Information Security and confidentially of medical records and access control

UNIT- IV APPLICATIONS OF TELEMEDICINE 9

Introduction - Archives - Electronic Documentation - Business aspects - Common Access to Biological Resources and Information (CABRI) - Database indexing and search terms - Nucleic and genome databases - Molecular data base and servers - Array express - Gateway to archives - Sequential retrieval system - Protein Identification Resource(PIR) - Telemedicine in Neuroscience – Telecardiology – Tele dermatology – Teleneurology – Tele ophthalmology – Telepathology – Teleoncology – Telepediatrics – Telepharmacy – Telepsychiatry and mental health – Teleradiology – Telesurgery – Veterinary – Other specialties

UNIT V ETHICAL ASPECTS AND CASE STUDIES IN TELEMEDICINE 9

Ethical and legal issues of Telemedicine - Confidentiality and the law - Patient rights and consent - Access to medical Records - Consent treatment - Jurisdictional Issues - Intellectual property rights - Telemedicine technology and Health care delivery for rural population - Use of telemedicine technology for clinical diagnostic study - Conceptual frame work on home telemedicine.

TEXT BOOKS

1. Olga (EDT) Ferrer – Roca, M.Sosa (EDT) Iudicissa Hand book of Telemedicine IOS press 2002.
2. A.C. Norris, Essentials of Telemedicine and Telecare John Sons & Ltd, 2002.
3. Marilyn J. Field, "A Guide to Assessing Telecommunications in Health Care",NATIONAL ACADEMY PRESS,1996.
4. Bashshur , R. L. , Sanders, J. H and Shannon, G. W.,"Telemedicine: Theory and Practice", Volume 27, Number 2,Springer Netherlands,1999,

REFERENCES

2. Norris, A.C. Essentials of Telemedicine and Telecare. Wiley (ISBN 0-471-53151-0), 2002
3. Wootton, R., Craig, J., Patterson, V. (Eds.), Introduction to Telemedicine. Royal Society of Medicine Press Ltd (ISBN 1853156779), 2006
4. Ferrer-Roca, O., Sosa-Iudicissa, M. (editors), Handbook of Telemedicine. IOS Press (Studies in Health Technology and Informatics, Volume 54). (ISBN 90-5199-413-3), 2002.
5. Simpson, W. 2006. Video over IP. A practical guide to technology and applications. Focal Press (Elsevier). ISBN-10: 0-240-80557-7.
6. **http://ebooks.iospress.nl/volume/current-principles-and-practices-of-telemedicine-and-e-health**

BBR404	**GENOMICS AND PROTEOMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Biology for Engineers				
	Course Designed by – Dept. of Genetics Engineering.				

OBJECTIVES

To learn Coding, non-coding chromosome and Applications of Proteome analysis- Proteomics in drug discovery.

COURSE OUTCOMES (COs)

CO1	Have Knowledge of Organization and structure of genomes, Genome Size.
CO2	Understand the Chromosomes Microdissection. Chromosomal mapping techniques.
CO3	To understand the Functional Genomics.
CO4	To understand the principle of Mass spectrometry
CO5	Have Knowledge about Functional genomics.
CO6	Have Knowledge about Proteomics.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L								
	CO5					M							
	CO6	M		M	L								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT –I INTRODUCTION TO GENOMICS 9

Organization and structure of genomes, Genome Size – Genome structure in Viruses and microbes, Coding, non-coding chromosomes and high order structures – Genomes relatedness.

UNIT- II PHYSICAL MAPPING TECHNIQUES 9

Chromosomes Microdissection.Chromosomal mapping techniques. Top down and bottom up approach – Linking and jumping of clones – Genome sequencing – Placing small fragments on map – STS assembly – Gap closure – Pooling strategies – Cytogenetic mapping techniques.

UNIT- III FUNCTIONAL GENOMICS 9

Gene finding – Annotation – ORF and functional prediction – Subtractive DNA library, screening –DNA sequencing -Hybridization techniques– Differential display and representational difference analysis – SAGE – TOGA., Analysis of RNA expression - Comparative genomics . Bioinformatics tools used in Genomics-

UNIT IV PROTEOMICS TECHNIQUES 9

Proteome – Bridging Genomics and Proteomics - Analysis of Proteome - Protein level estimation – Edman protein microsequencing – Protein cleavage – 2D gel electrophoresis – Metabolic labeling – Detection of proteins on SDS gels – Pattern analysis – Mass spectrometry – Principles of MALDI-TOF – Tandem MS-MS – Peptide mass fingerprinting.

UNIT V PROTEIN PROFILING 9

Post translational modification – Protein-protein interaction –Protein Chips – Applications of Proteome analysis- Proteomics in drug discovery- Phage antibodies as tools – Proteomics in plant genetics and breeding - Glycoprotein analysis –Phosphoprotein analysis- Genomics Vs Proteomics.

TEXT BOOKS

1. Primrose, S.B. and Twyman, R.H., "Principles of Genome Analysis and Genomics", Blackwell Publishing Co., 2003.
2. Liebler, D.C., "Introduction to Proteomics", Humana Press, 2002

REFERENCES

1. Pennington, S.R. and Dunn, M.J., "Proteomics", BIOS Scientific Publishers, 2001.
2. Hunt, S.P., Livesey, R. and Livesey, F.J., "Functional Genomics: A PracticalApproach" Oxford University Press, 2000.
3. Suhai S., "Genomics and Proteomics: Functional and Computational Aspects", Springer, 2000.

4. Cantor, C.R. and Smith, C.L., "Genomics: The Science and Technology Behind the Human Genome Project", Wiley and Sons, 1999.
5. Discovering Genomics, Proteomics, & Bioinformatics. Campbell &Heyer (2003) Pearson Education,ISBN:0-8053-4722-4.
6.Bioinformatics, Methods of Biochemical Analysis Series Vol. 43, Baxevanis& Ouellette (2001) John Wiley & Sons, ISBN 0-471-38391-0
7.Computational Molecular Biology.Pevzner, P.A. (2000) MIT Press, ISBN: 0262.
8.**http://authors.library.caltech.edu/9665/1/VAIieeecsm04.pdf**

OPEN ELECTIVE-I

BCS010	**TCP/IP PRINCIPLES AND ARCHITECTURE**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Computer Networks				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

To provide a solid foundation for understanding the communication process of the Internet exposure to fundamental concepts of computer networking in the context of the TCP/IP model and protocols.

COURSE OUTCOMES (COs)

CO1	Understand the principles of internetworking protocols.
CO2	Have aSummarize the functions of transport protocols.
CO3	Learn the concepts of routing
CO4	Learn the concept of Rlogin and UDP.
CO5	Have knowledge ofSubnetting and Supernetting.
CO6	Get an exposure to various next generation protocols in internetworking.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	L					H						M
	CO2		M				H						
	CO3	L	M										M
	CO4	M					M						
	CO5	L	M				M						M
	CO6		H				M						M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT- I INTRODUCTION 9

Protocols and standards - OSI model - TCP/ IP protocol suite - addressing -Version - Underlying technologies.

UNIT –II IP ADDRESSES, ROUTING, ARP AND RARP 9

Classful addressing - other issues - Subnetting - Supernetting - classless addressing - routing Methods - delivery - table and modules - CIDR - ARP package - RARP.

UNIT-III IP, ICMP, TGMP AND UDP 9

Datagram - fragmentation - options - checksum - IP package - ICMP - messages, formats - error reporting - query - checksum - ICMP package - IGMP - messages, operation - encapsulation - IGMP package - UDP - datagram - checksum - operation - uses - UDP package.

UNIT- IV TCP, UNICAST AND MULTICAST ROUTING PROTOCOLS 9

Services - flow, congestion and error control - TCP package and operation - state transition diagram - unicast routing protocols - RIP - OSPF - BGP - multicast routing - trees - protocols - MOSPF - CBT - PIM.

UNIT- V APPLICATION LAYER, SOCKETS 9

Client server model - concurrency - processes - sockets - byte ordering - socket system calls - TCP and UDP client-server programs - BOOTP -DHCP - DNS - name space, resolution - types of records - concept - mode of operation - Rlogin.

TEXT BOOKS:

1.Behrouz A. Forouzan, "TCP/IP Protocol Suite", 4th edition, McGraw Hill, 2013.
2.Douglas E. Comer, "Internetworking with TCP/IP: principles, protocols and architecture" (Volume1), 6th Edition, PHI Learning, 2013.

REFERENCES:

1. Douglas E. Comer, David L. Stevens, "Internetworking with TCP/IP, design, implementation and internals Volume 2, 3rdEdition, PHI Learning, 2009.
2. Ed Tittel, Laura Chappell, "TCP/IP", 1st Edition, Cengage Learning, 2008.
3. Dr. SidnieFeit, TCP/IP, architecture, protocols and implementation with IPv6 and IP Security, Tata McGraw-Hill, 2008.
4.**http://cpe.rmutt.ac.th/network/images/cn/[3]Comer_Douglas_Internetworking_with_TCP_IP_Vol.1.pdf**

BCS011	PERFORMANCE EVALUATION IN COMPUTER SYSTEMS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –System Simulation and Modelling ,Operating Systems				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

To understand the mathematical foundations needed for performance evaluation of computerSystems.

COURSE OUTCOMES (COs)

CO1	To understand the analytical modeling of computer systems.

CO2	Analyze a given problem for possibilities of parallel computations.
CO3	Select algorithms and hardware for the solution of high performance projects.
CO4	Use appropriate programming languages efficiently for scientific computations.
CO5	Program computers with shared and distributed memory architectures.
CO6	Run parallel programs on different hardware architectures and software environments.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M											H
	CO2	L	M										
	CO3		M	M					M	M			
	CO4	M											M
	CO5	M				M							H
	CO6	L		M					M				M

3	Category	Humanities & Social Studies	Basic Sciences &Maths	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT-I OVERVIEW OF PERFORMANCE EVALUATION 9

Need for Performance Evaluation in Computer Systems – Overview of Performance Evaluation Methods – Introduction to Queuing – Probability Review – Generating Random Variables for Simulation – Sample Paths, Convergence and Averages – Little's Law and other Operational Laws – Modification for Closed Systems.

UNIT-II MARKOV CHAINS AND SIMPLE QUEUES 9

Discrete-Time Markov Chains – Ergodicity Theory – Real World Examples – Google, Aloha – Transition to Continuous-Time Markov Chain – M/M/1 and PASTA.

UNIT-III MULTI-SERVER AND MULTI-QUEUE SYSTEMS 9

Server Farms: M/M/k and M/M/k/k – Capacity Provisioning for Server Farms – Time Reversibility and Burke's Theorem – Networks of Queues and Jackson Product Form – Classed and Closed Networks of Queues.

UNIT-IV REAL-WORLD WORKLOADS 9

Case Study of Real-world Workloads – Phase-Type Distributions and Matrix-Analytic Methods – Networks with Time-Sharing Servers – M/G/1 Queue and the Inspection Paradox – Task Assignment Policies for Server Farms.

UNIT-V SMART SCHEDULING IN THE M/G/1 9

Performance Metrics – Scheduling Non-Preemptive and Preemptive Non-Size-Based Policies - . Scheduling Non-Preemptive and Preemptive Size-Based Policies – Scheduling - SRPT and Fairness.

TEXT BOOKS

1. MorHarchol - Balter, "Performance Modeling and Design of Computer Systems – Queueing Theory in Action", Cambridge University Press, 2013.
2. LievenEeckhout, "Computer Architecture Performance Evaluation Methods", Morgan and Claypool Publishers, 2010.

REFERENCES

1. Paul J. Fortier and Howard E. Michel, "Computer Systems Performance Evaluation and Prediction", Elsevier, 2003.
2. **http://barbie.uta.edu/~jli/Resources/Resource%20Provisoning&Performance%20Evaluation/17.pdf**

BCS012	ADVANCED COMPUTER NETWORKS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Networks				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The objective of Advanced Computer Networks is to cover theoretical topics in the areas of advanced networking technologies, distributed computing.

COURSE OUTCOMES (COs)

CO1	Learn the concept of basic Network architecture.
CO2	Understand the various routing Methods.
CO3	Learn the concept about Networking and its types.
CO4	To Acquire experience in Domain Name System.
CO5	Understand the Networking Attacks.
CO6	Have a knowledge about how to protecting the data from intruders.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		H									
	CO2	L	M	M	H								M
	CO3	M	M	M	M								
	CO4	M		H									M
	CO5	L			H	M							
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT-I NETWORK ARCHITECTURE 9

Review of Basic Network Architectures: OSI reference model, TCP/IP reference model, ATM reference model; Applications(WWW, Audio/Video Streaming, Video conference, Networked Games, Client/Server); Traffic Characterization (CBR, VBR); Switching Paradigms; Multiplexing; Error Control; Flow Control, FTH, DTH, PON, ISDN, DSL, CATV, SONET, Optical Networks.

UNIT-II NETWORK TECHNOLOGIES 9

Local Area Network Technologies: Fast Ethernet, Gigabit Ethernet, IEEE 802.11 WLAN, Bluetooth, Connecting LANs, VLANS.

UNIT-III ROUTING AND ITS TYPES 9

Internetworking: Inter domain Routing, BGP, IPv6, Multicast Routing Protocols, Multi Protocol Label Switching, Virtual Private Networks, High speed transport protocols, Quality of Service Mechanisms, Improving QoS in Internet, DiffServ and IntServ Architectures, RSVP.

UNIT-IV DOMAIN NAME SYSTEMS 9

Distributed Systems: Naming, DNS, DDNS, Paradigms for Communication in Internet, Caching, Issues of Scaling in Internet and Distributed Systems, Caching Techniques forWeb, Protocols to Support Streaming Media, Multimedia Transport Protocols, Content Delivery Networks, Overlay and P2P Networks.

UNIT-V ATTACKS AND SECURITY IN NETWORK 9

Applications and Other Networking Technologies: RTP, RTSP, SIP, VoIP, Security Systems, SSH, PGP, TLS, IPSEC, DDoS Attack, Mitigation in Internet, Security in MPLS; Introduction to Cellular, Satellite and Ad hoc Networks.

REFERENCES:

1. Behrouz A. Forouzan, Data Communications and Networking, Fourth Ed., Tata McGraw Hill, 2006.
2. Larry L. Peterson and Bruce S. Davie, Computer Networks: A Systems Approach, Fourth Ed., Morgan Kaufmann, 2007.
3. Markus Hoffmann and Leland R. Beaumont, Content Networking: Architecture, Protocols, and Practice, Morgan Kauffman, 2005.
4. **http://www.cs.wayne.edu/~hzhang/courses/7290/Lectures/0-0%20-%20Course%20plan.pdf**

BCS013	**MOBILE COMMUNICATION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Networks				
	Course Designed by – Dept. of Computer Science and Engineering.				
OBJECTIVES					

The objective of This course is designed to all student understand about Medium Access Control (MAC), Wireless LAN, Bluetooth.	
COURSE OUTCOMES (COs)	
CO1	Understand the concepts and features of mobile networks.
CO2	Understand the working principles of wireless communication protocols.
CO3	Compare the routing protocols of mobile networks.
CO4	Learn DLL and MAC layer protocols for reliable and noisy channels.
CO5	Learn TCP & UDP protocols.
CO6	Have knowledge Radio signal propagation and properties of wireless communication systems.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	F		H									M
	CO2	M		H									
	CO3			H					M				
	CO4			H									M
	CO5	M		M									
	CO6								M				

3	Category	Humanities & Social Studies	Basic Sciences &Maths (BS)	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT – I INTRODUCTION 9

Medium access control – Telecommunication systems – Broadcast systems-SDMA-TDMA-FDMA-TCP/IP-UDP.

UNIT – II STANDARDS 9

Wireless LAN: Features-Security standards –Protocol Stack- IEEE 802.11: Standards-Architecture-Frame format-Features –HIPERLAN: Architecture-Standards – Bluetooth and Its Application.

UNIT-III ADHOC NETWORKS 9

Characteristics-Performance issues- Routing in mobile hosts-Applications of Ad hoc wireless networks-Issues in Ad hoc networks: Medium Access Scheme-Security-Energy management-Deployment Considerations.

UNIT-IVNETWORK ISSUES 9

Mobile IP - DHCP - Mobile transport layer - Indirect TCP - Snooping TCP -Mobile TCP - Transmission time-out freezing - Selective retransmission -Transaction oriented TCP.

UNIT-V APPLICATION ISSUES 9

Wireless application protocol - Dynamic DNS - File systems - Synchronization protocol - Context- aware applications - Security - Analysis of existing wireless network.

TEXTBOOK

1. J. Schiller, "Mobile Communications", 2nd Edition, Pearson Education, 2005.
2. William Stallings, "Wireless Communications and Networks", Pearson Education, 2002

REFERENCES

1. KavehPahlavan, PrasanthKrishnamoorthy, "Principles of Wireless Networks", 1stEdition, Pearson Education, 2003.
2. UweHansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles ofMobile Computing", Springer, 2003.
3. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.
4. **https://sgar91.files.wordpress.com/2011/10/mobile_communications_schiller_2e.pdf**

BCS014	**HIGH SPEED NETWORKS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Networks				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

This course gives an overview of High speed computer networks and TCP/IP protocols. It also discusses the security and network management aspects.

COURSE OUTCOMES (COs)

CO1	To learn High speed networks, Traffic and congestion management.
CO2	To understand resource allocation and service management approaches.
CO3	Compare the routing protocols of mobile networks.
CO4	Understand wireless network operations and functions.
CO5	Learn network management and its protocols.
CO6	Have knowledge ATM protocol Architecture.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	H	H								
	CO2		M	H	H								
	CO3			H	H								
	CO4			H	H								
	CO5		H										
	CO6	M	M	H	M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT-I HIGH SPEED NETWORKS 9

Introduction-frame relay networks –ATM protocol architecture-ATM logical connection –ATM cells-ATM service categories -AAL- high speed LANS: the emergence of high speed LANS-Ethernets-fiber channel-wireless LAN.

UNIT-II CONGESTION CONTROL 9

Congestion control in data networks and internets-link level flow and error control TCP Traffic - congestion control in ATM networks- Interior routing protocols.

UNIT-III QOS AND SWITCHING 9

Integrated service architecture-queuing discipline -random early detection differentiated services protocol for QOS support- RSVP- Multiportal Label switching - Real time transport protocol- IP v6.

UNIT-IV WIRELESS LAN 9

Local broad band and Ad hoc networks .Introduction to wireless LANS-IEEE 802.11 WLAN-WATM-HIPERLAN-Ad hoc networking and WPAN.

UNIT-V NETWORK MANAGEMENT AND APPLICATION 9

Network management- choosing a configuration method-MIB-SNMP-XMLCORBA-COPS-VPNS-Mobile IP-voice over IP

TEXTBOOKS:

1. Williams Stallings, ”High Speed networks and Internet Performance and Quality of Service”, Pearson Second Edition, 2002.
2. KavenPahlavan and PrashantKrishnamoorthy, “Principles of Wireless Network”, Prentice Hall Of India, 2010
3. Adrian Farrel,” The Internet and Its Protocols”, Elsevier Publications, 2011.

REFERNCES:

1. Behrouz A. Forouzan, “Data Communication and Computer Networking”, 4th edition, 2011.
2. Larry L. Peterson and Bruce S.Davie, ”Computer Networks”, Third edition, Elsevier Publications, 2003.
3. **http://www.kiv.zcu.cz/~ledvina/vyuka/PDS/PDS-tut/HighSpeedNetworks/hsn0101.pdf**

BBA009	**INTELLECTUAL PROPERTY RIGHTS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Value Education and Professional Ethics & Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

Strong intellectual property rights (IPR) protection is crucial to fostering trade, and

achieving the goals and benefits of global integration. Countries with high standards of IPR protection tend to attract more investment, stimulate more innovation, thereby developing more rapidly. Countries with inadequate protection are often vulnerable to infringements of intellectual property rights that hinder trade flow and economic development.

Hence, the objective is to introduce IPR to the UG Engineering and Technology students.

COURSE OUTCOMES (COs)

CO1	Understand the principles, function and basic legal rules of IP Law.
CO2	Recognize the relevant criteria for generating and protecting intellectual works.
CO3	Recognize the intellectual property likely to be produced in the academic and professional environment.
CO4	Demonstrate appreciation and critical awareness of pertinent IP issues in the academic and professional lives.
CO5	Understand the relevance and impact of IP Law on academic/scientific works/studies.
CO6	Understand the different forms of infringement of intellectual property rights.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					H					H	
	CO2		H		M					H			
	CO3	M							M		H		
	CO4			M	H							H	
	CO5							M					
	CO6	H			H					M			L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PROPERTIES AND TYPES 9

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i). Movable Property ii. Immovable Property and iii. Intellectual Property.

UNIT II PATENTS AND RIGHTS 9

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures..

UNIT III INTERNATIONAL TRADE 9

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV WTO 9

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V CASE STUDIES 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TEXT BOOKS:

1. Subbaram N.R. "Handbook of Indian Patent Law and Practice ", S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.

REFERENCES:

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.
4. www.ipmatters.net/features/000707_gibbs. html.
5. http://www.metastudio.org/Science%20and%20Ethics/file/readDoc/535a76367d9d331598f49e2d/34_Hb_on_IPR.pdf

NON MAJOR ELECTIVE-II

BCS015	PHP PROGRAMMING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Internet Programming ,Web Technology				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

This course gives all students exposure to basics of PHP and gives knowledge on session tracking and graphics using PHP.

COURSE OUTCOMES (COs)

CO1	To learn Recognize the difference between HTML, XHTML, MySQL& PHP.
CO2	To understand Differentiate between PHP Web & HTML Controls.
CO3	Understand different Web controls.
CO4	Apply the Understand connecting Web pages with DB.
CO5	Understand about Classes, Constructors.

CO6	Have knowledge about Data Storage.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H									
	CO2	M		H		M							M
	CO3			H									
	CO4			H									M
	CO5	M				H							
	CO6	L		M		M							M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT –I PHP INTRODUCTION 9

PHP Basics - Evolution of PHP - Introduction to PHP Programming Variables, Operators, and Constants: Introduction to Variables – Operators – Type Juggling - Type Casting - Variable Variables - function for Determining and Setting Variable- Types - Constants. Control Structures: Conditional Expressions- Arrays: Introduction to Arrays- Initializing Arrays - Working with Arrays. Functions: Introduction to Functions - Passing Arguments to Functions - Returning Values from Functions - Understanding the Scope of a Variable within a Function, Variable Functions and Variable Argument Functions

UNIT- II UNDERSTANDING CLASSES 9

Classes – Constructors - Extending a class, Form Parsing in PHP: Parsing HTML Posted Values in PHP - Form Validation- Printing the Confirmation Page - Printing Hidden Fields - Putting Theory into Practice. Handling Files: Working with Files - Putting Theory into Practice.

UNIT III HANDLING DATA STORAGE 9

An Introduction to Database Concepts - Database Management System - Relational Database Management System - Database Normalization - PHP Support to various Databases - Web Database Architecture -MySQL Database Programming.Using PHP with SQL Databases: Working with MySQL - Using Multiple Databases Simultaneously - Important PHP-MySQL Functions - Error handling in MySQL – Error Types in PHP - Creating Customized Error Handlers.

UNIT- IV SESSION TRACKING 9

An Overview of Sessions - Tracking Sessions. Input Validators in PHP: Validation Basics - Performing Validations in an HTML Web Page - Performing Validations in PHP - Functions for Validating User Input - Validating Email Addresses. Cookies: What Is a Cookie? Implementing Cookies in PHP - Are Cookies Harmful?

UNIT –V GRAPHICS IN PHP **9**

Graphics on the web - Creating Images in PHP. Understanding CVS: CVS an Overview – The CVS Repository – Environment Variables in CVS - CVS Command Options. PEAR: Introduction to PEAR – Coding Standards in PEAR – PEAR and CVS – Contributing Codes to PEAR – Requirements to Make Changes in PEAR – Help in PEAR.

TEXT BOOKS:

1. Matt Doyle," Beginning PHP 5.3",Wiley,2011.
2.AshishWilfred,Meeta Gupta and KartikBhatnagar with NIIT, "PHP Professional Projects", Prentice Hall of India, 2002.

REFERENCES:

1. Kevin Tatroe, Peter MacIntyre, RasmusLerdorf ,"Programming PHP",O'Rielley,2013.
2.RasmusLerdorf and Kevin Tatroe, "Programming in PHP", O'Reilly and Associates, 2002.
3.**http://www.infoap.utcluj.ro/multi/programming_PHP.pdf**

BCS016	**VIRTUAL REALITY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –System Modelling and Simulation.				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

This course gives Design a virtual environment and compelling virtual reality experience.

COURSE OUTCOMES (COs)

CO1	Be able to understand about computer graphics and 3 D.
CO2	Comprehend and analyze the fundamental issues of virtual reality**.**
CO3	Be able to familiar with virtual reality hardware.
CO4	Create compelling virtual experiences.
CO5	Learn the concepts about animating the virtual environment.
CO6	Have knowledge about virtual reality applications.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		H	H							
	CO2	H	H		H								M
	CO3		M										
	CO4	H			M	M							
	CO5												M
	CO6	M	H		H	M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT-I VIRTUAL REALITY AND ENVIRONMENTS 9

Introduction - Computer graphics - Real-time Computer Graphics -, Flight Simulation - Virtual environments- Requirements- Benefits of virtual reality. The historical development of virtual reality: Scientific landmarks, 3d computer graphics: Virtual world space - Positioning the observer- Perspective projection - Human vision - Stereo perspective Projection - Human Vision -Stereo Perspective Projection - 3D clipping - Color theory - 3D Modeling -Illumination models - Reflection models - Shading Algorithms - Hidden surf ace removal - Stereographic Images.

UNIT-II GEOMETRIC MODELING 9

Conversion from 20 to 3D-3D Space curves-3D Boundary Representation -modeling strategies. Geometric Transformations ; Frames of references -Modeling Transformations - Instances - Packing - Flying - Scaling the Virtual Environment-Collision detection. Generic Virtual Reality: Virtual Environment - Computer environment - Virtual reality Technology- Models of interaction - Virtual Reality Systems.

UNIT-III ANIMATING THE VIRTUAL ENVIRONMENT 9

The dynamics of numbers - Animation of objects - shape and Object In betweening - Frame-from deformation - Particle systems Physical Simulation Objects falling in a gravitational field - Rotating Wheels-Elastic collision -Projectiles - simple Pendulums - Springs - Flight dynamics of an aircraft. Human Factors; Eye-Ear- Somatic senses- Equilibrium.

UNIT-IV VIRTUAL REALITY HARDWARE 9

Sensor Hardware - Head Coupled displays - Acoustic hardware - Integrated Virtual Reality systems. Virtual Reality Software: Modeling virtual worlds -Physical Simulation-Virtual Reality Toolkits.

UNIT-V VIRTUAL REALITY APPLICATIONS 9

Engineering-Entertainment-Science-Training Future of Virtual Reality: Virtual environments - Models of interactions.

REFERENCES:

1. John Vince, “Virtual Reality Systems”, Pearson Education, 2005.
2. Adams, “Visualization of Virtual Reality”, Tata McGraw Hill, 2000.
3. **http://www.cs.tut.fi/kurssit/SGN-5406/lectures/VR1-introduction.pdf**

BCS017	E COMMERCE	L	T	P	C
	Total Contact Hours - 45	3	0	0	3

	Prerequisite –Internet Programming ,Web Technology
	Course Designed by – Dept. of Computer Science and Engineering.

OBJECTIVES

This course Discuss the current drivers and inhibitors facing the business world in adopting and using Ecommerce.

COURSE OUTCOMES (COs)

CO1	Create and refine website and application designs based on industry's usability.
CO2	Assess the suitability of various design principles for websites and applications.
CO3	Apply the skills necessary for large-scale project development on the Web.
CO4	Apply the technologies required to design and prototype Web-based information system
CO5	Recognize the business impact and potential of e-Commerce.
CO6	Understand the nature of e-Commerce.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1								H				
	CO2	M				M			H				
	CO3	M							H			H	
	CO4								H				
	CO5					M						M	
	CO6	M							H			M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT-I ELECTRONIC COMMERCE 9

Electronic Commerce, Electronic Data Interchange (EDI), E-Commerce Types – PC and networking: Networking, Communication media – Computer Communication Systems: ISO model, Electronic mail, X.400 Message Handling System, E-mail security, Lightweight directory access protocol – Internet: Introduction, Communication protocols, Issues of concern.

UNIT-II ELECTRONIC DATA INTERCHANGE 9

EDI: Introduction, Cost and Benefits, Components of EDI System, Implementation Issues – UN/EDIFACT Standard: Introduction, An EDIFACT Message, Interchange Structure, Message Directories - EDI Over Internet, Commerce Over Extranets, Identification and Tracking Tools.

UNIT-III BUSINESS PROCESS REENGINEERING 9

Business process reengineering – Approach to BPR, BPR methodology – Change management: Change management in the Government, Implementation plan.

CONCERNS FOR E-COMMERCE GROWTH

Legal issues, Risks: Paper document versus electronic document, Technology for authenticating an electronic document, Laws for e-commerce, EDI interchange agreement.

UNIT-IV CYBER SECURITY 9

Cyber Attacks, Hacking, Firewalls, IDS, Secure Sockets Layer, Symmetric and asymmetric crypto systems, Guidelines for Cryptography Policy, Developing a Security Policy.

CYBER CRIMES: Cybercrimes and the Information Technology Act, 2000, Cyber forensics

UNIT-V CASE STUDIES 9

E-Commerce: Case Studies: ITC's e-Choupal - E-Governance: Case Studies: Indian customs EDI System, Indian Railways, Government of Andhra Pradesh – eSeva.

COMPUTER EMERGENCY RESPONSE TEAM (CERT): Introduction, CERT-In, CERT-In Activities

REFERENCE BOOKS:

1. Kamlesh K Bajaj, Debjani Nag, "E-Commerce – The Cutting Edge of Business", Tata McGraw Hill, Second Edition, 2006
2. David Whitley, "E-Commerce: Strategy, Technologies and applications", McGraw Hill, 2000.
3. Ravi Kalakota and Andrew B. Whinston, "Frontiers of Electronic commerce", Pearson Education, 2005.
4. Pete Loshin, Paul A. Murphy, "Electronic Commerce", Jaico Publisher.
5. **https://books.google.co.in/books?id=Co8iBAAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false**

BCS018	**ADVANCED WEB DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Internet Programming ,Web Technology				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

This course builds web applications using ASP and client side script technologies use with Microsoft's IIS.

COURSE OUTCOMES (COs)

CO1	Create richly interactive environments natively within browsers.
CO2	Build web application frameworks which facilitate rapid application development.
CO3	Integrate web applications easily into other server-side web procedures, such as email and

	searching.
CO4	Understand about web design concepts.
CO5	Learn various tools and concepts using to build web applications.
CO6	Understand the role of scripting in web designing.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H									
	CO2			H		H							
	CO3			H		M							M
	CO4												
	CO5												
	CO6			M		H							M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT – I FUNDAMENTALS 9

Introduction to the Web-Web enabling Technologies-Web Service Protocol-web Design Concepts- Examining Good and Bad Web Design-Page Design Resources.

UNIT – II SIMPLE DESIGN ISSUES 9

Page Design-HTML-Web Page Style Considerations-Page composition-Type Faces-Tag Parameters-Color and Graphics for web Pages-WYSIWYG web Page Editor-Dream Weaver.

UNIT – III ADVANCE DESIGN ISSUES 9

Advanced Page Design-Tables and Frames-Preparing Graphics and animations Forms-Cascading Sheets-User interface Design-Page grid-Page Templates-Usability Testing.

UNIT – IV SCRIPTING IN DESIGN 9

Typography and Graphic Design for the Web-Creating Transparent GIP- Lean Graphics-Image Maps-Palette Map-web Programming-Web Site Garage-W3C HTML Validation Services-Net Mechanic-DHTML-XML.

UNIT –V TOOLS AND APPLICATIONS 9

Online Applications-Developing an Online Shopping application-Database Design Issues-Connecting Database with tools such as Java, ASP, Cold fusion-Designing Portals and Vortals.

TEXT BOOK:

1. Deitel and Deitel, "Internet and World Wide Web-How to Program", 3rd Edition, Pearson Education, 2005.

REFERENCES:

1.N.P.Gopalan&J.Akilandeswari, "Web Technology: A Developer's Perspective", PHI Learning,2008
2.JeffFrantzen and Sobotka, "Java Script", Tata McGraw Hill, 2002.
3.JustinHunter,William Crawford, "Java Servlet Programming", O'Reilly Publications, 2nd Edition, 2001.
4.**http://cdn.oreillystatic.com/oreilly/booksamplers/9781449319274_sampler.pdf**

BCS019	**OBJECT ORIENTED DATA BASE DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Database Management Systems ,Software Engineering				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The objective of the course is to provide postgraduate students with a sound technical exposure to the concepts, principles, Methods, and best practices in software architecture.

COURSE OUTCOMES (COs)

CO1	Design and motivate software architecture for large scale software systems.
CO2	Recognize major software architectural styles, design patterns, and frameworks.
CO3	Describe a software architecture using various documentation approaches.
CO4	Apply the technologies required to design and prototype Web-based information systems.
CO5	Learn various Database Modelling.
CO6	Understand the concept of clustering and Indexing.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H									H
	CO2		M	H								M	H
	CO3		M	H								M	H
	CO4												
	CO5		H	M									
	CO6											H	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT-I INTRODUCTION TO DATABASE 9

Database management systems - The concepts of the database- levels of representation, using a DBMS. Relational systems - toward the relational model, The relational model, using a relational system, Advantages & limitations of relational systems. A new generation of systems - A new computing context, New Applications.

UNIT-II DATABASE MODELING 9

Fundamental Aspects - The role of the data model general principles, Data manipulation languages, some important models - ER, SDM, IFO, RM/T, Daplex, Type systems - Concept of type. Data abstraction. Polymorphism, sub typing Integrating models & type system-Abstract types and modeling, concepts of inheritance, classes & relations, views & desired data constants.& transaction.

UNIT-III PROGRAMMING LANGUAGES 9

Extended relational models and system - different approaches, model with structured values, Deductive models and logic programming, models with object identity. Extensible systems. Database programming language - Two approaches Integration into an existing languages. Persistent programming languages.

UNIT-IV OBJECT ORIENTED DATABASE 9

Object Oriented systems - Principles & technology databases. The system - origins & objective Data model, Data manipulation, interface generator, the programming environment.Implementation of the 02 system.

UNIT-V CLUSTERING AND INDEXING 9

Object manager architecture - Introduction, Problems encountered, Addressing mechanisms, Virtual memory, two address levels, distributed architecture, Data management - Data representation, large sets & long strings, Representing inheritance. Indexing, clustering, transactions & versions.

TEXT BOOKS:

1. C.S.R. Prabhu,"Object-Oriented Database Systems: Approaches and Architectures", 2nd edition., Prentice-Hall Of India Pvt. Limited, 2005.
2. Jan L. Harrington,"Object-oriented Database Design Clearly Explained",MorganKaughman,2000.

REFERENCES:

1. Abraham Silberschatz, Henry F.Korth, S. Sudharson, "Database System Concepts", 6th Edition, Tata McGraw Hill, 2011.
2. **http://web.cs.wpi.edu/~cs561/s12/Lectures/2-3/OO.pdf**

CURRICULUM AND SYLLABUS
(R2015)

CHOICE BASED CREDIT SYSTEM
(Applicable to the batches admitted from July 2015)

B.Tech -ELECTRONICS AND COMMUNICATION ENGINEERING
FULL TIME
I – VIII SEMESTERS

SEMESTER I						
Course Code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN101	HS	English – I	3	1	0	3
BMA101	BS	Mathematics – I	3	1	0	3
BPH101	BS	Engineering Physics - I	3	0	0	3
BCH101	BS	Engineering Chemistry – I	3	0	0	3
BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
BFI201 *	HS	Foreign/Indian Language	3	0	0	3
BME102	ES	Engineering Graphics – C	1	0	3	3
BEE101	ES	Basic Electrical and Electronics Engineering	2	0	0	2
PRACTICAL						
BCS1L1	ES	Computer Practice Laboratory –I	0	0	3	1
BEE1L1	ES	Basic Electrical and Electronics Engineering Practices Laboratory	0	0	3	1
BPC1L1/2L1	BS	Physics and Chemistry Laboratory#	0	0	3/3	0
BSS1L7	HS	Yoga	0	1	2	1
*Any one of the following courses:BFR201–French, BGM201–German, BJP201– **Japanese**, BKR201 – Korean, BCN201 – Chinese, BTM201 - Tamil #Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)						
Total Number of Contact Hours = 38		**Total Number of Credits= 26**				

SEMESTER II						
Course Code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN201	HS	English – II	3	1	0	3
BMA201	BS	Mathematics – II	3	1	0	3
BPH201	BS	Engineering physics – II	3	0	0	3
BCH201	BS	Engineering Chemistry – II	3	0	0	3
BCS201	ES	Internet Programming	2	0	0	2
BSS201	HS	Personality Development	2	0	0	2
BBT202	BS	Biology for Engineers	2	0	0	2
BME203	ES	Basic Mechanical Engineering	2	0	0	2
BCE201	ES	Basic Civil Engineering	2	0	0	2
PRACTICAL						
BCS2L1	ES	Internet Practices Lab	0	0	3	1
BCM2L1	ES	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	3	1
BPC 1L1/2L1	BS	Physics and Chemistry Laboratory #	0	0	3/3	1
BSS2L4/ BSS2L5/ BSS2L6	HS	NCC/ NSS/NSO (to be conducted during week ends)	0	1	2	1
#Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)						
Total Number of Contact Hours = 36		**Total Number of Credits= 26**				

SEMESTER III						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
Theory						
BMA301	BS	Mathematics -III	3	2	0	4
BEE305	PC	Electrical Machines	3	0	0	3
BEC301	PC	Signals and Systems	4	0	0	4
BEC302	PC	Principles Of Digital Electronics	3	0	0	4
BEE301	PC	Circuit Theory	3	0	0	3
BCE306	BS	Environmental Studies	3	0	0	3
Practical						
BEE3L3	PC	Electrical Engineering Lab	0	0	3	2
BEC3L1	PC	Electronic Devices and Circuits Lab	0	0	3	2
BEC3L2	PC	Digital Electronics Lab	0	0	3	2
Total No. of Contact Hours: 30				**Total Credits: 27**		

SEMESTER IV						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
Theory						
BMA402	BS	Numerical Methods	3	2	0	4
BEC402	PC	Electronic Circuits	3	0	0	3
BEC405	PC	Linear Integrated Circuits	3	0	0	3
BCS406	PC	Object Oriented Programming and Data Structures	3	0	0	3
BEC403	PC	Electromagnetic Fields and Waves	4	0	0	4
BEI406	PC	Electronic Instrumentation	3	0	0	3
Practical						
BEC4L1	PC	Electronic Circuit Design Lab	0	0	3	2
BCS4L3	PC	Object Oriented Programming and Data Structures Lab	0	0	3	2
BEC4L2	PC	Linear Integrated Circuits Lab	0	0	3	2
Total No. of Contact Hours: 30				**Total Credits: 26**		

SEMESTER V						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
Theory						
BEC505	PC	Digital Signal Processing	4	0	0	4
BEC502	PC	Microprocessor and Microcontroller	3	0	0	3
BEC504	PC	Communication Engineering-I	3	0	0	3
BMA504	BS	Random Process	3	2	0	4
BEC5E1	OE	Open Elective I	3	0	0	3
BEC5E2	PE	Core Elective I	3	0	0	3
Practical						
BEC5L1	PC	Digital Signal Processing laboratory	0	0	3	2
BEC5L6	PC	Microprocessor and Microcontroller Lab	0	0	3	2
BEC5L3	PC	Communication Engineering Laboratory -I	0	0	3	2
BEC5C1	PR	Comprehension I	0	0	0	1
Total No. of Contact Hours: 31			**Total Credits: 27**			

SEMESTER VI						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
Theory						
BEC601	PC	Computer Communication and Networks	3	0	0	3
BEC604	PC	Communication Engineering - II	3	0	0	3
BEI 601	PC	Control Systems	4	0	0	4
BSS601	HS	Value Education and Professional Ethics	3	0	0	3
BEC6E3	CE	Core Elective II	3	0	0	3
BEC6E4	NE	Non-Major Elective -I	3	0	0	3
Practical						
BEC6L1	PC	Computer Communication & Networks Lab	0	0	3	2
BEC6L2	PC	Electronics System Design Lab	0	0	3	2
BEC6L3	PC	Communication Engineering –II Lab	0	0	3	2
Total No. of Contact Hours: 28			**Total Credits: 25**			

SEMESTER VII						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
Theory						
BEC701	PC	Fiber Optic Communication	3	0	0	3
BEC702	PC	Digital CMOS VLSI	4	0	0	4
BEC703	PC	Microwave Engineering	3	0	0	3
BEC704	PC	Antennas and Wave Propagation	3	0	0	3
BEC7E5	NE	Non-Major Elective -II	3	0	0	3
BEC7E6	CE	Core Elective – III	3	0	0	3
Practical						
BEC7L1	PC	Digital CMOS VLSI Lab	0	0	3	2
BEC7L2	PC	Optical Communication Lab	0	0	3	2
BEC7L3	PC	Microwave Engineering Lab	0	0	3	2
BEC7P1	PR	Term Paper	0	0	4	2
Total No. of Contact Hours: 32Total Credits: 27						

SEMESTER VIII						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
Theory						
BEC8E7	OE	Open Elective-II	3	0	0	3
BEC8E8	NE	Non- Major Elective-III	3	0	0	3
Practical						
BEC8C1	PR	Comprehension II	0	0	0	1
BET8P1	PR	Project Work	0	0	18	9
Total No. of Contact Hours:24				**Total Credits : 16**		

Overall credits for the Programme: 200

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S. No.	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	7	6	-	-	-	3	-	-	16	8.00
2	Maths &Basic Sciences (BS)	9	12	7	4	4			-	36	18.00
3	Engineering Sciences (ES)	10	8	-	-	-	-	-	-	18	09.00
4	Professional Core (PC)	-	-	20	22	16	16	19	-	93	46.50
5	Core Electives (CE)	-	-	-	-	3	3	3		9	4.5
6	Non major Electives (NE)	-	-	C-	-	-	3	3	3	9	4.5
7	Open Electives (OE)	-	-	-	-	3	-		3	6	3
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-		-	1	-	2	10	13	6.50
	Total Credit	26	26	27	26	27	25	27	16	200	100%
	Total Contact Hour	38	33	30	30	31	28	32	24	246Hrs	-

LIST OF ELECTIVES

Code no.	Course Title	L	T	P	C
Core Elective–I (CE - I)					
BEC503	Transmission lines, Networks and Waveguides	**3**	**0**	**0**	**3**
BEC001	Advanced Computer Architecture	3	0	0	3
BEC008	MEMS and NEMS	3	0	0	3
BEC005	Blue Tooth Technology	3	0	0	3
Core Elective – II (CE-II)					
BEC015	ASIC Design	3	0	0	3
BEC012	Cryptography and Network Security	3	0	0	3
BEC010	VLSI Design	3	0	0	3
BEC703	Cellular Mobile Communication	3	0	0	3
Core Elective – III (CE-III)					
BEC016	Cognitive Radio	3	0	0	3
BEC002	Integrated Service Digital Network	3	0	0	3
BEC007	Digital Image Processing	3	0	0	3
BEC003	Satellite Communication	3	0	0	3
Non-Major Elective – I (NE-I)					
BCS603	Artificial Intelligence& Expert System	3	0	0	3
BBM054	Bio Informatics	3	0	0	3
BEI605	Embedded Systems Design	3	0	0	3
BCS702	Mobile And Pervasive Computing	3	0	0	3
Non-Major Elective – II (NE-II)					
BCS 701	Grid and Cloud Computing	3	0	0	3
BCS 008	Distributed Operating Systems	3	0	0	3
BCS 002	Neural Networks	3	0	0	3
Non-Major Elective – III (NE-III)					
BBM 405	Biosensors and Transducer	3	0	0	3
BEI 704	Virtual Instrumentation	3	0	0	3
BET 603	Telecommunication Switching Systems	3	0	0	3
Open Elective-I (OE-I)					
BBA008	Total Quality Management	3	0	0	3
BBA001	Principles of Management And Organizational Behavior	3	0	0	3
BBA004	Engineering Economics and Financial Management	3	0	0	3
BBA009	Intellectual Property Rights	3	0	0	3
BSS001	NSS Paper I	2	0	2	3
Open Elective-II (OE-II)					
BEI701	Logic And Distributed Control System	3	0	0	3
BET008	Wireless Networks	3	0	0	3
BEI012	Analog Integrated Circuit Design	3	0	0	3
BSS002	NSS Paper II	2	0	2	3

BMO001	Massive Open Online Course	2	0	0	3

BEN101	ENGLISH – I	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Dept of English				

OBJECTIVES

To make the students learn the basic modes of communication for fluency and attainment of confidence in speech, reading and writing.

COURSE OUTCOMES (COs)

CO1	Understand the importance of being responsible, logical, and thorough.
CO2	Respond to the situations where short reports and instructions are required.
CO3	Explain "how things work", and what to suggest when "things don't work
CO4	Develop our confidence and authority in the practical use of language.
CO5	Understand the importance of being responsible, logical, and thorough.
CO6	Able to Face interviews and competitive examinations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H	H	M	L	L	H	H	H	H
	CO2							L					
	CO3	H						H		H			H
	CO4	H	M				M	L	H	H			H
	CO5							L					
	CO6	H		H	H	H	H	L		H	H	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I STRUCTURES 12

Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT II TRANSCODING 12

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT III REPORTING 12

Degrees of comparison – Positive, Comparative, Superlative - questions- SI units -Lab reports - Physics chemistry, workshop and Survey report for introducing new product in the market.

UNIT IV FORMAL DOCUMENTATION 12

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT V METHODOLOGY 12

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives , prepositional relatives.

TEXT BOOK:

1. Department Of Humanities and Social Sciences Division, Anna University, Oxford University Press, 2013.

REFERENCES:

1. S.P.Danavel, English and Communication for Students of Science and Engineering,Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007.
3. Murali Krishna and Sunitha Moishra, Communication Skills for Engineers . Pearson, New Delhi, 2011.

BMA101	**MATHEMATICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – + 2 Level Mathematics				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To make the students learn Mathematics in order to formulate and solve problems effectively in their respective fields of engineering.

COURSE OUTCOMES (COs)

CO1	Study the fundamentals of mathematics
CO2	Students learn multiple integral techniques
CO3	Students gain knowledge in application of variables
CO4	Find area and volume based on a function with one or more variables.
CO5	Apply matrix operations to solve relevant real life problems in engineering.

CO6	Formulate a mathematical model for three dimensional objects and solve												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	D	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2			M		H							
	CO3		H				M						
	CO4								L				
	CO5							H			L		
	CO6											L	
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar/ Internship (PR)
				√									
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT 1 MATRICES 12

Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes-Envelopes- Applications of Evolutes and Envelopes.

UNIT 1V FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives- Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobians- Taylor's expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates- Area as double integral- Volume as triple integral.

TEXT BOOK:

1. Ravish R.Singh and Mukkul Bhatt, "Engineering Mathematics-I" First Reprint, Tata McGraw Hill Pub Co., New Delhi. 2011.
2. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi. 2007.

REFERENCES:

1. Ramana.B.V. "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons, New York, 2003.
4. Murray R.Spiegel, "Advanced Calculus", Schaum's Outline Series, First Edn, McGraw Hill Intl Book Co.,New Delhi, 1981.

PH101	**ENGINEERING PHYSICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES:

To enhance the fundamental knowledge in Physics and its applications relevant to various streams of Engineering and Technology

COURSE OUTCOMES (COs)

CO1	Understand the Principles and Laws of Physics
CO2	To understand the impact of Crystal Physics
CO3	Learn the Properties of Elasticity and Heat transfer.
CO4	Acquire Knowledge on Quantum Physics.
CO5	Understand the concepts on Laser & Ultrasonic's and its Applications
CO6	Understand the Principle of Laser and its Applications in Engineering and Medicine.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	A	b	c	d	e	f	g	h	i	j	K	l
2	CO1	H						M			H		
	CO2		L	H		M				M		L	H
	CO3												
	CO4	H		M	L						L		M
	CO5		L	L								L	L
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity-Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress - strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion –Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO2, Semiconductor lasers (homo junction & hetero junction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TEXT BOOKS:

1. Jayaraman D Engineering Physics I. Global Publishing House, 2014.
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai Publishers, 2009.
4. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
4. http://ocw.mit.edu/courses/find-by-topic
5. http://nptel.ac.in/course.php?disciplineId=122
6. https://en.wikipedia.org/wiki/Engineering_physics

BCH101	**ENGINEERING CHEMISTRY - I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level Chemistry				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Understand the principles of water characterization and treatment for portable and industrial purposes.
CO2	To impart knowledge on the essential aspects of Principles of polymer chemistry and engineering applications of polymers
CO3	Having a sound knowledge in the Field of the Conventional and non-Conventional energy
CO4	To impart knowledge on the essential aspects of electrochemical cells, emf and applications of EMF measurements
CO5	To make the students understand the Principles of corrosion and corrosion control .
CO6	To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I WATER TECHNOLOGY 9

Introduction-Characteristics : Hardness of water – types - temporary and permanent hardness - estimation by EDTA method Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –Domestic water treatment – disinfection methods (Chlorination, Ozonation , UV treatment) Boiler feed water – requirements – disadvantages of using hard water in boilers Internal conditioning (Calgon Conditioning method) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

UNIT II POLYMERS 9

Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization– Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III ELECTRO CHEMISTRY 9

Introduction CELLS: types of Electrochemical cells , Electrolytic cells – Reversible and irreversible cells EMF – measurement of EMF– Single electrode potential – Nernst equation Reference electrodes : Standard Hydrogen electrode -Calomel electrode Ion selective electrode :Glass electrode and measurement of pH using Glass electrode Electrochemical series – significance Titrations :Potentiometer titrations (redox - Fe^{2+}vs dichromate titrations) Conduct metric titrations (acid-base – HCI vs, NaOH titrations)

UNIT IV CORROSION AND CORROSION CONTROL 9

Introduction: Chemical corrosion Definition - Chemical Corrosion - Electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion control – sacrificial anode and impressed cathodic current methods – Protective coatings :Paints– constituents of the paint and their functions Metallic coatings – electroplating of Gold and electro less plating of Nickel.

UNIT V NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Introduction : Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor Solar energy conversion – solar cells – wind energy Fuel cells –

hydrogen – oxygen fuel cell Batteries :Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries :Lead–acid storage battery –working –uses Nickel–cadmium battery - working –uses Solid – state battery : Lithium battery.

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara "A text book of engineering chemistry" S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES :

1. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Electrochemistry

BCS101	**FUNDAMENTALS OF COMPUTING AND PROGRAMMING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES

Students will understand the basics of computers and solve computer oriented problems using various computing tools.

COURSE OUTCOMES (COs)

CO1	Learn the fundamental principles in computing.
CO2	Learn to write simple programs using computer language
CO3	To enable the student to learn the major components of a computer system.
CO4	Computing problems
CO5	To learn to use office automation tools.
CO6	To interpret and relate programs

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H					H						
	CO2		L	H		M							
	CO3		L		S								
	CO4	M		M	W		M						
	CO5		L	L									
	CO6	H					H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO COMPUTER 9

Introduction- Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers- Basic Computer Organization-Number system. Computer Software: Types of Software—System software-Application software-Software Development Steps

UNIT II PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program – Purpose – Algorithm – Flowcharts– Pseudo code Introduction to Office Packages: MS Word, Spread Sheet, Power Point, MS Access, Outlook.

UNIT III INTRODUCTION TO C 9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions. Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV ARRAYS AND STRUCTURES 9

Arrays - Handling of Character Strings - Pointers – Structures-Union -Functions – Recursion-Call by value and Call by reference.

UNIT V INTRODUCTION TO C++ 9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TEXT BOOKS:

1. Ashok, N.Kamthane, ”Computer Programming”, Pearson Education (2012).
2. Anita Goel and Ajay Mittal, ”Computer Fundamentals and Programming in C”, Dorling V Kindersley (India Pvt Ltd).,Pearson Education in South Asia,(2011).
3. Yashavant P. Kanetkar, “Let us C”,13th Edition, BPB Publications(2013).
4. Yashavant P. Kanetkar,”Let us C++”10th Edition, BPB Publications (2013**).**

REFERENCES:

1. Pradeep K.Sinha, Priti Sinha “Foundations of Computing”, BPB Publications (2013).Byron Gottfried, “Programming with C”, 2nd edition, (Indian Adapted Edition), TMH Publication.
2. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in ‘C’ First Edition, Oxford University Press(2009).
3. The C++ Programming Language, 4th Edition, Bjarne Stroustrop, Addison-Wesley Publishing Company (2013).

BFR 101	FRENCH	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

Language gives access and insights into another culture. It is a fundamental truth that cultures define themselves through languages.

COURSE OUTCOMES (COs)

CO1	Introduce the basics of the language to beginners
CO2	Understand a dialogue and dialogue presentation
CO3	To develop their knowledge as well as their communicative skills so as to be able to respond in simple everyday contexts.
CO4	Synchronies I includes documents which initiate the learners to another world, anotherculture and which acclimatize them to the authentic use of the French language through the exploitation of written and iconographic documents. The Indian context has beenused.
CO5	Grammatical and lexical notions as well as activities required for communication are learnt by the students.
CO6	Interpreting skills and confidence in the language.
CO6	Interpreting skills and confidence in the language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 8

At the airport: Savoir– faire: exchanging greetings, self introduction, introducing another, welcoming someone, identifying someone - Grammar: verbs 'to be', 'to call oneself', subject pronouns, interrogation

UNIT II GRAMMAR 8

At the University: Savoir-faire: enquiring after one's welfare, taking leave, expressing appreciation -Grammar: definite & indefinite articles, gender of nouns, adjectives, present tense of regular 'er' verbs, 'to have', 'to learn', negation, irregular verbs

UNIT III CONVERSATION 8

At the café: Savoir –faire: speaking about one's likes, giving information, expressing admiration, asking information about someone - Grammar: Interrogative adjectives, irregular verbs, possessive and interrogative adjectives

UNIT IV PROPOSAL WRITING 7

At the beach: Savoir faire: proposing an outing, accepting/ refusing the proposal - Grammar: singular & plural, indefinite pronoun, demonstrative adjectives, negation, irregular verbs

UNIT V FORMAL LETTERS 7

A concert: Savoir –faire: inviting, accepting, expressing one's inability to accept an invitation

UNIT VI REGULAR & IRREGULAR VERBS 7

Grammar: Present tense of more irregular verbs, contracted articles, future tense, interrogative adverbs, **At Nalli's** Savoir- faire: asking the price of an article, protesting against the price, Grammar: possessive adjectives, Exclamative adjectives, imperative tense

REFERENCES:

1. Course Material: Synchronie I –Méthode de Français
2. Madanagobalane -Samita Publications, Chennai, 2007

BGM 101	**GERMAN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

At the end of this course, students shall be able to obtain good knowledge of the language, to r write and speak German, whereby the emphasis is laid on speech.

COURSE OUTCOMES (COs)	
CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.

CO4	Will understand German lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

Course structure:

A. German Language (speaking, reading, writing, grammar and test)
B. Life in Germany (shopping, restaurant, doctor, government, bank, post)
C. The German Way (introduction, doing business, conversation, meetings, dining)
D. Germany (Culture, Climate)

UNIT I PRONOUNCIATION 9

Welcome: Introduction to the Language, Spelling and Pronunciation (The alphabets and numbers) Greetings, ordering, requesting, saying thank you - Grammar **– the article "the", conjugation** of verbs

UNIT II SELF INTRODUCTION 9

Shopping - Grammar **–** adjectives, endings before nouns, practice. Self introduction

UNIT III TRAINING 9

Addresses, Occupations, Studies - Grammar - **'to be', the definite/indefinite** articles, individual Training

UNIT IV ORAL 9

Leisure Time, Sports, Hobbies - Grammar **–** position of a verb in a main clause , oral practice

UNIT V NARRATION

At a Restaurant, Food and Drink - Grammar – the personal pronoun in the Nominative and Accusative, Narrating an event

RESOURCES:

1. Sprachkurs Deutsch 1 (Verlag Diesterweg), New Delhi Learning Centre

BJP 101	**JAPANESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Japanese language, Japanese culture and heritage
To impart knowledge Japanese lifestyle.
To give sufficient exposure to develop basic conversational skills.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Japanese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CULTURAL HERITAGE 9

Introduction-history and origin of Japanese language-Japan and its cultural heritage-Self introduction-counting numbers (1-100)-time-conversation with the use of audio devices, grammar– usage of particles wa, no, mo and ka

UNIT II USAGE 9

Greetings, seasons, days of the week and months of the year-numbers (up to 99,999)-grammar–usage of kore, sore, are, kono, sono, ano, koko and kochira, arimasu and imasu-i-ending and na-ending adjectives-use of audio and drills for practice

UNIT III ORAL 9

Asking the price–associated vocabulary-usage of particles ni, ga and ne- use of audio and drills for practice-Introduction to basic Kanji characters- use of audio and drills for practice

UNIT IV ART AND CULTURE 9

Family relationships- colours-Kanji (numbers) and festivals of Japan-religion-Japanese art and culture-ikebana, origami-introduction to hiragana- use of audio and drills for practice

UNIT V DRILLS AND PRACTICE 9

Vocobulary associated with directions-asking way-particles – e, de, mo, koko, soko, asoko, doko, nani, mae, ushiro, ue, shita- use of audio and drills for practice-introduction to katakana

TEXT BOOKS

1. Japanese Hiragana and Katakana for beginners, Timothy G. Stout, 2011
2. Genki I: An integrated course in elementary Japanese, Eri Banno and Yuko Ikeda, 2011

REFERENCE BOOKS

1. Japanese Reader collection Volume I, Yumi Boutwell and Clay Boutwell, Kotoba books, 2013
2. Living Language Japanese Complete Edition beginners through advanced course.

BKR 101	**KOREAN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Korean language, Korean culture and heritage
To impart knowledge on Korean lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Korean lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PLANNING 9

Asking/giving reasons for studying Korean, making plans for the holiday, writing letters, describing past travel experiences and future travel plans, shopping in a grocery store, shopping in electronics store, storytelling Grammar: would like to (do), want to (do), construct future tense.

UNIT II MODIFIERS 9

Asking about feelings, asking about problems and giving advice, brief introductions - Grammar: Noun modifier, please try doing (something), irregular adjective/verb

UNIT III PLACING ORDERS 9

Asking about hobbies, asking about abilities (sports), job requirements, Ordering things for delivery, ordering a meal at a restaurant - Grammar: Sentence ending for the honorific form, please do something for me, have tried (something),

UNIT IV DESCRIPTIONS 9

Asking about evening plans, making plans with others, making preparations - Asking about rooms, describing your room to your classmates, describing your house. Grammar: to know/not know how to do something, must (do), have to (do), should,

UNIT V GRAMMAR 9

Describing your plans and giving reasons, cancelling appointments. Grammar: Shall we~? / Should we~?, with, and, irregular verbs/adjective, so, because, cannot, intend to, plan to, or hope to, (more) than, the most, tag question/is n't it? ,will (do)

COURSE MATERIAL:

Korean for Non-Native Speakers (Student Book 1B) Korean Language Education Center, Sogang University

BCN 101	CHINESE	L	T	P	C
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Chinese language, Chinese culture and heritage
To impart knowledge on Chinese lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Chinese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT 1 RISE OF DIALECTS 9

History, Origins, Old and middle Chinese, Rise of northern dialects

UNIT II VARIETIES 9

Influences 3 Varieties of Chinese. 1.Classification 2.Standard Chinese and 3.Nomenclature

UNIT III CHARACTERS 9

Chinese characters, Homophones, Phonology

UNIT IV TRANSCRIPTIONS 9

Tones, Phonetic transcriptions, Romanization, Other phonetic transcriptions

UNIT V GRAMMAR 9

Grammar and morphology, Vocabulary, Loanwords, Modern borrowings and loanwords

REFERENCES:

1. Hannas, William C. (1997), Asia's Orthographic Dilemma, University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-1892-0" 978-0-8248- 1892-0.
2. Qiu, Xigui (2000), Chinese Writing, trans. Gilbert Louis Mattos and Jerry Norman, Society for the Study of Early China and Institute of East Asian Studies, University of California, Berkeley, ISBN HYPERLINK http://en.wikipedia.org/wiki/Special:BookSources/978-1-55729-071-7,978-1-55729-071-7.
3. Ramsey, S. Robert (1987), The Languages of China, Princeton University Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-691-01468-5" 978-0-691-01468-5.
4. Schuessler, Axel (2007), ABC Etymological Dictionary of Old Chinese, Honolulu: University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-2975-9"978-0-8248-2975-9.
5. R. L. G. " Language borrowing Why so little Chinese in English?" The Economist. June 6, 2013.

BME 102	ENGINEERING GRAPHICS - C	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – +2 Level Maths + Physical Science				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

- To develop graphical skills in students for communication of concepts, design ideas of engineering products, and expose them to existing standards related to technical drawings.
- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science

COURSE OUTCOMES (COs)													
CO1	To visualize two dimensional graphic representation of three dimensional objects and buildings												
CO2	To produce two dimensional graphic representation of three dimensional objects and buildings												
CO3	To comprehend and visualize 3D views of objects.												
CO4	To understand and generate the different curves used in engineering applications.												
CO5	To learn and write program in "C".												
CO6	**:** To introduce the fundamental of CAD Graphics used in design.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H											H
	CO2	M	H										M
	CO3			L									M
	CO4						L		H	H			L
	CO5			L						H			L
	CO6			L							H		L
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
					√								
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNITI BASIC CURVES, PROJECTION OF POINTS ANDSTRAIGHT LINES 9

Conics-construction of ellipse, parabola and hyperbola by eccentricity method-construction of involutes of square and circle-Drawing of tangent and normal to the above curves-Scales-Basic drawing conventions and standards- Orthographic projection principles-Principal planes-First angleprojection-Projectionofpoints.Projectionofstraightlines(only first angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method.

UNITII PROJECTIONSOFPLANES ANDSOLIDS 9

Projectionofplanes(Polygonalandcircularsurfaces)inclinedtoboththeprincipal planes. Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method

UNITIII ORTHOGRAPHICPROJECTIONS,ISOMETRICPROJECTIONS & FREE HAND SKETCHING 9

Orthographic projection of Simplepartsfrom3Ddiagram-Principlesofisometric projection and isometric view-isometric scale- Isometric projections of simple solids and truncated solids-Prisms, pyramids, cylinders, cones.

UNITIV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 9

Sectioning of solids in simple vertical position when the cutting lane is inclined to the one of the principal planes and perpendicular to the other-obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids-Prisms, pyramids cylinders and cones.

UNITV PERSPECTIVE PROJECTION, BUILDING DRAWING AND COMPUTER AIDED DRAFTING 9

Perspective projection of cubes and cylinders by visual ray method .Introduction-components of simple residential or office building-specifications-plan and elevation of different types of Residential buildings and office buildings. Introduction to drafting packages and basic commands used in AUTO CAD.Demonstration of drafting packages.

TEXT BOOKS:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House,50th Edition,2010.
2. K.V.Natarajan "ATextbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai,2009.

REFERENCES:

1. K.R.Gopalakrishna, "Engineering Drawing", (Vol-I&II combined) Subhas Stores, Bangalore, 2007.
2. K.Venugopal and V.PrabhuRaja,"Engineering Graphics", New Age International Private limited, 2008.
3. Luzzader, Warren.J.,and Duff, John.M.,, "Fundamentals of Engineering Drawing with an Introductionto Interactive Computer Graphicsfor Designand Production",Eastern Economy Edition, Prentice Hall of India Pvt Ltd, NewDelhi,2005

BEE 101	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Engineering Mathematics, Engineering Physics-I & II				
	Course Designed by – Department of Electrical & Electronics Engineering				
	OBJECTIVES: To understand the laws of electrical engineering.				
	COURSE OUTCOMES (COs)				
CO1	Students will gain knowledge regarding the various laws and principles Associatedwith electrical systems.				

CO2	Students will gain knowledge regarding electrical machines and apply them forpractical problems.
CO3	Students will gain knowledge regarding various types semiconductors.
CO4	Student will gain knowledge digital electronics.
CO5	Student will gain knowledge on electronic systems.
CO6	Students will acquire knowledge in using the concepts in the field of electrical engg. projects and research.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L			
	CO2		H	M			L		L	L			
	CO3		H	M			L		L				
	CO4	M	H	M			L		L	L			
	CO5	M	H	M			L		L				
	CO6		H				L		L	H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ELECTRIC CIRCUITS 6

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem –Thevenin's and Norton's Theorem - Problems.

UNIT II ELECTRICAL MACHINES6

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT III BASIC MEASUREMENT SYSTEMS6

Introduction to Measurement Systems, Construction and Operating principles of PMMC,Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meterand two watt meter method and Energy meter.

UNIT IVELECTRON DEVICES 6

Basic Concepts of semiconductor devices – PN Junction Diode Characteristics and

Applications – HWR, FWR –Zener Diode – BJT (CB, CE, CC) configurati &Characteristics.

UNIT V DIGITAL ELECTRONICS 6 (

Number system – Logic Gates – Boolean Algebra– De-**Morgan's Theorem –** Half Adder & Full Adder – Flip Flops.

TEXT BOOKS:

1. N.Mittal "Basic Electrical Engineering". Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
3. Jacob Millman and Christos C-Halkias, "Electronic Devices and Circuits", Tata McGraw Hill

REFERENCE BOOKS:

1. Edminister J.A. "Theory and Problems of Electric Circuits" Schaum's Outline Series. McGrawHill Book Compay, 2nd Edition, 1983.
2. Hyatt W.H and Kemmerlay J.E. "Engineering Circuit Analysis", McGraw Hill International Editions, 1993.
3. D. P. Kothari and I. J. Nagrath" Electric Machines" Tata McGraw-Hill Education, 2004
4. Millman and Halkias, "Integrated Electronics", Tata McGraw Hill Edition, 2004.

BCS 1L2	**COMPUTER PRACTICE LABORATORY**										**L**	**T**	**P**	**C**
	Total Contact Hours - 45										0	0	3	1
	Prerequisite – Fundamentals of Computer													
	Course Designed by – Department of Computer Science &Engineering													
OBJECTIVES: To impart basic computer knowledge														
COURSE OUTCOMES (COs)														
CO1	Demonstrate major algorithms and data													
CO2	Implementation of array operations													
CO3	Implementation of binary tree.													
CO4	Implementation of linked list													
CO5	Students will able to do analyse data using spread sheet													
CO6	Student will able to understand the basics of C programming.													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low														
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	
2	CO1	H	H	L	H		H		L		H	H	H	
	CO2						H	H	L					
	CO3						H	H	L		M			
	CO4						H	H	L		M			
	CO5						H	H	L		M			
	CO6						H	H	L		M			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

A) WORD PROCESSING 6

Document creation, Text manipulation with Scientific Notations. Table creation, Table formattir and Conversion. Mail merge and Letter Preparation. Drawing-Flow Chart

B) SPREAD SHEET 9

Chart-Line XY Bar and Pie – Formula-Formula Editor-Spread sheet-Inclusion of Object, Picture and Graphics Protecting the document and sheet-Sorting and Import/Export features.

C) SIMPLE C PROGRAMMING* 15

Data types, Expression Evaluation, Condition Statement. Arrays structures and Unions – Functions

D) SIMPLE C++PROGRAMMING 15

-Classes and Objects
-Constructor and Destructor

***For Programming exercises Flow chart and Pseudo code are essential.**

BEE1L1	**BASIC ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Basic Electrical and Electronics Engineering				
	Course Designed by – Department of Electrical & Electronics Engineering				
OBJECTIVES: To enhance the student with knowledge on electrical and electronic equipments					
COURSE OUTCOMES (COs)					
CO1	Students will able to handle basic electrical equipments.				
CO2	Students will able to do staircase wiring.				
CO3	Students will able to understand domestic wiring procedures practically.				
CO4	Student will able to assemble electronic systems.				

CO5	Students will understand all the fundamental concepts involving electrical engineering												
CO6	Students will understand all the fundamental concepts involving electronics engineering												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	
	CO5	M	H	M			L		L		M	H	
	CO6		H				L		L	H		H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
						√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

I LIST OF EXPERIMENTS FOR ELECTRICAL ENGINEERING LAB

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

II LIST OF EXPERIMENTS FOR ELECTRONICS ENGINEERING LAB

1. Study of electronic components and equipments.
   a. Resistor colour coding using digital multi-meter.
   b. Assembling electronic components on bread board.
2. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

	PHYSICS AND CHEMISTRY LABORATORY	**L**	**T**	**P**	**C**
BPC 1L1/2L1	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				

OBJECTIVES: To impart knowledge to the students in practical physics and chemistry													
COURSE OUTCOMES (COs)													
CO1	Students will understand the concept of hall effect												
CO2	Students will understand the concept of semiconductors. .												
CO3	Student will understand the working of spectrometer.												
CO4	Student will able practically understand the chemical reactions.												
CO5	Students will Study the magnetic hysteresis and energy product												
CO6	Students understand the Determination of Band gap of a semiconductor												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)	
				√									
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Leeds Disc method.
6. Determination of Young's modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Fosters Bridge
8. Determination of Young's modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuilleos method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. Estimation of hardness of Water by EDTA

2. Estimation of Copper in brass by EDTA
3. Determination of DO in water (Winkler'smethod)
4. Estimation of Chloride in Water sample (Argentometry)
5. Estimation of alkalinity of Water sample
6. Determination of molecular weight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS1L7/BSS2L7 YOGA FOREMPOWERMENT

L	T	P	C
0	1	2	1

OBJECTIVE:
Providing Value Education to improve the Students' character - understanding yogic life and physical health - maintaining youthfulness - Measure and method in five aspects of life

UNITPHYSICAL HEALTH 6

Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment.
Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.
Yogasanas 1: Pranamasana - Hastha Uttanasana - Pada Hasthasana - Aswa Sanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana.
Pranayama: Naddi suddi - Clearance Practice - Benefits.
Simplified Physical Exercise - Kayakalpa Practices - Meditation Practices.

UNIT IILIFE FORCE 6

Reasons for Diseases: Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)
Philosophy of Kaya kalpa: Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind.
Maintaining youthfulness: Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid - Measure and method in five aspects of life - Controlling undue Passion.
Kayakalpa practice: Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

UNIT IIIMENTAL HEALTH6

Mental Frequencies: Beta, Apha, Theta and Delta wave - Agna Meditation explanation-benefits.

Shanti meditation: Shanthi Meditation explanation-benefits
Thuriya Meditation: Thuriya Meditation explanation-benefits
Benefits of Blessing: Self blessing(Auto suggestion) - Family blessing - Blessing the others - World blessing – Divineprotection

UNITIVVALUES 6
Human Values: Self control - Self confidence - Honesty Contentment - Humility -Modesty Tolerance – Adjustment - Sacrifice - Forgiveness
Purity(Body,Dress,Environment) – Physicalpurity-Mentalpurity - Spiritual purity

Social Values :
Non violence - Service Patriotism - Equality
Respectforparentsandelders – careandprotection – Respectforteacher Punctuality – TimeManagement

UNIT VMORALITY (virtues)6
Importance of Introspection: I - Mine (Ego, Possessiveness)
SixEvilTemperaments-Greed-Anger - Miserliness-Immoralsexualpassion – InferiorityandsuperiorityComplex - Vengeance
Maneuvering of Six Temperaments: Contentment - Tolerance - Charity - Chastity – Equality - Pardon (Forgiveness)
FiveessentialQualitiesacquiredthroughMeditation:Perspicacity – Magnanimity – Receptivity - Adaptability – Creativity(ImprovedMemoryPower)

Total periods: 30

REFERENCE BOOKS:

1. Yoga for modern age – ThathuvagnaniVethathiri Maharishi
2. Simplified Physical Exercises – ThathuvagnaniVethathiri Maharishi
3. Kayakalpam - Thathuvagnani VethathiriMaharishi
4. Thirukkural -Rev.Dr.G.U.Pope
5. Mind-ThathuvagnaniVethathiriMaharishi
6. SoundHealththroughyoga-Dr.Chandrasekaran
7. Light on yoga -BKS.lyenger
8. உணவுமுறை – தத்துவஞானிவேதாத்திரிமகரிஷி

BEN 201	**ENGLISH II**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – English I				
	Course Designed by – Department of English				
OBJECTIVES Students will be able to actively participate in group discussions. Students will have Telephonic Skills, Giving Directions and Information Transfer					
COURSE OUTCOMES (COs)					

CO1	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)
CO2	To make students comprehend the habit of intelligent Reading as well as Computer- based competitive exams glob
CO3	To achieve a reasonably good level of competency in Report Writing.
CO4	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)
CO5	To achieve a reasonably good level of competency in group discussions
CO6	To achieve a reasonably good level of competency in public speaking

	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	M	L	H	L	M			H		M	L	
	CO2			H	L				H		M	L	
	CO3			H	L	M			H		H	L	
	CO4			H	L	M			H		M	L	
	CO5			H	L	M			H		M	L	
	CO6			H	L	M			H		M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ORIENTATION 12

Numerical adjectives - Meanings in context - Same words used as different parts of speech - Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II ORAL SKILL 12

Listening to audio cassettes - C.Ds , News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - and Giving Instructions - Reading Comprehension answering questions. Inferring meaning.

UNIT III THINKING SKILL 12

Self- introduction describing –Group Discussion – Debate –Role play- Telephone- Things-etiquette- Recommendation and Sequencing jumbled sentences to make a suggestions-paragraph-advertisement and notice, Designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV WRITING SKILL 12

Definitions - Compound nouns - Abbreviations and acronyms – (a) business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) Letters to the editor (giving suggestions on an issue) .

UNIT V FORMAL INFORMATION 12

Editing – Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

TEXT BOOK:

1. Meenakshi Raman, Sangeetha Sharma , Technical English for Communication: Principle and Practice, OUP, 2009.

REFERENCE BOOKS:

1. Sumanth , English for Engineers, Vijay Nicole , Imprints Pvt ltd.2013.
2. Meenakshi Raman and Sangeetha Sharma , Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binod M ishra , Communication skills for engineers and scientists , PHI Learning Pvt Ltd, New Delhi, 2010.

BMA 201	**MATHEMATICS – II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – Mathematics I				
	Course Designed by – Department of Mathematics				

OBJECTIVES

Ability to apply these principles of mathematics in projects and research works.

COURSE OUTCOMES (COs)

CO1	Student shall be able to Solve differential equations, simultaneous linear equations, and some special types of linear equations related to engineering.
CO2	Relate the use of mathematics in applications of various fields namely fluid flow, heat flow, solid mechanics, electrostatics, etc.
CO3	Ability to test hypothesis
CO4	Find intensity of degree of relationship between two variables and also bring out regression equations.
CO5	Understand to solve matrix problems related to real life problems.
CO6	Formulate mathematical models

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	H		L									
	CO2		H				H		L	L		M	
	CO3		H				H		L	L		M	
	CO4					M						M	
	CO5										M	M	
	CO6										M		
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
				√									
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I ORDINARY DIFFERENTIAL EQUATION 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – **Cauchy's** and L**egendre's linear equations** - simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient, divergence and curl –Directional derivatives –Irrotational and solenoidal vector fields – vector integration– **Green's theorem in a plane , Gauss divergence theorem and** S**toke's theorem (**without proofs) – simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) – Harmonic and orthogonal properties of analytic functions – Harmonic conjugate – construction of analytic functions – conformal mapping: W= Z+C, CZ, 1/Z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration – **Statement and application of Cauchy's integral theorem and Cauchy's integral formula** –Taylor and Laurent expansions – Singular points – Residues – Residue theorem –Application of Residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V STATISTICS 12

Mean, Median, Mode – Moments – Skewness and Kurtosis – Correlation – Rank Correlation – Regression –Chi square test for contingency tables.

TEXT BOOK:

1. R.M.Kannan and B.Vijayakumar" Engineering Mathematics–II "2nd Edition, SRB

Publication, Chennai 2007.
2. Bali.N.P and Manish Goyal , "Engineering Mathematics", 3rdEdition, Laxmi Publications (P) Lltd, 2008 .
3. Grewal .B/S "Higher Engineering Mathematics", 40thEditon, Khanna Publications, Delhi, 2007

REFERENCES :

1. Ramana.B.V, "Higher Engineering Mathematic", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Gupta SC, and VK.Kapoor, "Fundamentals Mathematical Statistics", 11th Edition, Sultan Chand Sons, New Delhi, 2014.

BPH201	**ENGINEERING PHYSICS -II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING PHYSICS –I				
	Course Designed by – Department of Physics				

OBJECTIVES

- To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications
- To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

COURSE OUTCOMES (COs)

CO1	Understand about properties and advancements of conducting materials.
CO2	Understand the principle and properties semiconducting materials.
CO3	Acquire Knowledge on Magnetic and dielectric Materials.
CO4	To Know about the creation of new materials with novel properties
CO5	To Understand the impact of modern materials in technical uses.
CO6	Learn new engineering materials and its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L								
	CO5		L	L									
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications.

TEXT BOOKS:

1. Jayaraman D Engineering Physics II. Global Publishing House, 2014.
2. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.

3. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

REFERENCES:

1.Arumugam M., Materials Science. Anuradha publishers, 2010
2.Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4 http://ocw.mit.edu/courses/find-by-topic
5 http://nptel.ac.in/course.php?disciplineId=122
6 https://en.wikipedia.org/wiki/Engineering_physics

BCH 201	**ENGINEERING CHEMISTRY-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING CHEMISTRY –I				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Students will understand the concepts and further industrial applications of surface chemistry
CO2	To impart knowledge about the Industrial importance of Phase rule and alloys
CO3	To make the students to be conversant with Analytical techniques of chemistry and their importance
CO4	To have an idea and knowledge about the Chemistry of Fuels and
CO5	Understanding of engineering materials
CO6	All about bonding and molecular structures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L		H		H				M	
	CO2		H			H		H					
	CO3	H		L		H		H				M	
	CO4			L		H		H					
	CO5			L		H		H					
	CO6			L		H		H		H		M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SURFACE CHEMISTRY 9

Introduction **:** Adsorption , absorption , desorption , adsorbent, adsorbate and sorption – (definition only) Differences between adsorption and absorption Adsorption of gases on solids – factors affecting adsorption of gases on solids – Adsorption isotherms –Frendlich adsorption isotherm and Langmuir adsorption isotherm Role of adsorbents in catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II PHASE RULE AND ALLOYS 9

Introduction **:**Statement of Phase Rule and explanation of terms involved – one component system – water system – Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) – eutectic temperature – eutectic composition – Pattinsons Process of desilverisation of Lead Alloys: Importance, ferrous alloys –nichrome and stainless steel – 18/8 stainless steel - heat treatment of steel – annealing – hardening – tempering normalizing – carburizing - nit riding . Non- ferrous alloys: Brass and Bronze

UNIT III ANALYTICAL TECHNIQUES 9

Introduction: Type of Spectroscopy - Atomic spectroscopy – molecular spectroscopy - Explanation IR spectroscopy – principles – instrumentation (block diagram only) – applications - finger print region UV-visible spectroscopy –– principle – instrumentation (block diagram only) – Beer-**Lambert's law**- – estimation of iron by colorimetry– Atomic absorption spectroscopy- principle - instrumentation (block diagram only) - estimation of Nickel by Atomic absorption spectroscopy Flame photometry– principles – instrumentation (block diagram only) - estimation of sodium ion by Flame photometry

UNIT IV FUELS 9

Introduction **:** Calorific value – types of Calorific value - gross calorific value – net calorific value Analysis of Coal –- Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only) Flue gas analysis – importance - Orsat apparatus

UNIT V ENGINEERING MATERIALS 9

Introduction: Refractory's – classification – acidic, basic and neutral refractory's – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Manufacture of Refractory's: alumina bricks and Magnesite bricks, Abrasives – natural and synthetic abrasives Natural type : Siliceous - quartz ; Non –siliceous – diamond Synthetic Abrasives : silicon carbide and boron carbide. Lubricants: Liquid lubricants - Properties – viscosity index, flash and fire points, cloud and pour points, oiliness, Solid lubricants – graphite and molybdenum sulphide

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand &Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub. Co.Ltd, New Delhi,(2008)
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Spectroscopy

BCS 202	INTERNET PROGRAMMING	L	T	P	C
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Dept of Information Technology				

OBJECTIVES

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science.

COURSE OUTCOMES (COs)

CO1	To enable the student to learn the major components of a computer system.
CO2	To know the correct way of solving problem.
CO3	To identify efficient way of solving problem.
CO4	To learn to use office automation tools.
CO5	To implement office automation tools
CO6	To learn and write program in "C".

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I BASIC INTERNETCONCEPTS 6

Internet principles-IP addressing-Internet Service Provider (ISP)-URL-Basic web concepts-World Wide Web (WWW)-Intranet and Extranet-Internet Protocols: HTTP, TCP, UDP, FTP, Telnet-Domain Name System(DNS)-E mail-Next generation internet.

UNITII WEBDESIGNBASICS 6

Introduction to HTML–Structure of HTML Document– Tags-Headings–Links–Images–Lists–Tables –Forms–Frames-Style sheets and its types.

UNITIII DYNAMIC HTML 6

Introduction to Dynamic HTML-Object model and collections-Event model-Filters and transition-Data binding-Data control-Activex control.

UNITIV CLIENT ANDSERVERSIDEPROGRAMMING 6

VBScript &JavaScript: Introduction-Operators–Data type-Control structures-Looping–Classes and Objects–Arrays-Functions-Events-Example programs.

UNITV INTERNETAPPLICATIONS 6

Onlinedatabase-functionsofonlinedatabase-MeritsandDemerits-InternetInformationSystems (IIS)-EDI applications in business and its types-Internet commerce-Types and Applications

.

TEXT BOOKS:

1. Deitel, Deitel and Nieto, ‘’Internet and World Wide Web- How to program’’, Pearson Education Publishers, 5th edition, 2008.
2. Elliotte Rusty Harold, ‘’Java Network Programming’’, O’Reilly Publishers, 2010
3. Java Script: A Beginners Guide John Pollock 4thEdition, TMH Edition (2013)
4. VB Script Beginners Guide, Jyoti B. Giramkar, Create Space Independent Publishing (2014)

REFERENCES:

1... Krishnamoorthy & S.Prabhu, ‘’Internet and Java Programming’’, New Age International Publishers, 2010.
2. Thomno A.Powell, ’’The Complete Reference HTML and XHTML’’, fourth edition, Tata McGraw Hill, 2001
3. E Commerce Kamlesh K.Bajaj, Debjani Nag, Tata McGraw Hill, Second edition, 2010

BSS201	PERSONALITY DEVELOPMENT	L	T	P	C
	Total Contact Hours - 30	1	1	0	2
	Prerequisite – +2 Level Knowledge				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To make students groom their personality and prove themselves as good Samaritans of the society

COURSE OUTCOMES (COs)

CO1	Individual or in-group class presentations pertaining to the applications of conce theories or issues in human development..
CO2	Scores obtained from essay and or objective tests.
CO3	Attendance, classroom participation, small group interactions.
CO4	Research and write about relevant topics.
CO5	Design and complete a research project that can take the form of a developme interview, an observation or assessment through service learning.
CO6	Develop and maintain a Reflection

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	L
2	CO1	L		H				M					
	CO2		H	H				M					
	CO3							M	H				
	CO4									H	H		
	CO5							M			H	H	
	CO6							M					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 6

The concept personality- Dimensions of theories of Freud & Erickson- personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analyses.

UNIT II ATTITUDE & MOTIVATION 6

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III SELF-ESTEEM 6

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV OTHER ASPECTS OF PERSONALITY DEVELOPMENT 6

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics –Good manners and etiquette.

UNIT V EMPLOYABILITY QUOTIENT 6

Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TEXT BOOKS:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition, Prentice Hall.

REFERENCE BOOKS:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

BBT202	BIOLOGY FOR ENGINEERS	L	T	P	C
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – Basic Science				
	Course Designed by – Department of Industrial Bio Technology				
OBJECTIVES Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system**.**					
COURSE OUTCOMES (COs)					

CO1	Graduates within the first five years will be able to grasp and apply biological engineering principles, procedures needed to solve real-world problems.
CO2	To understand the fundamentals of living things, their classification, cell structure and biochemical constituents
CO3	To apply the concept of plant, animal and microbial systems and growth in real life situations
CO4	To comprehend genetics and the immune system
CO5	To know the cause, symptoms, diagnosis and treatment of common diseases
CO6	To give a basic knowledge of the applications of biological systems in relevant industries

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M					
	CO2		H							H			
	CO3			H							M		
	CO4										H		
	CO5												
	CO6						H						M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNITI INTRODUCTION TO LIFE 6

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell-Introduction to biomolecules: definition-general classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome.

UNIT II BIODIVERSITY 6

Plant System: basic concepts of plant growth-nutrition-photosynthesis and nitrogen fixation-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions-Microbial System: history-types of microbes-economic importance and control of microbes.

UNIT III GENETICS AND IMMUNE SYSTEM 6

Evolution: theories of evolution-**Mendel's** cell division–mitosis and meiosis-evidence of e **laws of inheritance**-variation and speciation- nucleic acids as a genetic material-central dogma immunity-antigens-antibody-immune response.

UNIT IV HUMAN DISEASES 6

Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis

UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION 6

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines-cloning-drug discovery-biological neural networks-bioremediation-biofertilizer-biocontrol-biofilters-biosensors-biopolymers-bioenergy-biomaterials-biochips-basic biomedical instrumentation.

TEXT BOOKS:

1. A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

REFERENCE BOOKS

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
3. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

BME201	BASIC MECHANICAL ENGINEERING	L	T	P	C
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

- The program educational objectives (PEOs) for the mechanical-engineering program are to educate graduates who will be ethical, productive, and contributing members of society.
- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- The ability to apply principles of engineering, basic science, and mathematics to design and realize physical systems, components, or processes

COURSE OUTCOMES (COs)

CO1	an ability to apply knowledge of mathematics
CO2	an ability to apply knowledge of science, and engineering
CO3	Ability to design and conduct experiments, as well as to analyze and interpret data.

CO4	an ability to function on multi-disciplinary teams
CO5	ToprovidebasicKnowledgeofbasicmanufacturingprocess.
CO6	ability to identify, formulate, and solve engineering problems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ENERGY RESOURCESANDPOWER GENERATION 6

RenewableandNon-renewableresources-solar,wind,geothermal,steam,nuclearandhidepowerplants-Layout,majorcomponentsandworking.ImportanceofEnergystorage,Environmentalconstraintsofpowergeneration usingfossil fuelsandnuclearenergy.

UNIT II IC ENGINES 6

Classification,workingprinciplesof petrol anddiesel engines-twostroke andfourstroke cycles,functionsofmain componentsofI.Cengine.Alternatefuelsandemissioncontrol.

UNIT III REFRIGERATION AND AIR-CONDITIONINGSYSTEM 6

Terminologyof Refrigerationand Air-Conditioning,PrincipleofVaporCompression& Absorptionsystem- Layoutoftypicaldomesticrefrigerator-window&Splittyperoomairconditioner.

UNITIV MANUFACTURING PROCESSES 6

BriefdescriptionofMouldmakesandcastingprocess,Metalforming,Classification typesofforging, forging operations, Briefdescription ofextrusion,rolling,sheetforging,anddrawing.Briefdescription ofwelding,brazing andsoldering.Principalmetalcuttingprocessesandcuttingtools,Brief descriptionofCentrelatheandradial drillingmachine.

UNITV MECHANICALDESIGN 6

Mechanicalpropertiesofmaterial-Yieldstrength,ultimatestrength,endurancelimit, etc.,Stress-Strain curvesof materials.Stresses inducedin simple elements.Factorofsafety-Design ofShaftsandbelts. Typesofbearingsand itsapplications.Introductionto CAD/CAM/CIM&Mechatronics.

TEXTBOOK:

1. T.J.Prabhuetal, "BasicMechanicalEngineering", SciTechPublications(P)Ltd,2000

REFERENCES:

1. NAGPAL,G.R,"Power PlantEngineering",KhannaPublishers,2004.
2. RAO.P.N,"ManufacturingTechnology",TataMcGraw-HillEducation,2000.
3. Kalpakjian,"ManufacturingEngineeringandTechnology",AdissoWesley Publishers,1995.
4. Ganesan.V,"Internal Combustion Engines",TataMcGraw-HillEducation,2000.
5. C.P.Arora,"RefrigerationandAir Conditioning",TataMcGraw-HillEducation,2001.
6. V.B.Bhandari,"DesignofMachine Elements",TataMcGraw-HillEducation,2010.

BCE 201	**BASIC CIVIL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Civil Engineering				

OBJECTIVES: Understand the basic concepts of civil engineering.

COURSE OUTCOMES (COs)

CO1	Will gain knowledge in Design, concept preparation
CO2	Loading calculation
CO3	Structural component design
CO4	Drawing and chart preparation
CO5	Will understand the components of buildings.
CO6	Will learn the engineering aspects to dams , water supply and sewage disposal.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			H		L					
	CO2					H	H						
	CO3							H	L				
	CO4									L			
	CO5										H	L	
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CIVIL ENGINEERING MATERIALS 8

Introduction – Civil Engineering – Materials – Stones – Bricks – Sand – Cement – Plain Concrete – Reinforced Cement Concrete – Steel Sections – Timber – Plywood – Paints –

UNIT II SURVEYING 5

Surveying – objectives – classification – principles of survey-Measurement of distances – Chain survey – Determination of areas – Use of compass – Use of leveling Instrument – (simple examples only)

UNIT III FOUNDATION FOR BUILDING 5

Bearing Capacity of Soil – Foundation – Functions – Requirement of good foundations – Types of foundations – Merits & Demerits.

UNIT IV SUPERSTRUCTURE 7

Stone Masonry – Brick Masonry – Columns – Lintels – Beams – Roofing – Flooring – Plastering– White Washing (Simple examples only)

UNIT V MISCELLANEOUS TOPICS 5

Types of Bridges –Dam- purpose – selection of site - Types of Dams – Water Treatment & Supply sources – standards of drinking- distribution system. – Sewage Treatment (simple examples only)

TEXT BOOKS:

1. Raju.K.V.B, Ravichandran .P.T, "Basics of Civil Engineering", Ayyappa Publications, Chennai, 2012.
2. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, (1st ed. 2005).
3. Dr.M.S.Palanisamy, "Basic Civil Engineering" (3rded. 2000), TUG Publishers, New Delhi/Tata McGrawHill Publication Co., New Delhi

REFERENCE BOOKS:

1. Rangwala.S.C, "Engineering Materials", Charotar Publishing House, Anand, 41st Edition: 2014.
2. National Building Code of India, Part V, "Building Materials", 2005
3. Ramesh Babu"A Textbook on Basic Civil Engineering" (1998). Anuradha Agencies, Kumbakonam.

4. RamamruthamS., “Basic Civil Engineering”, DhanpatRai Publishing Co. (P) Ltd. (1999).

BCS2L1	INTERNET PRACTICES LABORATORY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Internet Programming				
	Course Designed by – Dept of Information Technology				

OBJECTIVES

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying Computerscience.

COURSE OUTCOMES (COs)

CO1	To enable the student to learn the major components of a computer system.
CO2	To know the correct and efficient way of solving problem.
CO3	To identify and implement the correct and efficient way of solving problem.
CO4	To learn to use office automation tools.
CO5	To infer from use office automation tools.
CO6	To learn and write program in “C”.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. HTML (Hypertext Mark-up Language):

Basics of HTML.
How to create HTML Document
Steps for creating a simple HTML Program.
a) Favorite Personality
b) Resume Preparation

2. **ADVANCED HTML:** Advanced Topics of HTML
   a) Time Table
   b) Table Creation
3. **JAVASCRIPT:**
   Script Basics.
   Incorporating JavaScript into Web page.
   a) Star Triangle
   b) Temperature Converters
   Script Basics.
   Incorporating JavaScript into Web page.
   a) Star Triangle
   b) Temperature Converters
4. **VBSCRIPT:**
   VBScript Basics.
   Incorporating VBScript into HTML.
   a) Changing Background Color
   b) Simple Calculator
5. **WEB DESIGN:**
   Inserting External Media in the Web Page.
   a) Forms and Links
   b) Frames with Links and Lists
   To export a Dream weaver Document as XML File, checking entries, working in frames, windows control, the java script URL.

BCM1L1	**BASIC CIVIL & MECHANICALENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Department of Mechanical Engineering& Civil Engineering				

OBJECTIVES

To provide exposure to the students with hands on experience on various basic Civil & Mechanical Engineering practices.

COURSE OUTCOMES (COs)

CO1	Learn Basic concepts
CO2	Students will get exposure regarding pipe connection for pumps & turbines and to study the joint used in roofs, doors, windows and furniture's.
CO3	Students will get exposure regarding smithy, foundry operations and in latest welding operations such as TIG, MIG, CO2, spot welding etc.,

CO4	Students will get hands on experience on basic welding techniques, machining and sheet metal works.
CO5	Students will get hands on experience on basic machining techniques
CO6	Students will get hands on experience on basic sheet metal techniques

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H	L										
	CO2				H								
	CO3					H	L	L					
	CO4		H				M		L			H	
	CO5		H				M		L			H	
	CO6		H				M		L			H	
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective	Project/Term Paper/ Seminar/ Internship (PR)				
				√									
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

LIST OF EXPERIMENTS

I. CIVILENGINEERINGPRACTICE

Buildings:

a) Studyofplumbingandcarpentrycomponentsofresidentialandindustrialbuildings.Safetyaspects.

PlumbingWorks:

a) Studyofpipelinejoints,itslocationandfunctions:valves,taps,couplings,unions,reducers,elbowsin householdfittings.

b) Studyofpipeconnectionsrequirementsforpumpsandturbines.

c) Preparationofplumbinglinesketchesforwatersupplyandsewageworks.

d) Hands-on-exercise:Basicpipeconnection ofPVCpipes&G.I.Pipes–Mixedpipematerialconnection–Pipe connectionswithdifferentjoiningcomponents.

e) Demonstrationofplumbingrequirementsofhigh-risebuildings.

CarpentryusingHandtoolsandPowertools:

a) Studyofthejointsinroofs,doors,windowsandfurniture.

b) Hands-on-exercise: Woodwork,jointsbysawing,planningandcutting.

c) Preparationofhalfjoints,MortiseandTenonjoints.

II MECHANICALENGINEERINGPRACTICE

Welding:

a) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

BasicMachining:

a) Simple Turning and Taper turning

b) Drilling Practice

SheetMetalWork:

a) Forming&Bending:
b) Modelmaking–Trays,funnels, etc.
c) Differenttypeofjoints
d) Preparationofair-conditioningducts
e) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

Machineassemblypractice:

a) Assembling,dismantlingand Studyofcentrifugalpump
b) Assembling,dismantlingand Studyofairconditioner
c) Assembling,dismantlingandStudyoflathe

Moulding:

a) Mouldingoperationslikemouldpreparationfor gearandstepconepulley, etc

Fitting:

a) Fitting Exercises–Preparationofsquarefittingandvee–fittingmodels.

Demonstration:

a) Smithyoperations,upsetting,swaging,settingdownandbending.Example–Exercise–Productionofhexagonalheaded bolt.
b) Gaswelding.

REFERENCES:

1. K. Jeyachandran, S. Nararajan& S, Balasubramanian, "A Primer on Engineering Practices Laboratory" ,Anuradha Publications, (2007).
2. T.Jeyapoovan, M. Saravanapandian& S. Pranitha, "Engineering Practices Lab Manual",Vikas Publishing House Pvt. Ltd. (2006)
3. H. S. Bawa, "Workshop Practice", Tata McGraw–Hill Publishing Company Limited, (2007).
4. A. Rajendra Prasad & P. M. M. S Sarma, "Workshop Practice", Sree Sai Publication, (2002).
5. P. Kannaiah& K.L. Narayana, "Manual on Workshop Practice", Sci tech Publication, (1999).

BPC 1L1/2L1	**PHYSICS AND CHEMISTRY LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				
OBJECTIVES: To impart knowledge to the students in practical physics and chemistry					
COURSE OUTCOMES (COs)					
CO1	Students will understand the concept of hall effect				
CO2	Students will understand the concept of semiconductors. .				
CO3	Student will understand the working of spectrometer.				
CO4	Student will able practically understand the chemical reactions.				
CO5	Students will Study the magnetic hysteresis and energy product				

CO6	Students understand the Determination of Band gap of a semiconductor												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	A	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)				
			√										
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

I -LIST OF EXPERIMENTS – PHYSICS

14. Determination of Wavelength, and particle size using Laser
15. Determination of acceptance angle in an optical fiber.
16. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
17. Determination of wavelength of mercury spectrum – spectrometer grating
18. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
19. Determination of Young's modulus by Non uniform bending method
20. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
21. Determination of Young's modulus by uniform bending method
22. Determination of band gap of a semiconductor
23. Determination of Coefficient of viscosity of a liquid –Poiseuille's method
24. Determination of Dispersive power of a prism - Spectrometer
25. Determination of thickness of a thin wire – Air wedge method
26. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4

10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS 1L5 / 2L5	NSS PRACTICAL	L	T	P	C
		0	1	2	1

OBJECTIVES

1. Understand the community in which they work and their relation
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop capacity to meet emergencies and natural disasters
4. Practice national integration and social harmony and
5. Utilize their knowledge in finding practical solutions to individual and community problems.

1. Regular Activities Programme

1) Traffic regulation
2) Working with Police Commissioner's Office
3) Working with Corporation of Chennai
4) Working with Health Department
5) Blind assistance
6) Garments collection
7) Non-formal education
8) Environmental Education, Awareness and Training (EEAT)
9) Blood donation

2.Special Camp Programme

A) Legal awareness
B) Health awareness
C) First-aid
D) Career guidance
E) Leadership training - cum - Cultural Programme
F) Globalization and its Economic Social Political and Cultural impacts.

REFERENCE BOOKS:

1. National Service Scheme Manual, Government of India.
2. Training Programme on National Programme scheme, TISS.
3. Orientation Courses for N.S.S. Programme officers, TISS.
4. Case material as Training Aid for field workers, Gurmeet Hans.
5. Social service opportunities in Hospitals, Kapil K.Krishan,TISS.
6. Social Problems in India, Ram Ahuja.

BMA 301	MATHEMATICS - III	L	T	P	C
	Total Contact Hours – 75	3	2	0	4

	Prerequisite – Engineering Mathematics I & II
	Course Designed by – Dept. of Mathematics

OBJECTIVES

- To introduce Fourier series analysis which is central to many applications in engineering apart
- From its use in solving boundary value problems systems.
- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To introduce the effective mathematical tools for the solutions of partial differential equations
- That model several physical processes and to develop Z transform techniques for discrete time

COURSE OUTCOMES (COs)

CO1	Solve a set of algebraic equations representing steady state models formed in engineering problems
CO2	Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables
CO3	The trend information from discrete data set through numerical differentiation
CO4	To summary information through numerical integration
CO5	Solve PDE models representing spatial and temporal variations in physical systems through numerical method
CO6	Have the necessary proficiency of using MATLAB for obtaining the above solution

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+6

Formation - Solutions of standard types of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 9+6

Dirichlet's conditions - General Fourier series - Half-range Sine and Cosine series - Parseval's identity - Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9+6

Classification of second order linear partial differential equations - Solutions of one - dimensional wave equation, one-dimensional heat equation - Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates

UNITIV LAPLACE TRANSFORMS 9+6

Transforms of simple functions - Basic operational properties - Transforms of derivatives and integrals - Initial and final value theorems - Inverse transforms - Convolution theorem - Periodic functions - Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients and simultaneous equations of first order with constant coefficients.

UNIT V FOURIER TRANSFORMS 9+6

Statement of Fourier integral theorem - Fourier transform pairs - Fourier Sine and Cosine

transforms - Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

TEXT BOOKS:

1. Kreyszig, E.,"Advanced Engineering Mathematics"8th Edition, John Wiley and Sons, (Asia) Pvt., Ltd, Singapore, 2000.
2. Grewal, B.S.,"Higher Engineering Mathematics" (35thEdition), Khanna Publishers, Delhi2000.

REFERENCE BOOKS:

1. Kandasamy, P., Thilakavathy, K., and Gunavathy,K. "Engineering Mathematics",Volumes 1 and 3(4th Edition) S Chand and Co., New.
2. Narayanan, S.Manicavachangam Pillai, T.K.Ramanaiah, E.,"Advanced mathematics for Engineering Students", Volume2 and 3(2nd Edition), S.Viswanathan (printers & publishers Pvt, Ltd.,) 1992.
3. Venkataraman, M.K,"Engineering Mathematics"Volumes3-A&B, 13th Edition National Publishing Company, Chennai, 1998.
4. Shanmugam,T.N.:http:.www.annauniv.edu/shan/trans.h

BEE305	ELECTRICAL MACHINES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Basic Electronics and Electrical Engineering				
	Course Designed by – Dept. of Electrical and ElectronicsEngineering.				

OBJECTIVES

To impart basic knowledge on electrical machines, principles and its operation.

COURSE OUTCOMES (COs)

CO1	Outline the basics of electrical machines and analyze the characteristics of DC machines.
CO2	Understand and implement speed control techniques for practical applications.
CO3	Describe the working of transformer and assess its regulation and efficiency on load andno-load.
CO4	Know the working concept of different types of induction motor and analyze the operatingbehavior of induction motor using its performance indices.
CO5	Explain the basics of synchronous machines and interpret performance characteristics.
CO6	An ability to apply knowledge of mathematics, science, and engineering.

UNIT I CIRCUITS AND TRANSFORMERS 9

Three phase circuits and transformers, Three phase balanced circuits with R-L-C loads, Power measurement in 3 Phase circuit, Two watt meter method, Principle of operation of Transformers, Equivalent circuit, Voltage regulation, Efficiency, Transformer connections.

UNIT II DC MOTORS 9

Construction, Operating principle of motor, Types, Characteristics, Starting, Speed control, Testing.

UNIT III INDUCTION MOTORS **9**

Construction, Types, Principle of operation of 3 phase induction motors, Equivalent circuit, Performance calculation, Starting and Speed control.

UNIT IV SYNCHRONOUS AND SPECIAL MACHINES **9**

Construction of synchronous machines, Types, Induced EMF, Voltage regulation of round rotor alternators. Brushless Alternators, Permanent magnet Synchronous machines, Reluctance machines, Hysteresis motors, Stepper motor.

UNIT V TRANSMISSION AND DISTRIBUTION **9**

Structure of Electric Power systems, Generation, Transmission, Sub Transmission and Distribution systems, EHVAC and EHVDC transmission systems, Substation layout, Insulators, Cables.

TEXT BOOKS:

1. Nasar S.A., " Electric Machines and Power Systems ", Vol. 1, McGraw Hill Inc., New Delhi, 1995.
2. Wadhwa C.L., " Electrical Power Systems ", Wiley eastern Ltd., India, 1985.

REFERENCE BOOKS:

1. www.ceecs.fau.edu

BEC301	**SIGNALS AND SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours –60	3	2	0	4
	Prerequisite – Engineering Mathematics-II				
	Course Designed by – Dept. of Electronics and Communication Engineering.				

OBJECTIVES

- This course trains students for an intermediate level of fluency with signals and systems in both continuous time and discrete time, in preparation for more advanced subjects in digital signal processing (including audio, image and video processing), communication theory, and system theory,control and robotics.

COURSE OUTCOMES (COs)

CO1	To Understand different types of signals-continuous and discrete,odd and even,periodicand a periodic etc.Be able to classify systems based on their properties
CO2	To familiarize the concepts of transform based continuous time and discrete time analysis of signals and systems
CO3	Analyze continuous time signals and systems by using appropriate mathematical tools
CO4	Analyze sampling process and sampling of discrete time signals.
CO5	Analyze discrete time signals and systems by using appropriate mathematical tools

CO6	Determine Fourier transforms for continuous-time and discrete-time signals (or impulse-response functions), and understand how to interpret and plot Fourier transform magnitude and phase functions.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	C	d	E	f	g	h	i	j	k	L
2	CO1	H	M		M	H							H
	CO2	H			M	H					L		H
	CO3	M			H	H							H
	CO4					H		M				M	H
	CO5	H	M		M								
	CO6	H	M		M		M				M		H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	roject/Term Paper/ Seminar/ Internship (PR)nship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNITI CLASSIFICATION OF SIGNALS AND SYSTEMS 12

Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic and aperiodic, random singals, CT systems and DT systems, Classification of systems - Linear Time invariant Systems.

UNIT II ANALYSIS OF C.T. SINGALS 12

Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and Laplace Transform in Signal Analysis.

UNIT III LTI-CT SYSTEMS 12

Differential equation, Block diagram representation, Impulse response, Convolution integral, Frequency response, Fourier Methods and Laplace transforms in analysis, State equations and Matrix.

UNIT IV ANALYSIS OF D.T. SIGNALS 12

Spectrum of D.T. signals, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT), Properties of Z-transform in signal analysis.

UNIT V LTI-DT SYSTEMS 12

Difference equations, Block diagram representation, Impulse response, Convolution SUM, Frequency response, FFT and Z-transform analysis, State variable equation and Matrix.

TEXT BOOKS:

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, “Signals and Systems”, Pearson, 2007.

REFERENCE BOOKS:

1. B. P. Lathi, “Principles of Linear Systems and Signals”, Second Edition, Oxford, 2009.
2. R.E.Zeimer, W.H.Tranter and R.D.Fannin, “Signals & Systems - Continuous and Discrete”, Pearson, 2007.
3. John Alan Stuller, “An Introduction to Signals and Systems”, Thomson, 20076.
4.www.nptel.ac.in

BEC302	PRINCIPLES OF DIGITAL ELECTRONICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Basic Electronics Engineering				
	Course Designed by – Dept. ofElectronics And Communication Engineering.				

OBJECTIVES

- To manipulate across various number system and to compute binary arithmetic operations.
- To understand the design of combinational and sequential circuits using gates.
- To know the concept of memories and programmable logic devices
- To learn the design of asynchronous and synchronous sequential circuits.

COURSE OUTCOMES (COs)

CO1	Recall the different number systems and demonstrate the simplification of Boolean expressions using Boolean algebra & K-Map method.
CO2	Analyze the Combinational building blocks.
CO3	Analyze the sequential building blocks.
CO4	Develop a state diagram and simplify the given sequential logic.
CO5	To illustrate the concept of synchronous sequential circuits
CO6	To illustrate the concept of asynchronous sequential circuits

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H	H		H	L	M			M			H
	CO2	M	H	M	H		M						H
	CO3	H	H										
	CO4	H											
	CO5	M	H	M	H		M			M			H
	CO6	H	H	M	H					M			H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	roject/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I BASIC CONCEPTS ,BOOLEAN ALGEBRA AND LOGIC GATES 12

Number systems - Binary, Octal, Decimal, Hexadecimal, conversion from one to another, complement arithmetic, Boolean theorems of Boolean algebra, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map, Quine-McCluskeymethodofminimization .NAND-NOR implementation of Logic gates,Multilevel gate implementation,Multi output gate implementation,TTL and CMOS logic and their characteristics,Tristate gates.

UNITII COMBINATIONAL CIRCUITS 12

Problem formulation and design of combinational circuits, Half Adder ,Full adder,HalfSubtractor, Full Subtractor, Carry Look Ahead adder, BCD adder, Fast adder,Serial adder/subtractor,BinaryMultiplier,Binary Divider, Encoder ,Decoder, Mux / Demux, Code-converters, Parity Generators, Comparators.

UNIT III SEQUENTIAL CIRCUIT 12

Latches, Flip-flops - SR, JK, T, D, Master/Slave FF, Triggering of FF,Realization of one flip flop using other flip flops Analysis of clocked sequential circuits - their design, State minimization, State assignment, Circuit implementation, Registers-Shift registers, AsynchronousUp/Down counterSynchronousUp/Down counters, Modulo–n-counter, Ringcounter,Shiftcounters ,Sequencegenerators.

UNIT IV MEMORY DEVICES 12

Classification of memories – ROM,ROM organization - PROM, EPROM,EEPROM, EAPROM, RAM – RAM organization – Write operation , Read operation , Memory cycle, Timing wave forms , Memory decoding , memory expansion , Static RAM Cell, Dynamic RAM cell ,Programmable Logic Devices – Programmable Logic Array (PLA) and Programmable Array Logic (PAL) ,Field Programmable Gate Arrays (FPGA),Implementation using ROM, PLA, and PAL.

UNIT V SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS 12

Synchronous Sequential Circuits: General Model – Classification – Design – Use ofAlgorithmic State Machine – Analysis of Synchronous Sequential Circuits.

Asynchronous Sequential Circuits: Design of fundamental mode and pulse mode circuits – Incompletely specified State Machines – Problems in Asynchronous Circuits – Design of Hazard Free Switching circuits.

Text Book:

1. M. Morris Mano, “Digital Design”, 4th Edition, Prentice Hall of India Pvt. Ltd., 2008 / PearsonEducation (Singapore) Pvt. Ltd., New Delhi, 2003.
2. William I. Fletcher, " An Engineering Approach to Digital Design ", Prentice-Hall of India, 1980.

REFERENCE BOOKS:

1. John F.Wakerly, “Digital Design”, Fourth Edition, Pearson/PHI, 2008
2. John.M Yarbrough, “Digital Logic Applications and Design”, Thomson Learning,2006.
3. Charles H.Roth. “Fundamentals of Logic Design”, 6th Edition, Thomson Learning, 2013.

4. Donald P.Leach and Albert Paul Malvino, "Digital Principles and Applications",6th Edition,TMH,2006.
6 .http://www.electrical4u.com/digital-electronics

BEE301	**CIRCUIT THEORY**	**L**	**T**	**P**	**C**
	Total Contact Hours-45	3	0	0	3
	Prerequisite- basic Electrical & Electronics Engg				
	Course Designed by – Dept of Electrical & Electronics Engineering				

OBJECTIVES

To develop problem solving skills and understanding of circuit theory through the application of techniques and principles of electrical circuit analysis to common circuit problems.

COURSE OUTCOMES (COs)

CO1	To develop an understanding of the fundamental laws and elements of electric circuits.
CO2	To develop the ability to apply circuit analysis to DC and AC circuits
CO3	To understand advanced mathematical methods such as Laplace and Fourier transforms along with linear algebra and differential equations techniques for solving circuits problem
CO4	To learn the "alphabet" of circuits, including wires, resistors, capacitors, inductors, voltage and current sources, and operational amplifiers.
CO5	Introduce students to different methods involves in analysis both linear and non-linear networks;

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	H	H	L	M	L			H	M	M
	CO2	M	H	H	M	M	H	M	M		L	M	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H	L	M	M		L	M	M
	CO5	M	M	M	M	H		M			L	L	M

3	Category	Humanities and Social Sciences (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

					X				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I BASIC CIRCUIT CONCEPTS 9

Circuit elements – Kirchhoff's Law – V-I Relationship of R,L and C – Independent Sources – Dependent sources – Simple Resistive circuits – Networks reduction – Voltage division – current source transformation.- Analysis of circuit using mesh current and nodal voltage methods.

UNIT II SINUSOIDAL STEADY STATE ANALYSIS 9

Phasor – Sinusoidal steady state response concepts of impedance and admittance – Analysis of simple circuits – Power and power factors — Solution of three phase balanced circuits and three phase unbalanced circuits –-Power measurement in three phase circuits.

UNIT III NETWORK THEOREMS (BOTH AC AND DC CIRCUITS) 9

Superposition theorem – The venin's theorem - Norton's theorem-Reciprocity theorem- Maximum power transfer theorem.

UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS 9

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input with sinusoidal input.

UNIT V RESONANCE AND COUPLED CIRCUITS 9

Series and paralled resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

TEXT BOOKS:

1.Sudhaker A. and Shyam Mohan S.p., "Circuits and Network Analysis and Synthesis" TataMcGraw Hill Co. Ltd., New Delhi, 1994.

2. Hyatt W.H. and Kemmerlay J.E. „Engineering Circuits Analysis", McGrew Hill international Editions,1993.

REFERENCE BOOKS:

1.Edminister J.A. "Theory and Problems of Electric Circuits " Schaum's outline series, McGrew Hill Book Company 2nd edition, 1983.

3.http://nptel.ac.in/courses/108102042/

BCE306	ENVIRONMENTAL STUDIES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Physical Sciences				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To study the nature and facts about environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context
CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	F	g	h	i	j	k	l
2	CO1						M	M			M		
	CO2	L					M	H			H		M
	CO3		H					H					
	CO4							M			M		
	CO5	M	M					H					H
	CO6						M	H			H		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance, Need for public awareness.

Natural Resources : Renewable And Non – Renewable Resources

Natural resources and associated problems

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.
c) Mineral resources : Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing , effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.
f) Land resources : Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 8

Concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-

Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III BIODIVERSITY AND ITS CONSERVATION 7

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega-diversity nation, Hot-spots of biodiversity -Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution 7

Definition, Causes, effects and control measures of ;- Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management : floods earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8

From Unsustainable to Sustainable development, Urban problems related to energy, nuclear accident and holocaust, case studies, wasteland reclamation, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act,

Wildlife protection Act, Forest Conservation Act, Issues involved in enforcement of environmental Legislation, public awareness –
Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel –oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes – Noise produced by fire crackers – Noise pollution – Noise level standards for fire crackers – Intensity of sound – Impact on hearing – Safety measures.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations, population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXTBOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad–380013, India, 1989.
4. Benny Joseph, "Environmental Studies"., TATA McGraw Hill, 2010

REFERENCES

1. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, EnviroMedia 2009
2. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
4. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno Science Publications 2013
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB),2001.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
8. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
9. Mckinney, M.L. & School, R.M. 1996. Environmental Science Systems & Solutions, Web Enhanced Edition. 639p.
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publish Co. Pvt. Ltd. 345p.
12. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut.
13. http://eng.mft.info/uploadedfiles/gfiles/c8e31c9e52d84c3.pdf

BEE3L2	ELECTRICAL ENGINEERING LAB	L	T	P	C

	Total Contact Hours – 45	0	0	3	2
	Prerequisite –Electrical Engineering,Basic Electrical Engineering Lab				
	Course Designed by – Dept. of Electrical andElectronics Engineering.				

OBJECTIVES

To understand the performanceofelectricalgenerators, motorsand transformers by conductingdifferent tests

COURSE OUTCOMES (COs)

CO1	Experimentally verify the performance characteristics of Generators
CO2	Experimentally verify the performance characteristics of Motors
CO3	Experimentally verify the performance characteristics of Transformers
CO4	To verify the performance characteristics of Induction motors.
C05	To Understand the concepts of alternators
C06	To verify the performance of compound motors

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	A	B	c	d	e	F	g	h	i	j	k	L
2	CO1	H			H								
	CO2	H	H	H	H	H				M	M		
	CO3	H		H	H								H
	CO4		H		H								
	CO5	M			H					M	M		H
	CO6		H	M	H	H							H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	roject/Term Paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

List of Experiments:

1. Power Measurements in 3-phase circuits.
2. Swinburne's Test.
3. Speed control of DC Shunt motors
4. Load Test on DC shunt generator
5. OCC and Load Test on DC shunt generator
6. OC and SC tests on Transformers
7. Load Test on Transformer.

8. Regulation of alternator by EMF and MMF methods.
9. Equivalent circuit on Single phase induction motor.
10. Load test on DC Compound motor
11. Speed control of DC Compound motor.
12. Study of DC and AC motor starters.

Experiments beyond the syllabus should be conducted.

BEC3L1	**ELECTRONIC DEVICES AND CIRCUITS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	2
	Prerequisite –Basic Electronics Engineering Lab				
	Course Designed by – Dept. of Electronics andCommunication Engineering.				

OBJECTIVES

- To be exposed to the characteristics of basic electronic devices
- Model the electronic circuits using tools such as PSPICE

COURSE OUTCOMES (COs)

CO1	Learn the characteristics of basic electronic devices.
CO2	Learn the Characteristics of UJT
CO3	Learn the Characteristics of FET
CO4	Learn about Power amplifiers.
CO5	Learn about Differential amplifiers
CO6	To understand the concepts of simulation by using Spice tool

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	F	g	h	i	j	k	L
2	CO1	H			H		M			M	M		
	CO2	M		H	H			M					M
	CO3	M		H	H			M		M	M		
	CO4	M			H	H							L
	CO5	M	L		H								
	CO6		H	H	H		H			M			H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. CE Transistor Characteristics
2. UJT Characteristics
3. FET Characteristics
4. SCR Characteristics
5 Power Supplies
6. Frequency Response of CE, CB and CC Amplifiers with self bias, fixed bias and Collector to Base feedback bias.
7. Source Follower with gate resistance, Bootstrapped.
8. Class A and Class B Power amplifiers
9. Differential Amplifiers, CMRR measurements
10. Spice Simulation of Common Emitter and Common Source amplifiers

Experiments beyond the syllabus should be conducted.

BEC3L2	**DIGITAL ELECTRONICS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	2
	Prerequisite –Basic Electronics Engineering Lab				
	Course Designed by – Dept. of Electronics and Communication Engineering.				

OBJECTIVES

- To know the concepts of Combinational circuits.
- To understand the concepts of flip-flops, registers and counters

COURSE OUTCOMES (COs)

CO1	Learn the basics of gates.
CO2	Construct basic combinational circuits and verify their functionalities
CO3	Apply the design procedures to design basic sequential circuits
CO4	Learn about counters
CO5	Learn about Shift registers
CO6	To understand the basic digital circuits and to verify their operation

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	F	g	h	i	j	k	L
2	CO1	M			H		M			M			
	CO2	H		H	H			M			M		M
	CO3	H		H	H			M		M	M		M
	CO4	M	M	H	H	H							M
	CO5	M	L		H								
	CO6	H	H	H	H		H			M			H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	roject/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

List of Experiments

1.Study of logic gates.
2. Design and implementation of adders and subtractors using logic gates.
3. Design and implementation of encoder and decoder using logic gates.
4. Design and implementation of multiplexer and demultiplexer using logic gates .
5. Design and implementation of 2-bit magnitude comparator using logic gates,
6. Design and implementation of 16-bit odd/even parity checker.
7. Design and implementation of Flipflops using logic gates.
8. Design and implementation of code converters using logic gates.
9. Design and implementation of counters.
10. Design and Implementation of shift registers.

Experiments beyond the syllabus should be conducted.

BMA402	**NUMERICAL METHODS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 75	3	2	0	4
	Prerequisite – Calculus I & II				
	Course Designed by – Dept. ofMaths.				

OBJECTIVES

- To train the students to Predict the system dynamic behavior throughsolution of ODEs modelingthe system
- To solve PDE models representing spatial andtemporal variations in physical systems through numerical methods.

COURSE OUTCOMES (COs)

CO1	Solve a set of algebraic equations representing steady state models formed in engineering problems
CO2	Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables
CO3	Find the trend information from discrete data set through numerical differentiation and Summary information through numerical integration.
CO4	Predict the system dynamic behavior through solution of ODEs modeling he system

CO5	Solve PDE models representing spatial and temporal variations in physical systems through numerical methods.
CO6	To train the students with Mathematical techniques to solve problems in Engineering with numerical data.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	k	L
2	CO1	H	H				M			L			H
	CO2	H	H	M	M	H				M	H		H
	CO3	H					H						
	CO4	H		M		H							
	CO5	H	M							M			
	CO6	H	H	M		M	H			L	H		H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	roject/Term Paper/ Seminar/ Internship
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEM 9+6

Iterative method,Newton-Raphson method for single variable-solutions of linear system by Gaussian, Gauss-Jordan, Jacobian and Gauss-Siedal methods,Inverse of matrix by Gauss-Jordan method,Eigen value of a matrix power and Jacobian methods.

UNIT II INTERPOLATION (FINITE DIFFERENCES) 9+6

Newton's Divide difference formula, Lagrange's Interpolation, forward and backward difference formula Stirling's, Bessel's central difference formula.

UNIT III NUMERICAL DIFFERNTIATION AND INTEGRATION 9+6

Numerical Differentiation with interpolation polynomials, Numerical integration by Trapezoidal Simpson's (Both 1/3" and 3/8") rule, Double integrals using Trapezoidal and Simpson's rule.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATION 9+6

Single step methods, Taylor series, Euler and modified Euler, Runge Kutta method of first and second order differential equations, multiple step methods, Milne and Adam's –bash forth predict and corrected method.

UNIT V BOUNDARY VALUE PROBLEMS FOR ODE AND PDE 9+6

Finite difference for the second order ordinary differential equations, finite difference solutions for one dimensional heat equations(both implicit and explicit), one dimensional wave equation, Two dimensional, Laplace and Poisson equation.

TEXT BOOKS:

1. Sastry.SS "Introductory Numerical Methods" PHI, 2010
2. Jain K.K. Iyengar, S.R.K and Jain, R.K. "Numerical Methods for Scientific and Engineering Computation" 3rd edition, New Age International Publications and Co. 1993.

REFERENCE BOOKS:

1. Grewal, B.S. "Higher Engineering Mathematics (36th edition)" Khanna Publication Delhi .

2Curtis F.Gerald. "Applied Numerical Analysis" 7th Edn. Pearson Education, Chennai-600113.

2. Dennis G.Zill and Warren S.Wright. "Advanced Engineering Mathematics". 3rd Edn. Jones & Bartlett Publishers, UK. 1992
4. www.mathforcollege.com

BEC402	ELECTRONIC CIRCUITS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Basic Electronics Engineering				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- Develop the fundamental knowledge about the need for biasing and its various methods.
- Analyze the small signal equivalents circuits and high frequency analysis of Bipolar
- Junction Transistor and Field Effect Transistor
- Analyze the methods of constructing feedback amplifiers, oscillators and tuned amplifiers.
- Outline the performance ofwave shapingcircuits, multivibrators and time base generators
- Construction of power supplies

COURSE OUTCOMES (COs)

CO1	Discuss the concepts of various biasing methods for BJT. Analyze the BJT configurations and BJT amplifiers using small signal model.
CO2	To learn about the large signal amplifiers
CO3	To learn about the various feedback amplifier.
CO4	Understand the basic principles of different types of tuned amplifiers and learn the neutralization techniques
CO5	Describe the operation of multivibrator circuits, time base generators, and their applications
CO6	Discuss the working and characteristics of regulated power supply and SMPS.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	M	M		H		M			M			
	CO2	H		H	H			M			M		M
	CO3	H		H	H			M		M	M		M
	CO4	M	M	H	H	H							M
	CO5	M	L		H								

	CO6	H	H	H	L					M			
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ roject/Term Paper/ Seminar/ Internship (PR)				
					√								
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I BASIC DEVICE STABILIZATION AND LOW FREQUENCY DESIGN ANALYSIS 9

circuits for BJT, DC and AC Load lines, Stability factor analysis, Temperature compensation methods, biasing circuits for FET's and MOSFET's. Transistor, FET and MOSFET Amplifiers, Equivalent circuit, input and output characteristics, calculation of midband gain, input and output impedance of various amplifiers, cascode amplifier, Darlington Bootstrapping, Differential amplifier, CMRR measurement, Use of current source in Emitter.

UNIT II LARGE SIGNAL AMPLIFIERS 9

Class A, AB, B, C and D type of operation, efficiency of Class A amplifier with resistive and transformer coupled load, efficiency of Class B, Complementry Symmetry amplifiers, MOSFET Power amplifiers, Thermal stability of Power amplifiers, heat sink design.

UNIT III FEEDBACK AMPLIFIERS 9

Types of feedback, Effect of feedback on noise, distortion, gain, input and output impedance of the amplifiers, Analysis of Voltage and Current feedback amplifiers, Negative Resistance Oscillator, Barhausen Criterion for oscillation in feedback oscillator, Mechanism for start of oscillation and stabilization of amplitude, Analysis of RC Oscillators using Cascade connection of Lowpass and Highpass filters, Wein Phase shift and twin-T network, Analysis of LC Oscillators, Colpitts, Hartley, Clapp, Franklin, Armstrong and Miller Oscillator, Quartz Crystal Oscillator circuits.

UNIT IV TUNED AMPLIFIERS & MULTIVIBRATOR CIRCUITS 9

Tank circuits, Analysis of single tuned amplifier, Double tuned, stagger tuned amplifiers, instability of tuned amplifiers, stabilization techniques, Narrow band neutralization using coil, Broad banding using Hazeltine neutralization, Class C tuned amplifiers and their applications. Efficiency of Class C tuned Amplifier. Astable multivibrators, monostable and bistable multivibrator using similar and complementary transistors, speed up capacitors, Schmitt trigger circuits.

UNITV RECTIFIERS, BLOCK OSCILLATORS AND TIMEBASE GENERATORS9

Half Wave Rectifier - Full Wave Rectifier – Bridge Rectifier – Performance of Rectifiers – Filters – Types of Filters – L, C, LC, π Filters – Ripple Factor Calculation for C, L, LC and π Filter –

Regulators – Shunt and SeriesVoltage Regulator – IC Regulator – SMPS – Power Control using SCR. RC and RL wave shaping circuits, UJT sawtooth generators, Linearization using constant current circuit, Bootstrap and Miller saw tooth generators, current time base generators, Time base circuits - Voltage-Time base circuit, Current-Time base circuit.

TEXTBOOK:

1.RobertL.BoylestadandLouisNasheresky,"ElectronicDevices and CircuitTheory", 10th Edition,PearsonEducation/ PHI,2008

2.David A.Bell,"Electronic Devices and Circuits", FifthEdition, Oxford University Press,2000

3. Donald .A. Neamen, Electronic Circuit Analysis and Design –2nd Edition,Tata McGraw Hill, 2009.

4. Millman.J. and Halkias C.C, "Integrated Electronics", McGraw Hill, 2001.

REFERENCE BOOKS:

1.MillmanJ.andTaub H., "Pulse Digital and SwitchingWaveforms", TMH,2000.

2.Adel.S. Sedra, Kenneth C. Smith, "Micro Electronic Circuits", 6th Edition, Oxford University.

3.David A., "Bell Electronic Devices and Circuits", Oxford Higher Education Press,5th Editon,

4.Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill,2007.

5.Paul Gray, Hurst, Lewis, Meyer "Analysis and Design of Analog Integrated Circuits",

BEC405	**LINEAR INTEGRATED CIRCUITS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Electronic Circuits-I				
	Course Designed by – Dept. of Electronics And Communication Engineering				

OBJECTIVES

- To understand the basic concepts of operational amplifier and its various applications
- To understand the basics of PLL and its practical applications.
- To know about analog multipliers
- To know about various analog switches and different A/D and D/A convertors.
- To understand the concepts of switched capacitor filters, Voltage regulator

COURSE OUTCOMES (COs)

CO1	Learn about the basic concepts for the circuit configuration for the design of linear integrated circuits and develops skill to solve engineering problems
CO2	Develop skills to design simple circuits using OP-AMP
CO3	Gain knowledge about various multiplier circuits, modulators and demodulators
CO4	Gain knowledge about PLL
CO5	Learn about various techniques to develop A/D and D/A convertors
CO6	Develop skills to develop simple filter circuits and various amplifiers and can solve problems related to it.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	K	l
2	CO1		H				M						
	CO2	M			H	M				M			

	CO3	M	M	M		M							L
	CO4	M						M					M
	CO5		L		M	L		M		M	M		M
	CO6	M		M			H						
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	roject/Term Paper/ Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I CIRCUIT CONFIGURATION FOR LINEAR ICs 9

Current mirror and current sources, current Sources as active loads, Voltage sources, Voltage References, BJT Differential amplifier with active loads, Operational Amplifier-DC characteristics-Frequencyresponse characteristics-Stability-Limitations-Frequency Compensation-Slew rate.

UNIT II APPLICATION OF OPERATIONAL AMPLIFIERS 9

Integrator Voltage to Current convertor, Instrumentation amplifier, Sine wave Oscillators, Low pass and band pass filters, comparator, Multivibrator and Schmitt trigger, Triangle wave generator, Precision rectifier, Log and Antilog amplifiers, Non-linear Linear and Nonlinear Circuits using operational amplifiers and their analysis, Inverting and Non inverting Amplifiers, Differentiator function generator.

UNIT III ANALOG MULTIPLIER AND PLL 9

Integrator Voltage to Current convertor, Instrumentation amplifier, Sine wave Oscillators, Low pass and band pass filters, comparator, Multivibrator and Schmitt trigger, Triangle wave generator, Precision rectifier, Log and Antilog amplifiers, Non-linear Linear and Nonlinear Circuits using operational amplifiers and their analysis, Inverting and Non inverting Amplifiers, Differentiator function generator.

UNIT III ANALOG MULTIPLIER AND PLL 9

Analog Multiplier using Emitter Coupled Transistor Pair - Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications ,Voltage controlled Oscillator, Closed loop analysis of PLL, AM, PM and FSK modulators and demodulators. Frequency synthesizers, Compander ICs.

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTOR 9

Analog switches, High speed sample and hold circuits and sample and hold IC's, Types of D/A

converter Current driven DAC, Switches for DAC, A/D converter, Flash, Single slope, Dual slope, Successive approximation, DM and ADM, Voltage to Time and Voltage to frequency converters.

UNIT V SPECIAL FUNCTION IC 9

Timers, Voltage regulators - linear and switched mode types, Switched capacitor filter, Frequency to Voltage converters, Tuned amplifiers, Power amplifiers and Isolation Amplifiers, Video amplifiers, Fiber optics ICs and Opto couplers, Sources fo Noises, Op Amp noise analysis and Low noise OP-Amps.

TEXT BOOKS:

1. D.Roy Choudhry,Shail Jain,"LinearIntegratedCircuits", NewAgeInternational Pvt.Ltd.,2000.
2. Sergio Franco, "Design with Operational Amplifiers and Analog IntegratedCircuits",3rd Edition, Tata McGraw-Hill, 2007.

REFERENCE BOOKS:

1.Ramakant A.Gayakwad, "OP-AMP and LinearICs",4thEdition, Prentice Hall-PearsonEducation,2001.

2.RobertF.Coughlin,FrederickF.Driscoll,"OperationalAmplifiersandLinearIntegratedCircuits", Sixth Edition,PHI,2001.

3.B.S.Sonde, "Systemdesignusing IntegratedCircuits" ,2ndEdition, NewAgePub, 2001

4.GrayandMeyer,"Analysisand Design ofAnalogIntegratedCircuits",WileyInternational,2005.

5.MichaelJacob,"ApplicationsandDesignwithAnalogIntegratedCircuits",PrenticeHallofIndia, 1999

6. WlliamD.Stanley,"OperationalAmplifierswithLinearIntegrated Circuits", Pearson Education, 2000

7.S.Salivahanan&V.S.Kanchana Bhaskaran, "Linear IntegratedCircuits",TMH,2008.

8. www.chegg.com/tutors/

BCS406	OBJECTED ORIENTED PROGRAMMING AND DATA STRUCTURES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Fundamentals of Computing and Programming				
	Course Designed by – Dept. of Computer Science Engineering.				

OBJECTIVES

- To develop solutions to a given problems using class object concepts.
- To understand the concepts offloading, inheritance and polymorphism
- To learn the basic data structures and its operations.

COURSE OUTCOMES (COs)	
CO1	Develop solutions to a given problems using class object concepts.
CO2	Illustrate overloading, inheritance and polymorphism concepts with example
CO3	Explain the basic data structures and its operations
CO4	Make use of basic data structures to solve problems
CO5	To develop programs using C++ which forms the basic for advanced programming

CO6	Outline various searching and sorting algorithms												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	B	c	d	e	f	g	h	i	j	K	l
	L	M	H				M						
	CO2	M			H	M				M			M
	CO3	M	M			M							
	CO4	L						M					M
	CO5	H	H	L	M			M		M	M		M
	CO6	M					H						H

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I DATAABSTRACTION&OVERLOADING 9

OverviewofC++–Structures–Class Scope and Accessing Class Members –Reference Variables–Initialization–Constructors–Destructors–MemberFunctionsandClasses–FriendFunction–Dynamic Memory Allocation – Static Class Members –Overloading: Function overloading and Operator Overloading.

UNIT II INHERITANCE&POLYMORPHISM 9

Base Classes and Derived Classes–Protected Members–Overriding –Public,Protected and Private Inheritance –Constructors and Destructors in derived Classes–Implicit Derived– Class Object To Base–Class Object Conversion–Virtual functions–This Pointer–Abstract Base Classes and Concrete Classes– Virtual Destructors– Dynamic Binding.

UNIT III LINEARDATASTRUCTURES 9

Abstract Data Types(ADTs)–ListADT–array-basedimplementation– linked list implementation–singly linked lists–Polynomial Manipulation-Stack ADT – Queue ADT

UNIT IV NON-LINEARDATASTRUCTURES 9

Trees–BinaryTrees–Binary tree representation and traversals–The Search Tree ADT– Graph and its representations–Graph Traversals–Breadth-first search–Depth-first search– Bi-connectivity**.**

UNIT V SORTINGANDSEARCHING 9

Sorting algorithms:Insertion sort-Quick sort –Mergesor-Searching: Linear search –Binary Search.

TEXT BOOKS:

1. Deitel and Deitel, “C++,HowTo Program” ,FifthEdition, PearsonEducation, 2005.
2. BhushanTrivedi,—Programming withANSIC++,AStep-By-Step approach, OxfordUniversityPress, 2010.

REFERENCE BOOKS:

1. Goodrich, Michael T., Roberto Tamassia,David Mount, “Data Structuresand Algorithms in C++”, 7th Edition, Wiley. 2004
2. Thomas H. Cormen, CharlesE. Leiserson, RonaldL. Rivest andClifford Stein, "Introduction to Algorithms", Second Edition, McGraw Hill, 2002.
3. BjarneStroustrup, “TheC++ProgrammingLanguage”,3rdEdition,Pearson Education,2007
4.EllisHorowitz,SartajSahniandDineshMehta, “Fundamentals ofDataStructures inC++”, GalgotiaPublications, 2007.

OtherReferences:

1. http://users.cis.fiu.edu/~weiss/
2. www.youtube.com/watch?v=x3aC8F1X8ao

BEC403	ELECTROMAGNETIC FIELDS AND WAVES	L	T	P	C
	Total Contact Hours -60	4	0	0	4
	Prerequisite –Engineering Mathematics-III&Electrical Engineering				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

To understand and gain complete knowledge about

- Theorem, Laws, Principle & Applications of Static Electromagnetic Fields
- Various Laws of Static Magnetic Field
- Various relation & parameters of Electric Field in Dielectrics
- Magnetic Field with different structure in Ferromagnetic Materials
- Time Varying Electric And Magnetic Fields .

COURSE OUTCOMES (COs)

CO1	To understand the Theorem, Laws, Principle and their related problems over Static Electromagnetic Fields.
CO2	To learn the basic laws in Static Magnetic Field and able to find various parameters with the related problems
CO3	To know how the Electric Field is applied in Dielectrics with various equations and applications
CO4	To understand how the Magnetic field works with Ferromagnetic Materials
CO5	To analyse how the Time is Varying in both Electric And Magnetic Fields with various Derivation
CO6	To understand, and analysethe electromagnetic field distribution which forms the basis for advanced subjects related to electromagnetic field.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	K	l
2	CO1	H			M		M						

	CO2	M	M	M				M			H		
	CO3	M						L					H
	CO4					H		M		M	M		
	CO5		L	M	M					M			
	CO6	M				H	H			H			H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)(PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I STATIC ELECTROMAGNETIC FIELDS 12

Introduction to co-ordinate system, Gradient, Divergence, Curl, Divergence Theorem, Stoke's Theorem, Coulomb's Law, Electric field Intensity, Principle of superposition, Electric Scalar potential, Line charge distribution by Moment method, Electric flux Density, Gaus's Law and its applications, Field Computations and Problems.

UNIT II STATIC MAGNETIC FIELD 12

Magnetic field of a current carrying element, Ampere's Force law, The Biot-Savart Law, Magnetic Flux density, Gauss law for magnetic fields, Torgue on a loop, Magnetic moment, Ampere's Law and Magnetic field intensity, Magneto motive force, Field cells and permeability, Vector potential, Field computation and problems.

UNIT III ELECTRIC FIELD IN DIELECTRICS 12

Permittivity, Polarization, Boundary relation, Capacitance, Dielectric strength, Energy and energy density, Poisson's and Laplace equations and applications, Electric Current, Current Density, Ohms law at a point, Resistance and Conductance, Continuity relations for current problems.

UNIT IV MAGNETIC FIELD IN FERROMAGNETIC MATERIALS 12

Magnetic materials, Magnetic dipoles, Loops and Solenoids, Magnetization, Inductance, Energy in an Inductor and Energy Density, Boundary relations, Ferro magnetism, Hysteresis, Reluctance and Permeance, Problems.

UNIT V TIME VARYING ELECTRIC AND MAGNETIC FIELDS 12

Faraday's Law, Transformer and Motional Induction, Maxwell's equation from Faraday's Law, Self and Mutual Inductance, Displacement current, Maxwell's equation from Ampere's Law and its in-consistency, Boundary relation, Poynting Vector, Comparison of field and circuit theory, Circuit Application of pointing Vector.

TEXT BOOKS:

1. William H Hayt and Jr John A Buck, "Engineering Electromagnetics",Tata McGraw-HillPublishing Company Ltd, NewDelhi, 2008
2. Sadiku MH,"Principles of Electromagnetics", Oxford University PressInc, NewDelhi,2009
3. David K Cheng, "Field and Wave Electromagnetics", Pearson EducationInc,Delhi,2004

REFERENCE BOOKS:

1. John D Kraus and Daniel A Fleisch,"Electromagnetics with Applications",McGrawHillBook Co,2005
2. Karl E Longman and SavaV Savov,"Fundamentals of Electromagnetics",Prentice Hall ofIndia,NewDelhi,2006
3. Ashutosh Pramanic,"Electromagnetism", Prentice Hall of India,NewDelhi,2006
4. www.Wiley.com

BEI406	**ELECTRONIC INSTRUMENTATION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Electronic Circuits-I				
	Course Designed by – Dept. of Electronics and instrumentation Engineering.				

OBJECTIVES

- Explain basic concepts and definitions in measurement.
- Describe the bridge configurations and their applications.
- Elaborate discussion about the importance of signal generators and analyzers in measurements.

COURSE OUTCOMES (COs)

CO1	Recognize the evolution and history of units and standards in Measurements
CO2	Identify the various parameters that are measurable in electronic instrumentation
CO3	Employ appropriate instruments to measure given sets of parameters
CO4	Practice the construction of testing and measuring set up for electronic systems.
CO5	To have a deep understanding about instrumentation concepts this can be applied to control systems.
CO6	Relate the usage of various instrumentation standards.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	K	l
2	CO1		M										
	CO2	H		H		M	L		M	M			H
	CO3	M	M	H	H				M		M		H
	CO4	H		H	H	H			M				
	CO5				M					M			H
	CO6	H	L				H				L		

3	Category	Humanities & Social Studies (HS)	Basic Sciences & (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I TRANSDUCERS 9

Measurements, Instrumentation, Errors in measurements, Calibration and standard, Classification and characteristics of Transducers, Digital, Electrical, Electronic Weighing System, AC / DC Bridge measurement and their applications.

UNIT II SIGNAL GENERATOR AND SIGNAL ANALYZERS 9

A.F. Generator, Pulse Generator, AM/FM Signal generator, Function generator, Sweep frequency generator, wave analyzers, Spectrum Analyzers, Logic Analyzers, Distortion Analyzers.

UNIT III DIGITAL INSTRUMENTS 9

Digital Voltmeters and Multimeters, Automation in Voltmeters, Accuracy of DVM, Guarding Techniques, frequency, period, time interval and pulsewidth measurements, automatic vector voltmeter.

UNIT IV DATA DISPLAY AND RECORDING SYSTEM 9

CRO, single beam, dual trace, double beam CRO, Digital storage and Analog storage Oscilloscope, sampling Oscilloscope, Power scope, Curve Tracer, Analog, Digital Recorders and Printers.

UNIT V COMPUTER CONTROLLED TEST SYSTEM 9

Testing and Audio amplifier, Testing a Radio Receiver, Instrument used in Computer Controlled Instrumentation, Digital Control Description, Microprocessor based measurements, Isolation and safety standards of Electronic equipments, Case studies in Instrumentation.

TEXT BOOKS:

1. Rangan C.S., " Instrumentation Devices and Systems ", Tata McGraw Hill,1998.
2. Cooper, " Electronic Instrumentation and Measurement Techniques ", Prentice Hall of India, 1988.

REFERENCE BOOKS:

1. H.S.Kalsi, “Electronic Instrumentation”, Tata Mc Graw-Hill Education, 2004.
2. J.B.Gupta, “Measurements and Instrumentation”, S K Kataria & Sons, Delhi, 2003.
3. Oliver and Cage, " Electronic Measurements and Instrumentation ", McGraw Hill, 1975.
4. https://www.nptel.ac.in

BEC4L1	ELECTRONIC CIRCUIT DESIGN LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Electronics Devices and circuit Lab				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- To gain hands on experience in designing electronic circuits.
- To learn simulation software used in circuit design.
- To learn the fundamental principles of amplifier ,Oscillator and multivibrator circuits
- Construct waveform generation circuits

COURSE OUTCOMES (COs)

CO1	Analyse the characteristics of amplifiers.
CO2	Analyse the characteristics of Oscillators.
CO3	Analyse the characteristics of Multivibrators
CO4	Analyse the characteristics of tuned amplifiers
CO5	Analyse the frequency response of amplifiers using pSpice
CO6	Model the design of electronic circuits using PSpice

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	K	l
2	CO1	H		H	H		M			M			M
	CO2	H	M	H	H		M		M	M	L		
	CO3	M	M		H								
	CO4	M			H			M					
	CO5			M		H							
	CO6	L	H	H		H	H		M	M	M		H

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1.Feedback amplifier
2. Transistor phase shift oscillator
3. Class A single tuned amplifier
4. LC Oscillators
5. Collector coupled and Emitter coupled Astable multivibrator
6. Wein bridge oscillator
7. Schmitt Trigger
8. Emitter coupled bistable multivibrator

9. Monostable multivibrator
10. Class C tuned amplifier

SIMULATION USINGSPICE:

1.Frequencyresponseof CE amplifierwith Emitterresistance.
2.DC responseofCS amplifier
3.Frequencyresponseof Cascodeamplifier.
4.TransferCharacteristics ofClass B PowerAmplifier

Experiments beyond the syllabus should be conducted.

BEC4L2	**LINEAR INTEGRATED CIRCUITS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Basic Electronics Lab				
	Course Designed by – Dept. of Electronics And Communication Engineering				

OBJECTIVES

- To apply operational amplifiers in linear and nonlinear applications.
- To acquire the basic knowledge of special function ICs
- To use SPICE software for circuit design

COURSE OUTCOMES (COs)

CO1	Design and analyse the various linear application of op-amp
CO2	Design and analyse the various non-linear application of op-amp
CO3	Design and analyse filter circuits using op-amp
CO4	Design and analyse oscillators and multivibrator circuits using op-amp
CO5	Design and analyse the various application of 555 timer
CO6	Analyse the performance of oscillators and multivibrators using SPICE

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l
2	CO1	H		H	H		M		L				
	CO2	H		H	H					M	L		
	CO3	M	M	M	H	M			H	M	M		M
	CO4	M		M	H					M			
	CO5	M		M	H					H			
	CO6	H	M	M	H	M				H	M		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Inverting and non-inverting amplifier
2. Integrator , differentiator

3. Summer,subtractor using op-amp
4. Triangular wave generator using op-amp
5. RC Phase shift Oscillator using op-amp
6. Schmitt trigger using Op-amp
7. Active low pass and high pass filters.
8. Astable Multivibrator using 555 timer
9. Monostable multivibrator using 555 timer
10. Schmitt trigger using 555 timer
11. Voltage controlled Oscillator.
12. PLL characteristics.
13. Study of SMPS.

SIMULATION USINGSPICE

1. Simulation of Experiments, 4, 5, 6 ,7 and 8..
2. CMOS Inverter, NAND and NOR

Experiments beyond the syllabus should be conducted.

BCS4L3	**OBJECT ORIENTED PROGRAMMING AND DATA STRUCTURES LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Computer Practice Lab				
	Course Designed by – Dept. of Computer Science Engineering				

OBJECTIVES

- To learn various object oriented concepts through simple programs.
- To understand the concepts of searching and sorting algorithms

COURSE OUTCOMES (COs)

CO1	Implement various object oriented concepts through simple programs
CO2	Implement different data structures usingC++.
CO3	Apply the different data structures for implementing solutions to practical problems.
CO4	Demonstrate searching algorithms
CO5	Demonstrate sorting algorithms
CO6	To develop the skills in programming using C++ which forms the basics for advanced programming

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l
2	CO1	H	H				M		L				
	CO2				M	M				M	M		
	CO3		M		M	M		M		M	M		M
	CO4	M	M	M						M			H
	CO5	M		M						H			H
	CO6	H	H	M		M		H		H	M		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

Programs forC++ Concepts

- Constructors and destructors
- Static data member
- Function overloading
- Operator overloading
- Inheritance

Data Structures

1. List
   - Array implementation
   - Linked list implementation
   - Polynomial operations
2. Stack
   - Arrayimplementation
   - Linked list implementation
   - Applications
3. Queue
   - Array implementation
   - Linked list implementation
4. Binary Search tree
5. Sorting
   - Quick sort
   - Merge sort
6. Searching
   - Linear search
   - Binary search

Experiments beyond the syllabus should be conducted.

BEC505	DIGITAL SIGNAL PROCESSING	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite –Signals and Systems				

	Course Designed by – Dept. of Electronics And Communication Engineering.

OBJECTIVES:

- To study about discrete time systems and to learn about FFT algorithms.
- To study the design techniques for FIR and IIR digital filters
- To study the finite word length effects in signal processing
- To study the properties of random signal,Multirate digital signal processing and about QMF filters.

COURSE OUTCOMES (COs)

CO1	To apply DFT for the analysis of digital signals & systems
CO2	To design FIR filters
CO3	To design IIR filters
CO4	To characterize finite Word length effect on filters
CO5	To have a deep understanding on basics of digital signal processing which can be applied to communication systems
CO6	To design the Multirate Filters

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	K	l
2	CO1	H			H	H							
	CO2	H	H	H	H	H				M			H
	CO3	H	H	H	H	H				M			H
	CO4		M		M		H			M			
	CO5	M									M		H
	CO6			H			L						M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core	Core Elective (CE)	Non-Major Elective (NE)	Open Elective	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I DISCRETE – TIME SIGNALS AND SYSTEMS 12

Sampling of Analogue signals – aliasing – standard discrete time signals – classification – discrete time systems – Linear time invariant stable casual discrete time systems – classification methods – linear and circular convolution – Overlap add and Save methods-Difference equation representation – DFS, DTFT, DFT – FFT computations using DIT and DIF algorithms.

UNIT II INFINITE IMPULSE RESPONSE DIGITAL FILTERS 12

Review of design of analogue Butterworth and Chebyshev Filters, Frequency transformation in analogue domain – Design of IIR digital filters using impulse invariance technique – Design of

digital filters using bilinear transform – pre warping – Frequency transformation in digital domain – Realization using direct, cascade and parallel forms.

UNIT III FINITE IMPULSE RESPONSE DIGITAL FILTERS: 12

Symmetric and Antisymmetric FIR filters – Linear phase FIR filters – Design using Frequency sampling technique – Window design using Hamming, Hanning and Blackmann Windows – Concept of optimum equiripple approximation – Realisation of FIR filters – Transversal, Linear phase and Polyphase realization structures.

UNIT IVFINITE WORD LENGTH EFFECTS: 12

Quantization noise – derivation for quantization noise power – Fixed point and binary floating point number representations – Comparison – Overflow error – truncation error – coefficient quantization error – limit cycle oscillations- signal scaling – analytical model of sample and hold operations.

UNIT V SPECIAL TOPICS IN DSP: 12

Discrete Random Signals- Mean, Variance, Co-variance and PSD – Periodiogram Computation – Principle of Multi rate DSP – decimation and Interpolation by integer factors – Time and frequency domain descriptions – Single, Multi stage, polyphase structures – QMF filters – Subband Coding

TEXT BOOKS:

1. John G.Proakis&DimitrisG.Manolakis,"Digital Signal Processing–Principles, Algorithms & Applications", Fourth Edition, Pearson Education/Prentice Hall,2007.

REFERENCE BOOKS:

1.Sanjit K.Mitra,"Digital Signal Processing–A Computer Based Approach",Tata McGraw Hill,

2. A.V.Oppenheim, R.W. Schafer andJ.R. Buck, "Discrete-Time Signal Processing", 8th IndianReprint,Pearson,2004.

3.www.ocw.mit.edu

BEC502	MICROPROCESSOR AND MICROCONTROLLER	L	T	P	C
	Total Contact Hours - 45	4	0	0	4
	Prerequisite –Principles of Digital Electronics				
	Course Designed by – Dept. of Electronics and Communication Engineering				

OBJECTIVES

- The objective of this course is to become familiar with the architecture and the instruction set of an Intel microprocessor
- Assembly language programming will be studied as well as the design of various types of digital and analog interfaces
- Understand the architecture of 8085 and 8051

COURSE OUTCOMES (COs)

CO1	Design and implement programs on 8086,ARM, PIC.
CO2	DesignI/O circuits.

CO3	The program prepares students to successfully compete for employment in Electronics, Manufacturing and Embedded fields.
CO4	Design Memory Interfacing circuits.
CO5	Design and implement 8051 microcontroller based systems.
CO6	Describethe architectureand instruction setof ARM microcontroller

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	F	g	h	i	j	K	l
2	CO1	M	H		H		M			H	M		H
	CO2	M	L	H		M				L			
	CO3	M											M
	CO4	M			H	H				M	M		
	CO5	M	H			H				M			H
	CO6					M	H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I MICROPROCESSOR 8086 12

Register Organization -Architecture-Signals-Memory Organization-Bus Operation-I/O Addressing-Minimum Mode-Maximum Mode-Timing Diagram-Interrupts - Service Routines – I/O and Memory Interfacing concepts.

UNIT II PROGRAMMING OF 8086 12

Addressing Modes-Instruction format-Instruction set-Assembly language programs in 8086. RISC architecture – introduction to ARM Programming register configuration and instruction set - introduction to PIC Programming register configuration and instruction set – sample program.

UNIT III INTERFACING DEVICES 12

Programmable Peripheral Interface (8255) - Programmable Interval Timer (8254) - Programmable Interrupt Controller (8259A) - Programmable DMA Controller (8257) - Programmable Communication Interface (8251A) – Programmable Keyboard and Display Controller (8279).

UNIT IV MICROCONTROLLER-8051 12

Register Set-Architecture of 8051 microcontroller- I/O and memory addressing-Interrupts-Instruction set- Addressing modes. Timer-Serial Communication-Interrupts Programming-Interfacing to External Memory-Interfacing to ADC, LCD, DAC, Keyboard and stepper motor.

UNIT V SYSTEM DESIGN USING MICROPROCESSOR & MICROCONTROLLER **12**

Case studies – Traffic light control, washing machine control, RTC Interfacing using I2C Standard- Motor Control- Relay, PWM, DC & Stepper Motor.

TEXT BOOKS:

1. Muhammad Ali Mazidi and Janice Gillispie Mazidi, "The 8051 -Microcontroller and Embedded systems", 7th Edition, Pearson Education, 2004.
2. Doughlas.V.Hall, "Microprocessor and Interfacing : Programming and Hardware", Revised 2nd edition, McGraw Hill, 1992
3. Steve Furber, "ARM System On Chip Architecture", Second Edition,Pearson Education, 2000.
4. K. Ray and K. M. Bhurchandi, "Advanced Microprocessors and Peripherals – Architectures, Programming and Interfacing", Tata McGraw Hill, 2002 Reprint
5. Design with PIC microcontroller by John B Peatman.

REFERENCE BOOKS:

1. Kenneth.J.Ayala, "8051 Microcontroller Architecture, Programming and Applications", 3rd edition, Thomson, 2007.
2. NuvoTon Cortex M0 (Nu-LB-NUC100/140) Driver and Processor Reference Manual;
3. www.nuvoton.com

BEC504	COMMUNICATION ENGINEERING I	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Signals and Systems				
	Course Designed by – Dept. of Electronics And Communication Engineering				

OBJECTIVES

- Analog modulation and demodulation techniques.
- Acquiring mathematical understanding of Analog Communication Systems.
- Understanding the trade-offs (in terms of bandwidth, power, and complexity requirements)
- Performance evaluation of communication systems in the presence of noise.

COURSE OUTCOMES (COs)

CO1	Students will have knowledge of basic mathematical concepts and from a block-diagram system approach.
CO2	It will allow thinking in the two "domains" of communications, the time domain and the frequency domain.
CO3	To evaluate communication systems in the presence of noise.
CO4	They will have knowledge of basic types of analog modulation (AM, FM, and PM) from mathematical description.
CO5	Tounderstand trade-offs (in terms of bandwidth, power, and complexity requirements)
CO6	Design of practical communication system at the block diagram level under certain constraints and requirements

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	K	L
2	CO1	H		M	H		M	M			M		M
	CO2	M	M					M		M			
	CO3	M	M		H	M	L			M	L		
	CO4	M		M		H					M		M
	CO5		M		M		M			H			M
	CO6	H	M		M	M		M		M			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I AMPLITUDE MODULATION SYSTEMS 9

Need for modulation, Amplitude Modulation System, Single Tone & Multiple Tone Amplitude Modulation, Power Relation, Generation of Amplitude Modulation – Linear Modulation – Collector Modulation method Non-linear Modulation – Square law Modulator, Product Modulator, Switching Modulator - Demodulation of Amplitude Modulation – Envelope Detector,Coherent Detector, VSB, Performance comparison of various Amplitude Modulation System.

UNIT II ANGLE MODULATION SYSTEMS 9

Frequency Modulation, Types of Frequency Modulation, Generation of NBFM, WBFM, Transmission BW of FM Signal, Phase Modulation. Relationship between PM & FM, Comparison, Generation of FM Direct Method, Indirect method, Demodulation of FM - FM Discriminators.

UNIT III RADIO RECEIVERS 9

Introduction – Functions & Classification of Radio Receivers, Tuned Radio Frequency (TRF) Receiver, Superheterodyne Receiver – Basic Elements, Receiver Characteristics, Frequency Mixers, AGC Characteristics

UNIT IV NOISE THEORY 9

Noise, Types of noise, White Noise, Addition of Noise due to several sources in series and parallel, Generalized Nyquist Theorem for Thermal Noise,Calculation of Thermal Noise for a Single Noise Source, RC Circuits & Multiple Noise sources. Equivalent Noise Bandwidth, Signal to Noise Ratio, Noise-Figure, Noise Temperature, Calculation of Noise Figure, Noise FigureDetermination for Cascaded Stages of Amplifiers

UNIT V PERFORMANCE OF COMMUNICATION SYSTEM 9

Receiver Model, Noise in DSB-SC Receivers, Noise in SSB-SC Receivers, Noise in AM receiver (Using Envelope Detection), Noise in FM Receivers, FM Threshold Effect, Threshold Improvement through Pre-Emphasis and De-Emphasis, Noise in PM system – Comparison of Noise performance in PM and FM, Link budget analysis for radio channels.

TEXT BOOKS:

1. John G. Proakis & Masoud Salehi, *"Communication System Engineering",* 2nd Edition, 2002.
2. R.P. Singh & S.D. Sapre, *"Communication Systems: Analog & Digital",* 3rd Edition, Tata McGraw-Hill, 2012.

REFERENCE BOOKS:

1. Sanjay Sharma, "Communication Systems, Analog & Digital", S.K. Kataria & Sons, 5th Edition, 2009.
2. Dennis Reddy & John Coolen, "Electronic Communications", 4th Edition, Prentice Hall, 2008.
3. www.techvyom.com

BMA504	**RANDOM PROCESS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 75	3	2	0	4
	Prerequisite –Probability theory.				
	Course Designed by – Dept. of Mathematics				

OBJECTIVES

- To impart adequate knowledge about probability concepts,
- To make students understand Moment Generating Functions.

COURSE OUTCOMES (COs)

CO1	After completing this course students would be able to apply concepts of Probability to solve problems in Electronic Engineering.
CO2	Find functional relationship between random inputs and outputs with the use of Random Process Techniques
CO3	Find the linearity in Birth and Death Processes with the use of Poisson processes.
CO4	To make students understand Discrete and Continuous Random variables, Random Processes and their applications in Electronic Transmissions
CO5	To Understand about the correlation Functions
CO6	Find the trend information from discrete data set through numerical differentiation and summary information through random process

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	L
2	CO1	H					M	M	H	H		H	
	CO2	H	M	H									M
	CO3	H			H	M	M				L		
	CO4	H		M		H		M	L			M	
	CO5	H	M		M			H		M			H
	CO6	H	M			M	H			M	M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PROBABILITY AND RANDOM VARIABLES 9+6

Probability concepts, Bayes' theorem, Random variables. Moments, Moment Generating function, Binomial, Poisson, Geometric, Exponential, and Normal distributions. Univariate Transformation of random variable.

UNIT II TWO-DIMENSIONAL RANDOM VARIABLES 9+6

Marginal and conditional distributions, Covariance, Correlation and regression, Transformation of random variables, Central limit theorem-Lindberg and Liapounouff Theorems (applications).

UNIT III RANDOM PROCESSES 9+6

Classification, Stationary and Markov processes, Binomial process, Poisson process, Sine-wave process, Ergodic processes.

UNIT IV CORRELATION FUNCTION 9+6

Auto correlation for discrete and continuous processes, Cross correlation functions, Correlation integrals.

UNIT V SPECTRAL DENSITIES 9+6

Power spectral density, Cross spectral density, Applications to linear systems with random inputs

TEXT BOOKS:

1. S.C.Gupta & V.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi , 2003.
2. O Flynn M., " Probability, Random Variables and Random Processes", HarperandRowPublishers, New York, (1982).

REFERENCE BOOKS:

1. Peebles Jr.,"Probability, Random Variables and Random Signal Principles", McGraw Hill Publishers, (1987).
2. Ochi M.K., "Applied Probability and Stochastic Processes ", Wiley India Pvt Ltd, New Delhi.
3. Douglas C.Montgomory, George C.Runger, and Norma F.Hubele. "Engineering Statistcs" 4th Edn. Wiley India Pvt Ltd., New Delhi. 2007.
4. Ronald E.Walpole. "Probability and Statistics for Engineers and Scientists". 9th Edn. 2014.
5. Pearson Education, Chennai-600113
6. www.math.chalmers.se/Stat/.../CTH/.../091

BEC5L1	DIGITAL SIGNAL PROCESSING LABORATORY	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Object Oriented Programming & data Structures Lab				
	Course Designed by – Dept. of. Electronics And Communication Engineering				

OBJECTIVES - To implement Linear and Circular Convolution
- To implement FIR and IIR filters
- To study the architecture of DSP processor.

COURSE OUTCOMES (COs)

CO1	Experiment concepts of DSPand its applications usingMATLABSoftware
CO2	To understand about the basic signal generation
CO3	To learn Fourier Transform Concepts
CO4	To design FIR filters
CO5	To design IIR filters.
CO6	Demonstrate their abilities towards DSP processor based implementation of DSP systems

Mapping of Course Outcomes with Program outcomes (POs
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	K	L
2	CO1	H	H		M	H	M			M			
	CO2	L		M		H		M					M
	CO3	M				H		M		M	M		
	CO4	M	M	M		H		M		M	M		H
	CO5	M	M	M		H				M			H
	CO6	L			M						H		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1.Waveform generation
2.Sampling and its effect on aliasing
3.Linear and circular convolution
4.DFT computation
5.Fast Fourier transforms
6. FIR Filters Implementation
7. IIR Filters Implementation
8. Quantisation Noise.
9. Multirate Signal Processing

10.DSP processor implementation.

Experiments beyond the syllabus should be conducted.

BEC5L6	MICROPROCESSOR AND MICROCONTROLLER LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Principles of Digital Electronics				
	Course Designed by – – Dept. of Electronics And Communication Engineering				

OBJECTIVES

- Study the Architecture of 8085&8086 microprocessor.
- Learn the design aspects of I/O and Memory Interfacing circuits.
- Study the Architecture of 8051 microcontroller

COURSE OUTCOMES (COs)

CO1	Design and implement programs on 8085 microprocessor.
CO2	Design and implement programs on 8086 microprocessor.
CO3	Design interfacing circuits with 8085
CO4	Design interfacing circuits with 8086.
CO5	Design and implement 8051 microcontroller based systems
CO6	To Understand the concepts related to I/O and memory interfacing

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	K	l
2	CO1	H			M		L		L	H	L		
	CO2	H			M			M					M
	CO3	M	M	M	H			M		M			
	CO4	M	M	M	H				H		M		
	CO5	M	H	H		H				H			H
	CO6			M			M						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Programming with 8085 – 8-bit/16-bit addition/subtraction
2. Programming with 8085 – 8-bit/16-bit multiplication/ division using repeated addition/subtraction.

3. Programming with 8085 – 8-bit/16-bit Ascending/Descending order
4. Programming with 8085 – 8-bit/16-bit Largest/smallest number
5. Programming with 8085- code conversion, decimal arithmetic, bit manipulations.
6. Programming with 8085 – matrix multiplication, floating point operations.
7. Programming with 8086 – String manipulation, search, find and replace, copy operations, sorting.
8. Interfacing with 8085/8086 – 8255, 8253.
9. Interfacing with 8085/8086 – 8279, 8251.
10. 8051 Microcontroller based experiments – Simple assembly language programs
11. 8051 Microcontroller based experiments – simple control applications.

Experiments beyond the syllabus should be conducted.

BEC5L3	**COMMUNICATION ENGINEERING LABORATORY-I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Communication Engineering-I				
	Course Designed by – Dept. of Electronics And Communication Engineering				

OBJECTIVES

- To practice the basic theories of analog communication system.
- To use computer simulation tools such as P-SPICE, or Matlab to carry out design experiments as it is a key analysis tool of engineering design.
- To give a specific design problem to the students, which after completion they will verify using the simulation software or hardware implementation.

COURSE OUTCOMES (COs)

CO1	To develop practical knowledge about theories of analog communication
CO2	To develop practical knowledge about simulation software
CO3	To provide hands-on experience to the students, so that they are able to apply theoretical concepts in practice.
CO4	Demonstrate various pulse modulation techniques
CO5	Evaluate analog modulated waveform in time /frequency domain and also find modulation index
CO6	Develop understanding about performance of analog communication systems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	k	L
2	CO1	H	M				M		L	M		L	
	CO2	M											
	CO3	M	M	M	H						L		H
	CO4	M	M	M		H		M		H		H	
	CO5		L	M					M				
	CO6	M					H				H		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. AM modulator and Demodulator.
2. DSB-SC modulator and Demodulator.
3. SSB modulator and Demodulator.
4. FM modulator and Demodulator.
5. PAM modulator and Demodulator.
6. TDM Multiplexer and Demultiplexer.
7. FDM Multiplexer and Demultiplexer.
8. Pre emphasis and De-emphasis in FM.
9. Simulation experiments using P-SPICE and Matlab.
   i) AM modulator with AWGN noise in Matlab.
   ii) Pre-emphasis and De-emphasis in FM usingP-SPICE**.**

RESOURCESREQUIRED

1. AM Kit
2. TDM Kit

Experiments beyond the syllabus should be conducted.

	COMPREHENSION I	**L**	**T**	**P**	**C**
BEC5C1	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses up to fifth semester				
	Course Designed by – Dept. Electronics& Communication Engineering				

OBJECTIVES

- To provide a complete review of Electrical & Electronics engineering topics covered up to fifth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to fifth semester.

BEC601	COMPUTER COMMUNICATION AND NETWORKS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Communication Engineering-II				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- To make the students to understand the different layers of ISO /OSImodel and TCP/IP NetworkIEEE standards.
- To understand IPaddressing methods and QOS parameters.
- To know the functions and congestion control mechanism of TCP.
- To know about application layer and network security.

COURSE OUTCOMES (COs)

CO1	Explain the networks, topologies and layers of OSI model,compare with TCP/IPmodel.
CO2	Classify error control and flow control techniques and types of LAN technologies.
CO3	Analyze different routing algorithms and methods to improve QOS.
CO4	Explain the role of protocols in networking.
CO5	Summarize the transport layer protocols and congestion controls methods.
CO6	Describe various application layer services and cryptographic techniques.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	K	l
2	CO1	H	H			M	M				H	L	
	CO2	M	L							M			M
	CO3	M	H	M	M			H			M		
	CO4	M	H	M	M	H		M		M		H	
	CO5								L	H			L
	CO6	H					M						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I DATA COMMUNICATION: 9

ISO reference model, Open system standard, Transmission of Digital Data – Electrical Interface, MODEMS, Line Configuration, Encoding and Decoding, Multiplexing, Error Detection and Correction (CRC).

UNIT II DATA LINK CONTROL AND PROTOCOLS: 9

Flow control and error control, stop and wait, Sliding windows, Automatic Repeat (ARQ), Asynchronous Protocols, - X MODEM, Y MODEM, Synchronous protocols – Character Oriented and Bit oriented protocols (HDLC).

UNIT III LOCAL AREA NETWORKS: 9

IEEE 802 standards, LLC, MAC layer protocols – CSMA/CD Ethernet, Token Bus, Token Ring, FDDI, Distributed Queue Dual Bus, Switched Multimega Bit Data Service.

UNIT IV WIDE AREA NETWORKS: 9

Circuit Switch packet Switch, Message Switching, X .25 Protocols, Architecture And Layers of Protocol, Frame Delay, ISDN and ATM Protocol, Internet working Device, Repeater, Bridge, Routes and Gateways, Routing Algorithms.

UNIT V UPPER OSI LAYERS: 9

Session layer protocols, Presentation layer – Data Security, Encryption/Decryption, Authentication, Data Composition, Application layer protocols – MHS, File transfer, Virtual terminal, CMIP.

TEXT BOOKS:

1. Behrus A. Forouzane.tal, "Data Communication and Networking", 2nd Edition, Tata McGraw-

REFERENCE BOOKS:

1. William Stallings, "Data and Computer Communication", Fifth Edition, Prentice Hall of India,1997.
2.Andrew S.Tanenbaum, "Computer networks", Third Edition, prentice Hall of India, 1996.
3.www.studytonight.com/computer-network...

BEC604	COMMUNICATION ENGINEERING - II	L	T	P	C
	Total Contact Hours -45	3	0	0	3
	Prerequisite – CommunicationEngineering-I				
	Course Designed by – – Dept. of Electronics And Communication Engineering				

OBJECTIVES

- To learn and understand
- The process of sampling, quantization and coding that are fundamental to the digital transmission of analog signals and digital modulation systems.
- Baseband and passband transmission systems.
- M-ary signaling and spread spectrum Techniques. .

COURSE OUTCOMES (COs)

CO1	Students will learn about the basic concepts of Sampling, basic concepts of baseband transmission of binary data
CO2	They gain knowledge about basics of digital modulation techniques.
CO3	They can understand the concepts of spread spectrum digital communication system
CO4	To provide in-depth analysis of noise performance in various receivers
CO5	Design basic communication systems
CO6	To understand the basic concepts of analog pulse modulation techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l
2	CO1	H	M		M		M	H		H			H
	CO2	M	M	H		M	M	M		H		M	
	CO3	M			H					H			
	CO4	M	M			M		M		H			L
	CO5		L	H		M						M	
	CO6	M	M		M		L					L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SAMPLING AND QUANTIZATION 9

Sampling Process – Aliasing – Instantaneous sampling – Natural Sampling –Flat Sampling – Quantization of signals – sampling and quantizing effects –channel effects – SNR for quantization pulses – data formatting techniques –Time division multiplexing.

UNIT II DIGITAL MODULATION 9

PCM Systems – Noise Considerations in PCM system – Overall Signal-tonoise ratio for PCM system – Threshold effect – Channel Capacity – Virtues,Limitations & Modification of PCM system – PCM Signal Multiplexing – Differential PCM – Delta Modulation – Noise Considerations in Delta Modulation – SNR Calculations – Comparison of PCM, DPCM & DM.

UNIT III BASE BAND PULSE TRANSMISSION 9

Maximum likelihood receiver structure – Matched filter receiver – Probability error of the Matched filter – Intersymbol interference – Nyquist criterion for distortionless baseband transmission – Correlative coding – Eye pattern.

UNIT IV PASS BAND DATA TRANSMISSION 9

Pass Band Transmission Model – Generation, Detection, Signal Space Diagram, Probability of Error for BFSK, BPSK, QPSK, DPSK, and Schemes – Comparison.

UNIT V M-ARY SIGNALING AND INTRODUCTION TO SPREAD SPECTRUM TECHNIQUES 9

M-ary signaling, vectoral view of MPSK and MFSK signaling, symbol error performance of M-ary systems –Introduction – Discrete Sequence Spread Spectrum technique – Use of Spread Spectrum with CDMA-Ranging Using Discrete Sequence Spread Spectrum – Frequency Hopping Spread Spectrum –Generation & Characteristics of PN Sequence.

TEXT BOOKS:

1. Bernard Sklar, *"Digital Communication, Fundamentals and Application",* Pearson Education Asia, 2nd Edition, 2001.
2. Simon Haykin, *"Communication Systems"*, John Wiley & Sons, 4th Edition, 2000.
3. Taub & Schilling, *"Principle of Communication Systems",* 2nd Edition, 2003.

REFERENCEBOOKS:

1.John G. Proakis, "Digital Communication", McGraw Hill Inc, 5th Edition, 2008.
2.Singh, R.P. & Sapre, S.D, "Communication Systems: Analog &Digital", Tata McGraw-Hill, 5th Reprint
3.www.scribd.com

BEI601	CONTROL SYSTEMS	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Electronics and Instrumentation				
	Course Designed by – – Dept. of Electronics and Instrumentation Engineering.				

OBJECTIVES

- To study control problem, control system dynamics and feedback principles.
- To study time response of first and second order systems and basic state variable analysis and to do simple problems.
- To study the concept of stability and criteria for stability and to do simple problems.
- To study the frequency response through polar plots and Bode plots and Nyquist

stability criteria and to do simple problems.													
COURSE OUTCOMES (COs)													
CO1	Outline the development of mathematical models to represent systems and theirrepresentation by transfer functions												
CO2	Discuss the transient and steady state response of control systems												
CO3	Practice frequency domain plots (Bode and Polar)												
CO4	Analyze performance of control systems												
CO5	Design compensation networks												
CO6	Design the different types of compensators												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	B	c	d	e	f	g	h	i	j	K	L
2	CO1	H					M	L		M	M		
	CO2	M	L	H	M	M				L			L
	CO3	M			H								M
	CO4	M		M		H		M			H		
	CO5		L							M			
	CO6						H						H
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I CONTROL SYSTEM MODELLING 12

System concept. Differential equations. Transfer functions. Introduction to model based design-Modelling of electric systems, Translational and rotational mechanical systems, simple Electro - mechanical systems. Block diagram representation of systems. Block Diagram reduction methods. Closed loop transfer function, determination of Signal flow graphs. Mason's gain formula. Examples.

UNIT II TIME RESPONSE ANALYSIS: 12

First Order Systems. Impulse and Step Response analysis. Second Order system Analysis. Steady state error. Error Coefficients and Generalized error series. Principle of PI, PD and PID Compensation. Servo Motor, Synchros & Stepper Motor-analysis using Matlab.

UNIT III STABILITY IN TIME DOMAIN 12

Stability Analysis. Routh - Hurwitz Criterion. Root locus Method. Construction of root, locus diagrams. Stability Study. Application of root locus diagram-analysis using Matlab.

UNIT IV STABILITY IN FREQUENCY DOMAIN 12

Frequency response analysis. Frequency domain specifications . Polar plot, Bode's Plot, Magnitude - Phase plot, Constant M and N Circles. Nichol's Chart Nyquist Stability Criterion. Relative Stability - gain Margin and Phase margin, determination from Polar plot, Bode's Plot and Magnitude – Phase Plot. Use of Nichol's Chart in system analysis to determine relative stability, Bandwidth, Resonance peak and resonance frequency- Analysis using Matlab.

UNIT V COMPENSATION TECHNIQUES 12

Cascade and feedback compensation. Lag, Lead and Lag- lead Compensation. Design of Cascade Compensators - Using Bode's Plot.

TEXT BOOKS:

1. J.Nagrath andM.Gopal, "Control SystemEngineering", NewAgeInternational Publishers, 5thEdition, 2007.

REFERENCE BOOKS:

1. Benjamin.C.Kuo, "Automatic control systems", Prentice Hall ofIndia, 7th Edition, 1995.
2. M.Gopal, "Control System– Principles and Design",TataMcGrawHill, 2nd Edition,2002.
3. Schaum'sOutlineSeries, "FeedbackandControlSystems" Tata McGraw-Hill,2007.
4. John J.D'Azzo &ConstantineH.Houpis, "LinearControl System Analysisand Design",Tata McGraw-Hill,Inc., 1995.
5. www.electrical4u.com

BSS601	VALUE EDUCATION AND PROFESSIONAL ETHICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Total Quality Management				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
- To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)	
CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing
CO4	To learn more of Engineer as Responsible Experimenter.

CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To learn more of Responsibilities and Rights as Professional and facing Global Challenges

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	I	j	k	L
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (GOE	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE) 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.

UNIT III MIND CULTURE & TENDING PERSONAL HEALTH 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelising the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS'SRESPONSIBILITIES FOR SAFETY 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Chalenger, case study. Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies.

UNIT V ENGINEERS'S RESPONSIBILITIES FOR RIGHTS AND GLOBALISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership

TEXT BOOKS:

1. Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata McGraw Hill, NewYork 2005 (Units IV & V)

REFERENCE BOOKS:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall,New Mexico, 2004 (Units IV-V)
5. www.waceinc.org/philly2011/conference.../KARSTE~1.PDF

BEC6L1	COMPUTER COMMUNICATION AND NETWORKS LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Communications background equivalent				
	Course Designed by – Dept. of Electronics and communication Engineering				

OBJECTIVES

- Defining, using and implementing Computer Networks and the basic components of a Network system.
- Knowing and Applying pieces of hardware and software to make networks more efficient, faster, more secure, easier to use, able to transmit several simultaneous messages, and able to interconnect with other networks.
- Differentiating the various types of network configurations and applying them to meet the changing and challenging networking needs of organizations.

COURSE OUTCOMES (COs)

CO1	Understand fundamental underlying principles of computer networking
CO2	Understand details and functionality of layered network architecture .

CO3	Apply mathematical foundations to solve computational problems in computer networking
CO4	Analyze and summarize research literature describing P2P file sharing system architectures
CO5	Understand ethical, legal, security, and social issues related to computer networking
CO6	Participate in a medium scale team project utilizing modern software development tools

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l
2	CO1	H					M		L	H		M	M
	CO2	M	L	H	M	M					M		
	CO3	M			H					M			
	CO4	M	M			H		M				H	H
	CO5		M	H							L		H
	CO6						H						H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

LISTOFEXPERIMENTS

1. PC to PC Communication Parallel Communication using 8 bit parallel cableSerial communication using RS 232C
2. Ethernet LAN protocol: To create scenario and study the performance of CSMA/CD protocol through simulation
3. Token bus and token ring protocols: To create scenario and study the performance of token bus and token ring protocols through simulation
4. Wireless LAN protocols: To create scenario and study the performance of network with CSMA / CA protocol and compare with CSMA/CD protocols.
5. Implementation and study of stop and wait protocol
6. Implementation and study of Go back-N and selective repeat protocols
7. Implementation of distance vector routing algorithm
8. Implementation of Link state routing algorithm
9. Implementation of Data encryption and decryption
10. Transfer of files from PC to PC using Windows / Unix socket processing

Experiments beyond the syllabus should be conducted.

BEC6L2	ELECTRONICS SYSTEM DESIGN LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Electronics Circuits and Communication engineering				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- To understand the design procedure of different power supplies.
- To know to design transreceiver and voltage regulator.
- To understand the working of Microprocessor and DSP based system design

COURSE OUTCOMES (COs)

CO1	Design different forms of power supply.
CO2	Design Voltage regulators and
CO3	AM/FM transreceiver.
CO4	Know the design procedure of Instrumentation amplifier and Digital Indicator.
CO5	Learn CAD based PCB layout design.
CO6	Understand the working of modems and timers.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	L
2	CO1	H					M		L	H		M	M
	CO2	M	L	H	M	M					M		
	CO3	M			H					M			
	CO4	M	M			H		M				H	H
	CO5		M	H							L		H
	CO6						H						H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Design of high current linear variable DC Power supply.
2. Design of Switched Mode power supply.
3. Design of AC / DC Voltage regulator using SCR.
4. Design of Programmable Logic controller.

5. Design of process control timer.
6. Design of AM / FM transreceiver
7. Design of wireless data Modems
8. Design of Instrumentation amplifier and Digital Indicator
9. PCB layout Design using CAD
10. Microprocessor based system design.
11. DSP based system design.

Experiments beyond the syllabus should be conducted.

BEC6L3	**COMMUNICATION ENGINEERING-II LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Communication engineering-I Lab				
	Course Designed by – Dept. of Electronics And Communication Engineering				

OBJECTIVES

- To demonstrate digital communication concepts using hands-on experience and using simulation environments such as PSPICE/Multisim, or Matlab/Simulink, or LabVIEW.
- To use commercial, modular systems which have some distinct advantages over bread boarding to examine more complex communication topics and to deliver a hands-on laboratory experience.

COURSE OUTCOMES (COs)

CO1	Tounderstandlineartimeinvariantsystemwithrandominputs,andoptimumreceiverfor AWGN channel.
CO2	To understand the Discrete channel models and itsproperties
CO3	To understand the Continuous channel models andits properties
CO4	Execute hardware implementation
CO5	They will have knowledge of basic types of digital modulation (ASK, FSK, and PSK) from mathematical description
CO6	Develop understanding about performance of digital communication systems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l
2	CO1	H					M		L	M		L	
	CO2	M	L	H									
	CO3	M			H						L		H
	CO4	M				H		M		H		H	
	CO5		L						M				
	CO6						H				H		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. FSK Modulation and Demodulation.
2. PSK Modulation and Demodulation.
3. QPSK Modulation and Demodulation.
4. DPSK Modulation and Demodulation.
5. PAM Modulation and Demodulation.
6. PWM Modulation and Demodulation.
7. PPM Modulation and Demodulation.
8. Pulse Code Modulation and Demodulation.
9. Delta Modulation and Demodulation.
10. Differential Pulse Code Modulation and Demodulation.
11. Data formatting.
12. BER comparison of different modulation schemes in AWGN channel in MATLAB , Simulink.

RESOURCESREQUIRED

1. PSK
2. PCM Kit
3. Delta modulation kit
4. Line coding and Decoding kit
5. FSK kit
6. PAM,PWM,PPM kit
7. Delta demodulation kit
8. Sampling kit

Experiments beyond the syllabus should be conducted.

BEC701	**FIBRE OPTIC COMMUNICATION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Microwave Engineering				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- To learn the basic elements of optical fiber transmission link, fiber modes Configurations and structures.
- To understand the differentkind of losses, signal distortion, SM fibers.
- To learn the various optical sources, materials and fiber splicing
- To learn the fiber opticalreceivers and noise performance in photo detector.
- To learn link budget, WDM, solitons and SONET/SDH network.

COURSE OUTCOMES (COs)

CO1	Demonstrate an understanding of optical fiber communication link, structure, propagation and transmission properties of an optical fiber.
CO2	Estimate the losses and analyze the propagation characteristics of an optical signal in different types of fibers
CO3	Describe the principles of optical sources and power launching-coupling methods.
CO4	Compare the characteristics of fiber optic receivers.
CO5	Design a fiber optic link based on budgets
CO6	To assess the different techniques to improve the capacityof the system.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	L
2	CO1	H					M		L	M		L	
	CO2	M	L	H									
	CO3	M			H						L		H
	CO4	M				H		M		H		H	
	CO5		L						M				
	CO6						H				H		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INTRODUCTION TO OPTICAL FIBER9

Evolution of fiber Optic system – Element of an Optical Fiber Transmission link – Ray Optics – Optical Fiber Modes and Configurations – Mode theory of Circular Wave guides – Overview of Modes – Key Modal concepts – Linearly Polarized Modes – Single Mode Fibers – Graded Index fiber structure.

UNIT IISIGNAL DEGRADATION IN OPTICAL FIBER 9

Attenuation – Absorption losses, Scattering losses, Bending Losses, Core and Cladding losses, Signal Distortion in Optical Wave guides – Information Capacity determination – Group Delay – Material Dispersion, Wave guide Dispersion, Signal distortion in SM fibers – Polarization Mode dispersion, Intermodal dispersion, Pulse Broadening in GI fibers – Mode Coupling – Design Optimization of SM fibers – RI profile and cut-off wavelength.

UNIT III FIBER OPTICAL SOURCES 9

Direct and indirect Band gap materials – LED structures – Light source materials – Quantum efficiency and LED power, Modulation of a LED, Laser Diodes – Modes and Threshold condition – Rate equations – External Quantum efficiency – Resonant frequencies – Laser Diodes structures and radiation patterns – Single Mode lasers – Modulation of Laser Diodes, Temperature effects, Introduction to Quantum laser, Fiber amplifiers.

UNIT IV FIBER OPTICAL RECEIVERES 9

PIN and APD diodes – Photo detector noise, SNR, Detector Response time, Avalanche multiplication Noise – Comparison of Photo detectors – Fundamental Receiver Operation – pre-amplifiers - Error Sources – Receiver Configuration – Probability of Error – The Quantum Limit.

UNIT V DIGITAL TRANMISSION SYSTEM 9

Point-to-Point links – System considerations – Fiber Splicing and connectors – Link Power budget – Rise-time budget – Noise Effects on System Performance – Operational Principals of WDM, Solutions.

TEXT BOOKS:

1. Gerd Keiser, "Optical Fiber Communications, TataMcGraw–Hill Education PrivateLimited,NewDelhi, FifthEdition,2008,Reprint, 2009.

REFERENCE BOOKS:

1. J.Senior, "OpticalCommunication, PrinciplesandPractice", Prentice Hall of India, ThirdEdition,2004.
2. J.Gower, "OpticalCommunicationSystem,PrenticeHall ofIndia,2001
3. Yarvi.A.QuantumEletronics,JohnWiley4th edition,1995
4. https://books.google.co.in/books?isbn=9380156693

BEC702	DIGITAL CMOS VLSI	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Principles of Digital Electronics				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- To learn basic CMOS Circuits.
- To learn CMOS process technology.
- To learn techniques of chip design using programmable devices.
- To learn the concepts of designing VLSI Subsystems.

COURSE OUTCOMES (COs)	
CO1	Identify the various IC fabrication methods.
CO2	Express the Layout of simple MOS circuit using Lambda based design rules.
CO3	About the implementation of various adders and multipliers in VLSI technology.
CO4	About the design styles of FPGA.
CO5	About testing of CMOS circuits.
CO6	To understand the concepts of modeling a digital system using Hardware Description Language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	L
2	CO1	M					M	M	H	M			
	CO2	M	L	H					M	H	H		
	CO3	M			H				M		H	H	H
	CO4	M				H		M	M				M
	CO5		L							L			M
	CO6	H				H	H					M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO MOS TRANSISTOR 12

MOS Fabrication**,** Enhancement mode and Depletion mode MOSFET, Threshold voltage derivation – body effect – Drain current Vs voltage derivation – channel length modulation - CMOS technologies, CMOS Fabrication: n-well – p-well – twin tub –DC transfer characteristics-

UNIT II MOS CIRCUITS DESIGN PROCESSAND CMOS LOGIC GATES 12

MOS Layers, Stick Diagram, Layout Diagram, Propagation Delays, CMOS Static Logic Transmission Gate Logic, Tri-State Logic , Pass Transistor Logic , Dynamic CMOS Logic , Domino CMOS Logic,., Differential Cascade Voltage Switch (DCVS) Logic, Scaling of MOS Circuits.

UNIT III VLSI IMPLEMENTATION STRATEGIES 12

Introduction – Design of Adders: carry look ahead-carry select-carry save.Design of multipliers: Array – Braun array – Baugh-Wooley Array.Introduction to FPGA – Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures.

UNIT IV CMOS TESTING 12

Need for testing- Testers, Text fixtures and test programs- Logic verification- Silicon debug principles- Manufacturing test – Design for testability – Boundary scan

UNIT V SPECIFICATION USING VERILOG HDL 12

Basic concepts- identifiers- gate primitives, gate delays, operators, timing controls, procedural assignments conditional statements, Data flow and RTL, structural gate levelswitch level modeling, Design hierarchies, Behavioral and RTL modeling, Test benches, Design of decoder, equality detector, comparator, priorityencoder, half adder, full adder, Ripple carry adder, D latch and D flip flop

TEXT BOOKS:

1. Weste and Harris: CMOS VLSI DESIGN (Third edition) Pearson Education, 2005
2. Uyemura J.P: Introduction to VLSI circuits and systems, Wiley 2002.

REFERENCE BOOKS:

1.D.A Pucknell & K.Eshraghian Basic VLSI Design, Third edition, PHI, 2003
2.Wayne Wolf, Modern VLSI design, Pearson Education, 2003
3.M.J.S.Smith: Application specific integrated circuits, Pearson Education, 1997
4.J.Bhasker: Verilog HDL primer, BS publication,2001
5. Ciletti Advanced Digital Design with the Verilog HDL, Prentice Hall of India, 2003
6.https://en.wikipedia.org/wiki/Very-large-scale_integration

BEC702	MICROWAVE ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Electromagnetic Fields and Waves.				
	Course Designed by – Dept. of Electronics And Communication Engineering				

OBJECTIVES

- Microwave Engineering introduces the student to RF/microwave analysis methods and design techniques..
- Scattering parameters are defined and used to characterize devices and system behavior. Passive and active devices commonly utilized in microwave subsystems are analyzed
- To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.
- To understand about microwave measurements..

COURSE OUTCOMES (COs)

CO1	Demonstrate the ability to identify formulate and solve microwave network related problems
CO2	Understand the need for the different microwave components and their specifications
CO3	Understand the working principles of different microwave sources
CO4	Demonstrate the ability to identify microwave active devices along with their applications.
CO5	Know how to model and determine the performance characteristics of a microwave circuit or system.

CO6	Identify the measurement techniques for different parameters like VSWR, impedance, frequency, power of microwave sources and loads.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	L
2	CO1	H					M				M		M
	CO2	M	M	M	M					H		M	
	CO3	M		M	M	M							
	CO4	M				M		M			H		M
	CO5		M	M						M		M	
	CO6				M		H						M
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
								√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I MICROWAVE NETWORK THEORY 7

Introduction –Microwave frequency range, applications of microwaves.– Scattering matrix representation of multi port network -properties of S-parameters – S matrix of a two port network with mismatched load – Z and ABCD parameters-Comparison between [S] - [Z] and [Y] matrices

UNIT II MICROWAVE PASSIVE DEVICES 10

Coaxial cables-connectors and adapters – Wave guides- Matched terminations –Rectangular to circular wave guide transition–Wave guide corners – Bends and twists – Windows – Attenuators – Phase shifters – Wave guide tees– E plane tee – H plane tee – Magic tee – Isolators – Circulators –Directional couplers – scattering matrix derivation for all components .

UNIT III MICROWAVE VACCUM TUBE DEVICES 10

Introduction – Two cavity klystron amplifier – Mechanism and mode of operation –Power output and efficiency -Applications – Reflex klystron oscillator – Mechanism and mode of operation-Power output – Efficiency – Mode curve –Applications – TWT amplifier – Principle of operation-gain and applications – Magnetron oscillator – Hull cut-off voltage mechanism of operation– Power output and efficiency –Applications – Numerical problems.

UNIT IV MICROWAVE SEMICONDUCTOR DEVICES AND CIRCUITS 9

Principles of tunnel diodes - Varactor and Step recovery diodes – Transferred Electron Devices -Gunn diode- Avalanche Transit time devices- IMPATT and TRAPATT Devices- Parametric Amplifiers – Introduction to Micro strip Lines, & Monolithic Microwave Integrated circuits-Materials, MMIC Fabrication Techniques.

UNIT V MICROWAVE MEASUREMENTS 9

Introduction – Slotted line carriage — Spectrum analyzer – Network analyzer – Power measurements – Schottky barrier diode sensor –Bolometer sensor – Power sensor – High power measurement – Insertion loss and attenuation measurement – VSWR measurement – Low and high VSWR – Impedance measurement – Frequency measurement – Measurement of cavity Q – Dielectric measurement of a solid by wave-guide method – Antenna measurement – Radiation pattern – Phase and gain.

TEXT BOOKS:

1. Annapurna Das, Sisir K. Das, "Microwave Engineering", TMH Co., Ltd., 1999.Reprint 2001.

REFERENCE BOOKS:

1. Collin R.E., "Foundation of Microwave Engineering", 2nd Edition, TMH, 1992.
2. Samuel Y. Liao, "Microwave devices and Circuits", PHI Pvt Ltd., 1995.
3. http://www.microwaves101.com

BEC704	**ANTENNA AND WAVE PROPAGATION**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Electromagnetic Fields and waves				
	Course Designed by – Dept. of Electronics And Communication Engineering				

OBJECTIVES

- Students will be introduced to antennas, their principle of operation
- Antenna analysis and their applications.
- introduce the student to wave propagation over ground, through troposphere and ionosphere; diversity principles,
- Propagation effectsin microwave systems, satellite, space, and radar links.

COURSE OUTCOMES (COs)

CO1	Define various antenna parameters
CO2	Analyze radiation patterns of antennas
CO3	Evaluate antennas for given specifications
CO4	Illustrate techniques for antenna parameter measurements
CO5	To understand the various applications of antennas.
CO6	Discuss radio wave propagation

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	f	g	h	i	j	k	L
2	CO1	H					M			H		M	
	CO2	M	M	H	M	M					L		L
	CO3	M		M	H			M		M			
	CO4	M		M	M	H		M				H	
	CO5		L								M		M
	CO6		M				L						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I BASIC ANTENNA CONCEPTS 12

Radiation Patterns, Beam solid angle, radiation intensity, Directivity, effective aperture, Antenna field zones, Polarization, impedance, cross field, Poynting vector. Friis Transmission formula, Duality of Antennas, Antenna and Transmission line, Radiation from a dipole antenna, Antenna temperature System temperature.

UNIT II POINT SOURCES 12

Definition, Power patterns, Array of two point sources – Pattern multiplication, Broad side array, End fire array, n-isotropic array, Evaluation of null directions and maxima, Amplitude distributions.Concept of Phased arrays, Adaptive array, Basic principle of antenna Synthesis-Binomial array.

UNIT III SMALL ANTENNAS: 12

Halfwave dipole antenna radiated fields of short dipole, small loop and helical Antenna, monofilar- multifilar helix. Radiation resistance, Directivity and Design Feature. Half wave dipole: radiated fields and other feature. Numerical tool for antenna analysis.

UNIT IV SPECIAL ANTENNAS: 12

Yagi uda Antenna, Tunstile antenna, Principle of frequency independent antennas –Spiral antenna, Helical antenna, Log periodic. Modern antennas- Reconfigurable antenna, Active antenna, Dielectric antennas, rhombic antenna, Horn antenna, Reflector antennas and their feed systems, Micro strip antenna, Impedance and antenna measurements.

UNIT V WAVE PROPOGATION12

Ground wave propagation, Troposphere wave, wave- tilt of the surface wave, Ionosphere propagation – effective permittivity and Conductivity of ionized gas, Reflection – Refraction of waves from ionosphere, regular – irregular variation of Ionosphere, earth magnetic field, Faraday rotation, wave propagation in the Ionosphere. Duct propagation, Critical frequency and Space propagation,

TEXT BOOKS:

1. John D Kraus, Ronald J Marhefka, Ahmad S Khan, *"Antenna and Wave Propagation",* Tata McGraw Hill, 4th Edition, 2010.
2. R.L.Yadava, *"Antennas and Wave Propagation",* PHI, 2011

REFERENCE BOOKS:

1. Constantine A.Balanis, *"Antenna Theory: Analysis and Design",* Third Edition, John Wiley and Sons, 2012.
2. G.S.N. Raju, *"Antennas and wave propagation",* 1st Edition Pearson Education, 2012.
3. Robert S. Elliott, *"Antenna Theory and Design",* John Wiley and Sons, Revised Edition, 2007.
4. www.**study**nama.com/.../229-**Antenna-wave-propagation**-(AWP)-pdf-eb.

BET7L1	**DIGITAL CMOS VLSI LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Verilog HDL and Principles of Digital Electronics Lab				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- To learn Hardware Descriptive Language(Verilog/VHDL)
- To learn the fundamental principles of VLSI circuit design in digital domain
- To familiarize implementation of logical modules on FPGAs

COURSE OUTCOMES (COs)

CO1	Demonstrate a clear Understanding in hardware design language Verilog HDL.
CO2	Model a Combinational circuit using hardware description language Verilog HDL and validate itsfunctionality.
CO3	Design and implement a sub system on a FPGA board.
CO4	Model a Sequential circuit using hardware description language Verilog HDL and validate its functionality..
CO5	Demonstrate implementation of FPGA of ADC.
CO6	To Understand the FPGA implementation of Traffic Light Controller

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	A	b	c	d	e	f	g	h	i	j	K	L
2	CO1	H				H	M		M		H	H	H
	CO2	M	M	H		H	M	H		M			
	CO3	M	H		H			L	M	M	M	M	H
	CO4	M	H	H	M	H	M	H		M			
	CO5		L		M					L			
	CO6				M						L		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Design and implementation of logic gates
2. Design and implementation of Half adder and full adder
3. Design and implementation of Half subtractor and full subtractor
4. Design and implementation of Boolean expressions
5. Design and implementation of simple logic circuits
6. Design and implementation of MUX & DEMUX – 4x1 and 8x1
7. Encoder and decoder – 2x4 and 3x8
8. Magnitude comparator
9. Code converters
10. Design and implementation of counters
11. Design and implementation of flipflops
12. FPGA implementation of ADC
13. FPGA implementation of traffic light controller

REQUIREMENTSHARDWARE

1. FPGA Trainer kit
2. ADC module
3. Traffic light interfacing module

SOFTWARE

1. XILINX 10.1
2. Modelsim

Experiments beyond the syllabus should be conducted.

BEC7L2	**OPTICAL COMMUNICATION LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Optical Communication				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- To studythe performance parameters of optical source and detector.
- To study fiber losses and loss mechanism the operation of optical detectors – PIN photodiode, avalanche photodiode
- To study the light propagation of the fiber.

COURSE OUTCOMES (COs)	
CO1	Couple light in and out of fibers and connect them
CO2	Measure loss and dispersion in fibers
CO3	Measure the performance of analog and digital fiber links
CO4	Relate an integrated view of engineering by explaining the fundamental analogies between electrical and optical communication systems
CO5	To study the numerical aperture of the fiber
CO6	To become familiar with different modes.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	L
2	CO1	H					M		H			M	
	CO2	M	L	H	M	M		H	H	M	H		
	CO3	M	H	H	H	M	M	M		M			H
	CO4	M	H		M			M	M	M			M
	CO5	M	M			M	M			L			
	CO6				M						M	H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)		
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

LIST OF EXPERIMENTS

1. V-I and P-I characteristics of LED
2. V-I and P-I characteristics of Photodiode
3. Setting up an analog link using plastic fiber cable
4. Setting up a digital link using plastic fiber cable
5. Amplitude Modulation and Demodulation
6. Frequency modulation and Demodulation
7. Numerical Aperture for a Plastic Fiber
8. Pulse width modulation and Demodulation
9. Pulse position modulation and Demodulation
10. Time Division Multiplexing(TDM)
11. Finding V-number for a glass fiber(Multimode / single mode fiber)
12. Numerical Aperture for optical glass fiber(Multimode / single mode)
13. Coupling loss in optical glass fiber(multimode / single mode fiber)
14. Bit Error Rate Measurement
15. Study of Pulse Broadening

Resources required:

1. Optical Communication Kit
2. CRO
3. FG

Experiments beyond the syllabus should be conducted.

BEC7L3	MICROWAVE ENGINEERING LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Transmission Lines and Networks				
	Course Designed by – Dept. of Electronics And Communication Engineering				

OBJECTIVES

- Know about the behavior of microwave components.
- Understand the radiation pattern of horn antenna.

COURSE OUTCOMES (COs)

CO1	Demonstrate the characteristics of Microwave sources
CO2	Demonstrate the characteristics of directional Couplers
CO3	To test the characteristics of microwave components
CO4	To analyze the radiation pattern of antenna.
CO5	To measure antenna gain
CO6	Practice microwave measurement procedures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	L
2	CO1	H		H	H		M		L				
	CO2	M	L	H	H					H	M		M
	CO3	M			H							L	
	CO4	M			H	M		M					
	CO5		M		H	M				L	M		H
	CO6						H					H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

LIST OF EXPERIMENTS

1. Study of microwave components
2. Characteristics of reflex klystron oscillator
3. Characteristics of gunn diode oscillator
4. Radiation pattern of horn antenna
5. Measurement of Antenna gain
6. Frequency and wavelength measurement
7. Impedance measurement by slotted line method
8. VSWR and Reflection Co-efficient measurement

9. Characteristics of E Plane/ H Plane Tee.
10. Characteristics of Magic Tee.
11. Characteristics of Directional coupler.

Experiments beyond the syllabus should be conducted.

BEC7P1	**TERM PAPER**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Mini Project				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- Learn to work as a member of a project team.
- Understand project management tasks.
- Develop a hardware / software solution for a real-time, industry relevant problem.

COURSE OUTCOMES (COs)

CO1	Apply knowledge of basic science and engineering to Electronics And Communication Engineering problems
CO2	Implement the simple applications and verify using modern simulation tools.
CO3	Identify, formulate, and model engineering equipment
CO4	Recognize the real world applications and to solve with core engineering knowledge.
CO5	Analyze and work on multidisciplinary tasks
CO6	Choose latest tools, software and equipment to solve real world problems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l
2	CO1	H					M		H				
	CO2	M	L	H				H	H	L	H		
	CO3	M	H		H		M	L		M		H	H
	CO4	M	H		M	H		M	M	M			
	CO5		L				M			L			
	CO6				M		H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

BEC8C1	COMPREHENSION II	L	T	P	C
	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses upto eighth semester				
	Course Designed by – Dept. of Electronics& Communication Engineering				

OBJECTIVES

- To provide a complete review of Electronics& Communication Engineering topics covered up to eighth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to eighth semester.

BEC8P1	PROJECT WORK	L	T	P	C
	Total Contact Hours - 45	0	0	18	9
	Prerequisite –Term paper				
	Course Designed by – Dept. of Electronics and Communication Engineering.				

OBJECTIVES

- Learn to work as a member of a project team.
- Understand project management tasks.
- Develop a hardware / software solution for a real-time, industry relevant problem.

COURSE OUTCOMES (COs)

CO1	Apply knowledge of basic science and engineering to Electronics and Communication Engineering problems
CO2	Implement the simple applications and verify using modern simulation tools.
CO3	Identify, formulate, and model engineering equipment
CO4	Recognize the real world applications and to solve with core engineering knowledge.
CO5	Analyze and work on multidisciplinary tasks
CO6	Choose latest tools, software and equipment to solve real world problems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	L
2	CO1	H					M		H				
	CO2	M	L	H				H	H	L	H		
	CO3	M	H		H		M	L		M		H	H
	CO4	M	H		M	H		M	M	M			
	CO5		L				M			L			
	CO6				M		H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

CORE ELECTIVE – I

BEC503	TRANSMISSION LINES, NETWORKS AND WAVEGUIDES	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Electromagnetic Fields and waves.				
	Course Designed by – Dept. of Electronics And Communication Engineering				

OBJECTIVES

- To introduce the various typesoftransmission lines and to discuss the losses associated.
- Togivethorough understanding about impedance transformation andmatching.
- To impart knowledge on filter theories and waveguide theories

COURSE OUTCOMES (COs)

CO1	Discuss the fundamental concepts of wave propagation in Transmission Linesand Wave Guides.
CO2	Analyze the line parameters and various losses in transmission lines.
CO3	Apply smith chart for line parameter and impedance calculations
CO4	Evaluate the characteristics of parallel plane and rectangular wave guides.
CO5	Evaluate the characteristics of Circular waveguides.
CO6	Evaluate the characteristics of resonators.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	D	e	f	g	h	i	j	K	L
2	CO1	H		M	H		M	M			M		M
	CO2	M	L					M		M			
	CO3	M	M		H	M				M	L		
	CO4	M	M	M		H		M					M
	CO5		M								M		M
	CO6				M					L			

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNITI TIME VARRYINGFIELDSAND MAXWELL'S EQUTIONS 12

Motional Electromotive Force, General Expression for motional EMF, Faraday's Law of Induction, Displacement current, Maxwell's equation in the point or differential form, Maxwell's equations in Integral form, Maxwell's equations from Gauss's Law, Maxwell's equations and Boundary conditions, Poynting's theorem, Time harmonic (sinusoidal) fields, Maxwell's equations in phasor form.

UNITII TRANSMISSION LINES 12

Need for Transmission Lines, Types of Transmission lines, Characterization in terms of primary and secondary constants, Characteristic impedance, General wave equation, Loss less propagation, Propagation constant, Wave reflection at discontinuities, Voltage standing wave ratio, Transmission line of finite length, The Smith Chart, Smith Chart calculations for lossy lines, Impedance matching by Quarter wave transformer, Single and double stub matching.

UNIT III THE UNIFORM PLANE WAVE 12

Wave propagation in free space, Wave propagation in dielectrics, Forward and Backward Travelling Wave, Poynting Theorem and Wave Power, Energy of the Radiated wave, Propagation in good conductors and good dielectrics, Skin effect, Wave polarization, Linearly, Elliptically and Circularly polarized waves,

UNIT IV TRANSMISSION AND REFLECTION OF PLANE WAVES ATBOUNDARIES 12

Normal incidence of Uniform Plane waves: Conductor-Conductor interface, Dielectric-Dielectric interface, Dielectric-perfect Conductor interface, Dielectric-Conductor interface. Oblique incidence on a plane boundary for perpendicular polarization, Dielectric-Dielectric interface, Dielectric-Conductor interface.

UNIT V WAVE GUIDES AND CAVITY RESONATORS 12

General Wave behaviors along uniform Guiding structures, Transverse Electromagnetic waves, Transverse Magnetic waves, Transverse Electric waves, TM and TE waves between parallel plates, TM and TE waves in Rectangular wave guides, Bessel"s differential equation and Bessel function, TM and TE waves in Circular wave guides, Rectangular and circular cavity Resonators.

TEXTBOOK:

1. John D Ryder, "Networks Linesand Fields", Prentice Hall ofIndia, NewDelhi, 2005

REFERENCE BOOKS:

1. William H Haytand Jr JohnA Buck, "Engineering Electro Magnetic"Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008
2.David KCheng, "Field and Wave Electromagnetics", Pearson Education Inc,Delhi,2004
3. John D Krausand Daniel A Fleisch,"Electromagneticswith Applications",McGraw Hill BookCo,2005
4. GSN Raju, "Electromagnetic Field Theory and Transmission Lines",Pearson Education, 2005
5. Bhag Singh Guru and HR Hiziroglu, "Electromagnetic Field Theory Fundamentals", Vikas Publishing House, New Delhi,2001.
6.N.Narayana Rao, " Elements of Engineering Electromagnetics"6th Edition PrenticeHall,2004
7.mit.edu/.../Microwave_Engineering_David_M_Pozar_4ed_Wiley_2011

BEC001	**ADVANCED COMPUTER ARCHITECTURE**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Programming and Data structures,				
	Course Designed by – Dept. of Electronics & Communication Engineering				

OBJECTIVES

- To make students know about the Parallelism concepts in Programming
- To give the students an elaborate idea about the different memory systems and buses.
- To introduce the advanced processor architectures to the students.
- To make the students know about the importance of multiprocessor and multi-computers.
- To study about data flow computer architectures

COURSE OUTCOMES (COs)

CO1	Demonstrate concepts of parallelism in hardware/software.
CO2	Discuss memory organization and mapping techniques.
CO3	Describe architectural features of advanced processors.
CO4	Interpret performance of different pipelined processors.
CO5	Explain data flow in arithmetic algorithms
CO6	Development of software to solve computationally intensive problems.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	C	d	e	f	g	h	i	j	K	L
2	CO1	H					M				M		
	CO2	M	M	H					L				
	CO3	M		H	H					H			H
	CO4	M				H		M				M	
	CO5		M			M				M			
	CO6						H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PARALLEL COMPUTER MODELS 9

Evolution of Computer architecture, system attributes to performance, Multi processors and multi computers, Multi-vector and SIMD computers, PRAM and VLSI models-Parallelism in Programming, conditions for Parallelism-Program Partitioning and Scheduling-program flow Mechanisms-Speed up performance laws-Amdahl‘s law, Gustafson‘s law-Memory bounded speedup Model.

UNIT II MEMORY SYSTEMS AND BUSES 9

Memory hierarchy-cache and shared memory concepts-Cache memory organization-cache addressing models, Aliasing problem in cache, cache memory mapping techniques-Shared memory organization-Interleaved memory organization, Lower order interleaving, Higher order interleaving. Back plane bus systems-Bus addressing, arbitration and transaction.

UNIT III ADVANCED PROCESSORS 9

Instruction set architectures-CISC and RISC scalar processors-Super scalar processors-VLIW architecture- Multivector and SIMD computers-Vector processing principles-Cray Y-MP 816 system-Inter processor communication

UNIT IV MULTI PROCESSOR AND MULTI COMPUTERS 9

Multiprocessor system interconnects- Cross bar switch, Multiport memory-Hot spot problem, Message passing mechanisms-Pipelined processors-Linear pipeline, on linear pipeline-Instruction pipeline design-Arithmetic pipeline design.

UNIT V DATA FLOW COMPUTERS AND VLSI COMPUTATIONS 9

Data flow computer architectures-Static, Dynamic-VLSI Computing Structures-Systolic array architecture, mapping algorithms into systolic arrays, Reconfigurable processor array-VLSI matrix arithmetic processors-VLSI arithmetic models, partitioned matrix algorithms, matrix arithmetic pipelines.

TEXT BOOKS:

1. Kai Hwang, “Advanced Computer Architecture Parallelism, Scalablity, Programmablity”, McGraw Hill,N.Y, 2003
2. Kai Hwang and F.A.Briggs, “Computer architecture and parallel processor”‘ McGraw Hill,N.Y, 1999

REFERENCE BOOKS:

1. David A. Patterson and John L. Hennessey, ―Computer organization and design‖ Elsevier, Fifth edition, 2014.
2. **www.sci.tamucc.edu/~sking/Courses/COSC5351/syllabus.php**

BEC008	MEMS AND NEMS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Cellular Mobile Communication				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- Have a concept on the scope and recent development of the science and technology of micro- andnano-systems;
- Gain the physical knowledge underlying the operation principles and design of micro- and nano- systems;
- Learn some typical or potentially applicable micro- and nano-systems at the frontier of the

development of the field..

COURSE OUTCOMES (COs)

CO1	Ability to understand the operation of micro devices, micro systems and their applications.
CO2	Ability to design the micro devices, micro systems using the MEMS fabrication process.
CO3	Gain a knowledge of basic approaches for various sensor design
CO4	Gain a knowledge of basic approaches for various actuator design
CO5	Develop experience on micro/nano systems for photonics.
CO6	Gain the technical knowledge required for computer-aided design, fabrication, analysis and characterization of nano-structured materials, micro- and nano-scale devices.

.Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	F	g	h	i	j	k	L
2	CO1	H				M	M		H	M	H		M
	CO2	M	M	M		M		H					M
	CO3	M	H		M		M					H	
	CO4	M	H	M				M	M		M		
	CO5		M	M		H	M		M	M		M	M
	CO6				M	H	H			M			M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I OVERVIEW AND INTRODUCTION 9

New trends in Engineering and Science: Micro and Nanoscale systems Introduction to Design of MEMS and NEMS, Overview of Nano and Micro Electromechanical Systems, Applications of Micro and Nano Electromechanical systems, Micro Eectromechanical systems, devices and structures Definitions, Materials for MEMS: Silicon, silicon compounds, polymers, metals

UNIT II MEMSFABRICATIONTECHNOLOGIES9

Microsystem fabrication processes: Photolithography, Ion Implantation, Diffusion, Oxidation.Thin film depositions: LPCVD, Sputtering, Evaporation, Electroplating; Etching techniques: Dry and wet etching, electrochemical etching; Micromachining: Bulk Micromachining, Surface Micromachining, High Aspect-Ratio (LIGA and LIGA-like) Technology; Packaging: Microsystems packaging, Essential packaging technologies, Selection of packaging materials

UNIT III MICRO SENSORS 9

MEMS Sensors: Design of Acoustic wave sensors, resonant sensor, Vibratory gyroscope, Capacitive and Piezo Resistive Pressure sensors- engineering mechanics behind these Microsensors. Case study: Piezo-resistive pressure sensor

UNIT IV MICRO ACTUATORS 9

Design of Actuators: Actuation using thermal forces, Actuation using shape memory Alloys, Actuation using piezoelectric crystals, Actuation using Electrostatic forces (Parallel plate, Torsion bar, Comb drive actuators), Micromechanical Motors and pumps. Case study: Comb drive actuators

UNIT V NANOSYSTEMSAND QUANTUM MECHANICS 9

Atomic Structures and Quantum Mechanics, Molecular and Nanostructure Dynamics: Shrodinger Equation and Wavefunction Theory, Density Functional Theory, Nanostructures and Molecular Dynamics, Electromagnetic Fields and their quantization, Molecular Wires and Molecular Circuits.

TEXT BOOKS:

1. Marc Madou, “Fundamentals of Micro Fabrication”, CRC press 1997.
2. Stephen D. Senturia,” Micro system Design”, Kluwer Academic Publishers,2001

REFERENCE BOOKS:

1. Tai Ran Hsu ,"MEMS and Microsystems Design and Manufacture" ,Tata McGraw Hill,2002.
2. Chang Liu, "Foundations of MEMS", Pearson Education India Limited, 2006
3.www.tutorials point.com

BEC005	**BLUE TOOTH TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Wireless Communication,				
	Course Designed by – Dept. of Electronics & Communication Engineering				

OBJECTIVES

- To study the fundamental concepts of Bluetooth module.
- To analyze the protocol operation.
- To gain knowledge on various low power modes and Quality of Service parameters.
- To understand the security issues

COURSE OUTCOMES (COs)

CO1	Understand Bluetooth's standards, architecture and operation.
CO2	Understand the APIs, radio interface used by Bluetooth.
CO3	Configure Bluetooth-enabled devices including mobile phones, PDAs and Access Points.
CO4	Install and configure Bluetooth hardware and software.
CO5	Configure LAN access, remote access and FAX gateway access point solutions using Bluetooth.
CO6	Understand the Protocol layers used by Bluetooth..

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	C	d	e	f	G	h	i	j	k	l
2	CO1	H			M		M			M	M		M
	CO2	M	M	H					L				M
	CO3	M		H	H	H		M		H			H
	CO4	M						L				M	
	CO5		M			M				M			
	CO6		M	H		M	H				M		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I BASIC CONCEPTS 9

Origin, Blue tooth SIG, Protocol Stack, Security, applications and Profiles, Management, Test and qualification Technology Basics. RF and IR Wireless Communication.

UNIT II BLUETOOTH MODULE 9

Antennas Patterns, Gain and losses; Types of antennas: on chip antennas Radio interface: FH, Modulation, symbol timing, power emission and control, Performance Parameters, RF architecture, Blur RF, Base band:- Blue tooth Device address system Timing ,Physical links , Packet, structuring types and construction, channel coding and time base synchronization.

UNIT III LINK CONTROLLER AND MANAGEMENT 9

Link controller and management: LCP, controller states, Pico net and scattered operations, Master/Slave Role switching LC Architectural Overview, LMC< Link set up, Quality of service, LMP version, Name Represent, Test Mode.

UNIT IV BLUETOOTH HOST 9

L LC and adaptation Protocol L2cap signalling: Connections: Blue Tooth profiles; Version 1.0; Generic Profiles, Serial and Object exchange.

UNIT V SECURITY 9

Encryption and Security Key generation, security Modes and architecture, Low power Operation and QOS Management.

TEXT BOOKS:

1. Jennifer Bray and C.F. Stuntman "BlueTooth Connect Without Cables",Pearson Education 2001.

REFERENCES

1.Blue Tooth Reveeled: Brent A. Miller and C.Bisdikian, Pearson Education 2001.
2.Bluetooth Demystified Nathan J.Miller Tata McGraw Hill 2001
3.www.radio-electronics.com/info/.../**bluetooth**/**bluetooth**_overview.php

CORE ELECTIVE-II

BEC015	**ASIC DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Electronic Circuits and Principles of Digital Electronics				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- To acquire knowledge about different types of ASICs design.
- To study about various types of Programmable ASICs architectures and interconnects.

COURSE OUTCOMES (COs)	
CO1	Recognize need for programmable devices.
CO2	Describe architecture of programmable devices.
CO3	Explain programmable methodologies.

CO4	Recall IC fabrication techniques vis-à-vis CMOS switch.
CO5	Relate design and implementation flow for PLDs.
CO6	Low power design techniques and methodologies.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	B	c	d	e	F	g	h	i	j	k	l
2	CO1	H		M		M	M	M	H	M		L	
	CO2	M	L	H				H		L	H		
	CO3	M	H	M				M	M	M		H	H
	CO4	M	H	H		M				M		M	M
	CO5		L			M	M	M		L		M	M
	CO6				M	M	H	M					

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO ASICS, CMOS LOGIC, ASIC LIBRARY DESIGN 9

Types of ASICs - Design flow – CMOS transistors- CMOS Design rules –Combinational logic Cell Sequential logic cell - Transistor as Resistors - Transistor parasitic capacitance – Logical effort - Library cell design – Library architecture.

UNIT II PROGRAMMABLE ASICS, PROGRAMMABLE ASIC LOGIC CELLS 9

Anti fuse - Static RAM - EPROM and EEPROM technology - PREP benchmarks - Actel ACT - Xilinx LCA –Altera FLEX - Altera MAX DC & AC inputs and outputs - Xilinx I/O blocks.

UNIT III PROGRAMMABLE ASIC INTERCONNECT, PROGRAMMABLE ASIC DESIGN SOFTWARE AND LOW LEVEL DESIGN9

Entry: Actel ACT -Xilinx LCA - Xilinx EPLD - Altera MAX 5000 and 7000 - Altera MAX 9000 - Altera FLEX –Design systems - Logic Synthesis - Half gate ASIC -Low level design language - PLA tools EDIF- CFI design representation.

UNIT IV SILICON ON CHIP DESIGN 9

Voice over IP SOC - Intellectual Property – SOC Design challenges- Methodology and design-FPGA to ASIC conversion – Design for integration-SOC verification-Set top box SOC.

UNIT V PHYSICAL AND LOW POWER DESIGN 9

Over view of physical design flow- tips and guideline for physical design- modern physical design techniques- power dissipation-low power design techniques and methodologies-low power design tools- tips and guideline for low power design.

TEXT BOOKS:

1. M.J.S. Smith, "Application Specific Integrated Circuits", Pearson Education, 2008

REFERENCE BOOKS:

1. Wayne Wolf, "FPGA-Based System Design", Prentice Hall PTR, 2009.
2.Farzad Nekoogar and Faranak Nekoogar, "From ASICs to SOCs: A Practical Approach", Prentice Hall PTR, 2003.
3. www.vhdl.org/rassp/vhdl/guidelines/**Design**Req.pdf

BEC012	**CRYPTOGRAPHY AND NETWORK SECURITY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Communication Engineering-II				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- To know about various encryption techniques.
- To understand the concept of Public key cryptography.
- To study about message authentication and hash functions
- To impart knowledge on Network security

COURSE OUTCOMES (COs)

CO1	Classify the symmetric encryption techniques.
CO2	Illustrate various Public key cryptographic techniques.
CO3	Evaluate the authentication and hash algorithms.
CO4	Discuss authentication applications
CO5	Summarize the intrusion detection and its solutions to overcome the attacks.
CO6	Basic concepts of system level security

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	E	F	g	h	i	j	k	l
2	CO1	H		M		M	M	M	H	M		L	
	CO2	M	L	H				H		L	H		
	CO3	M	H	M	M			M	M	M		H	H
	CO4	M	H	H		M				M		M	M
	CO5		M			M	M	M		M			M
	CO6				M	M	H	M					

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

OSI Security Architecture - Classical Encryption techniques – Cipher Principles – DataEncryption Standard – Block Cipher Design Principles and Modes of Operation - Evaluation criteria for AES – AES Cipher – Triple DES – Placement of Encryption Function – Traffic Confidentiality

UNIT II PUBLIC KEY CRYPTOGRAPHY 9

Key Management - Diffie-Hellman key Exchange – Elliptic Curve Architecture and Cryptography - Introduction to Number Theory – Confidentiality using Symmetric Encryption – Public Key Cryptography and RSA.

UNIT III AUTHENTICATION AND HASH FUNCTION 9

Authentication requirements – Authentication functions – Message Authentication Codes – Hash Functions – Security of Hash Functions and MACs – MD5 message Digest algorithm - Secure Hash Algorithm – RIPEMD – HMAC Digital Signatures – Authentication Protocols – Digital Signature Standard.

UNIT IV NETWORK SECURITY 9

Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security – PGP – S/MIME – IP Security – Web Security.

UNIT V SYSTEM LEVEL SECURITY 9

Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

TEXT BOOKS:

1. WilliamStallings,CryptographyandNetworkSecurity,6th Edition,PearsonEducation,March 2013.

2.CharlieKaufman,RadiaPerlmanandMikeSpeciner,"NetworkSecurity",PrenticeHallofIndia,2002.

REFERENCE BOOKS:

1. BehrouzA.Ferouzan, "Cryptography&NetworkSecurity",TataMcGrawHill,2007.

2. Charles Pfleeger, "Security in Computing",4th Edition,Prentice Hall ofIndia,2006.

3. Ulysess Black, "InternetSecurity Protocols", PearsonEducationAsia,2000.

4. Charlie Kaufmanand Radia Perlman, Mike Speciner, "NetworkSecurity,SecondEdition,Private Communicationin PublicWorld", PHI, 2002.
5. BruceSchneierand NeilsFerguson, "Practical Cryptography", FirstEdition,WileyDream Tech India PvtLtd, 2003.
6.www.ics.uci.edu/~stasio/spring04/ics180.html

BEC010	VLSI DESIGN	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Principles of Digital Electronics				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- To learn basic CMOS Circuits.
- To learn CMOS process technology.
- To learn techniques of chip design using programmable devices.
- To learn the concepts of designing VLSI Subsystems.

COURSE OUTCOMES (COs)

CO1	Identify the various IC fabrication methods.
CO2	Express the Layout of simple MOS circuit using Lambda based design rules.
CO3	Apply the Lambda based design rules for subsystem design.
CO4	Differentiate various FPGA architectures.
CO5	Design an application using Verilog HDL.
CO6	Concepts of modeling a digital system using Hardware Description Language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H					M		H				
	CO2	M	L	H					M	L	H		
	CO3	M			H				M			H	H
	CO4	M				H		M	M				
	CO5		L							L			
	CO6						H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I MOS TRANSISTOR THEORY 9

MOSFET– Enhancement mode & Depletion mode – Fabrication – NMOS, PMOS – CMOS fabrication – P-well, N-well, Twin-Tub, SOI – BiCMOS Technology –Comparison with CMOS.

UNIT II MOS CIRCUITS AND DESIGN 9

Basic Electrical properties of MOS circuits – DC Equations, NMOS & CMOS inverter –Second Order Effects– Basic circuit concepts-Sheet resistance-Area Capacitances-Capacitance calculations-Inverter delays–Scaling of MOS Devices –Scaling Models and Scaling Factors-MOS layers – Stick diagram – NMOS Design Style – CMOS Design style – lambda based design rules– Simple Layout examples

UNIT III SUBSYSTEM DESIGN & LAYOUT 9

Switch Logic – Pass transistors and transmission gates – Two input NMOS, CMOS gates: NOT–NAND– NOR gates – Other forms of CMOS logic – Static CMOS logic-Dynamic CMOS logic – Clocked CMOS logic - Precharged domino CMOS logic – Structured design of simple Combinational logic design– Multiplexers – Clocked sequential circuits – Two phase clocking – D-Flip-flop-Charge storage - Dynamic register element –Dynamic shift register

UNIT IVPROGRAMMABLE LOGIC DEVICES 9

Programmable Logic Devices – PLA , PAL – Finite State Machine design using PLA – Introduction to FPGA – FPGA Design flow –Architecture – FPGA devices: Xilinx XC 4000 – Altera cyclone III

UNIT V VERILOG HDL DESIGN PROGRAMMING 9

Basic concepts: VLSI Design flow, Modeling, Syntax and Programming, Design Examples:Combinational Logic – Multiplexer, Decoder/Encoder, Comparator, Adders, Multipliers, Sequential logic- Flip Flops, Registers, and Counters, Memory- Introduction to back end tools.

TEXT BOOKS:

1. Douglas A.Pucknell, K. Eshragian, ”Basic VLSI Design”, Third Edition,PHI,2009

REFERENCE BOOKS:

1. Neil.H.E.Weste,KamaranEshraghian,”Principles of CMOS VLSI Design”,Second Edition, AddisoWesleyPublications,2002
2. SamirPalnitkar, ”VerilogHDL–GuidetoDigital Designand Synthesis”,SecondEdition Pearson Education,2009
3. Wayne Wolf, “Modern VLSI Design”,PearsonEducation , 2003
4. *https://en.wikipedia.org/wiki/Very-large-scale_integration*

BEC703	CELLULAR MOBILE COMMUNICATION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Computer Communication and Networking				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- To understand the basic cellular system concepts.
- To have an insight into the various propagation models and the speech coders used in mobile communication.
- To understand the multiple access techniques and interference education techniques in mobile communication..

COURSE OUTCOMES (COs)

CO1	Discuss cellular radio concepts
CO2	Identify various propagation effects
CO3	To have knowledge of the mobile system specifications.
CO4	Classify multiple access techniques in mobile communication.
CO5	Outline cellular mobile communication standards.
CO6	Analyze various methodologies to improve the cellular capacity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H					M		H	M	H		M
	CO2	M	L	M				H		L			
	CO3	M	H	M	L		M	L				H	
	CO4	M	H		M	H		M	M		M		
	CO5		L				M			L			
	CO6				M	H	H			M			M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INTRODUCTION TO WIRELESS MOBILE COMMUNICATION 9

History and evolution of mobile radio systems, Types of mobile wireless services/systems – Cellular, WLL, Paging, Satellite systems, Standard, Future trends in personal wireless systems.

UNIT II CELLULAR CONCEPT AND SYSTEM DESIGN FUNDAMENTALS 9

Cellular concept and frequency reuse, Multiple Access Schemes, Channel assignment and handoff, Interface and system capacity, Trunking and Erlang capacity calculations.

UNIT III MOBILE RADIO PROPAGATION 9

Radio wave propagation issues in personal wireless systems, Propagation models, Multipath fading and based and impulse models, Parameters of mobile multipath channels, Antenna systems in mobile radio.

UNIT IV MODULATION AND SIGNAL PROCESSING 9

Analog and digital modulation techniques, Performance of various modulation techniques – Spectral efficiency, Error rate, Power Amplification, Equalization/Rake receiver concepts, Diversity and Space-time processing, Speech coding and channel coding.

UNIT V SYSTEM EXAMPLES AND DESIGN ISSUES 9

Multiple Access Techniques – FDMA, TDMA and CDMA Systems, Operational Systems, Wireless networking, design issues in personal wireless systems.

TEXT BOOKS:

1. K. Feher, Wireless Digital Communication, Prentice Hall of India, New Delhi, 1995.

REFERENCE BOOKS:

1.T.S. Rappaport, Wireless Communication; Principles and Practice, Prentice Hall, NJ, 1996.
2.W.C.Y. Lee, Mobile Communication Engineering; Theory and Application, Second Edition, McGraw-Hill International, 1998.
3.https://en.wikipedia.org/wiki/Cellular_network

CORE ELECTIVE III

BEC016	**COGNITIVE RADIO**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Cellular Mobile Communication				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES:1.Learnthedesignofthewireless networksbasedonthecognitive radios
2. Understandtheconcepts of wireless networksand next generationnetworks..

COURSE OUTCOMES (COs)

CO1	Describe thebasicsofthe softwaredefinedradios.
CO2	To learn the hardware and software architecture of software defined radio
CO3	Designthewireless networksbasedonthecognitive radios.
CO4	Gives an understanding of cognitive radio architecture
CO5	Explain the concepts behind the wireless networks and next generation networks
CO6	To have a better understanding of cognitive techniques

. Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	C	d	e	f	g	h	i	j	k	L
2	CO1	H				M	M		H	M	H		M

	CO2	M	M	M		M		H					M
	CO3	M	H		M		M					H	
	CO4	M	H		L			M	M		M		
	CO5		M	M		H	M		M	M		M	M
	CO6				M	H	H			M			M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNITI INTRODUCTION TOSOFTWARE DEFINED RADIO 9

Definitionsandpotentialbenefits,softwareradioarchitectureevolution,technology tradeoffs and architecture implications.

UNITII SDRARCHITECTURE 9

Essential functions of the software radio, basic SDR, hardware architecture, Computational processingresources,softwarearchitecture, toplevelcomponentinterfaces,interface topologies amongplugandplaymodules,.

UNITIII INTRODUCTION TOCOGNITIVE RADIOS 9

Markingradioself-aware, cognitive techniques–positionawareness, environmentawarenessin cognitive radios,optimization ofradioresources, Artificial IntelligenceTechniques.

UNITIV COGNITIVE RADIOARCHITECTURE 9

CognitiveRadio- functions,components anddesign rules,Cognitioncycle-orient,plan, decideand actphases,InferenceHierarchy,Architecture maps,BuildingtheCognitiveRadioArchitectureon SoftwaredefinedRadioArchitecture.

UNITV NEXTGENERATION WIRELESS NETWORKS 9

TheXGNetworkarchitecture,spectrumsensing, spectrummanagement, spectrummobility, spectrum sharing,upperlayerissues,cross –layerdesign.

TEXT BOOKS:

1. JosephMitolaIII,"SoftwareRadioArchitecture:Object– OrientedApproachesto WirelessSystem Engineering",JohnWiley&SonsLtd.2000.
2. ThomasW.Rondeau,CharlesW.Bostain,"ArtificialIntelligenceinWireless Communication",ARTECH HOUSE.2009.
3. BruceA. Fette, "Cognitive RadioTechnology",Elsevier,2009.
4.IanF.Akyildiz,Won –Yeol Lee,Mehmet C. Vuran,ShantidevMohanty,"Next

generation/Dynamicspectrumaccess/cognitive radio wireless networks:A Survey"ElsevierComputer Networks, May, 2006.

REFERENCE BOOKS:

1. SimonHaykin, "Cognitive Radio:Brain–EmpoweredWireless Communications", IEEE Journal onselectedareas in communications, Feb 2005.
2. Hasari Celebi,Huseyin Arslan, "EnablingLocationand Environment Awareness in CognitiveRadios",ElsevierComputer Communications, Jan 2008.
3.Markus Dillinger, KambizMadani,NancyAlonistioti, "SoftwareDefined Radio",JohnWiley,2003.
4. Huseyin Arslan,"Cognitive Radio,SDR andAdaptive System", Springer, 2007.
5. AlexanderM.Wyglinski, Maziarnekovee,Y. Thomas Hu, "Cognitive Radio Communicationand Networks",Elsevier, 2010
6.www.nptel.ac.in

BEC002	**INTEGRATED SERVICES DIGITAL NETWORK**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Communication and Networks				
	Course Designed by – Dept. of Electronics & Communication Engineering				

OBJECTIVES

- To Study basic concepts of ISDN standards and services.
- To develop knowledge in ISDN protocol Architecture and Signaling.
- To Study concepts of Broad band ISDN
- To have knowledge in Network performance Modeling and Estimation

COURSE OUTCOMES (COs)

CO1	To know the basics of ISDN,
CO2	Protocols involved in ISDN
CO3	To learn about Broad Band ISDN
CO4	To understand about network Management
CO5	To Empower knowledge in Network Traffic Management
CO6	To Estimate the Network Performance.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M		M				M		
	CO2	M	M	H					L				M
	CO3	M		H	H	H		M		H			H
	CO4	M						L				M	
	CO5		M			M				M			

	CO6		M	H			H					M			M				
3	Category	Humanities & Social Studies (HS)		Basic Sciences		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)					
									√										
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016																	

UNIT I ISDN – STANDARDS AND SERVICES: 9

Review of switching technologies and OSI protocol architecture, ISDN channels, access interfaces, functional devices and standards, ISDN bearer services and teleservice attribute, Broadband services.

UNIT II ISDN PROTOCOL ARCHITECTURE AND SIGNALI NG 9

Physical layer protocol, D-channel datalink layer and layer 3 protocols, Network signaling systems, SS7 protocol overview and services, ISDN products, Switches, Multiplexers, Terminal adapters, ISDN chip sets.

UNIT III BROAD BAND ISDN 9

Frame Relay – concepts, protocols, applications and products, asynchronous transfer mode – concepts, protocols, application and products, switched multi megabit data service, Internetprotocol over ISDN frame relay and ATM.

UNIT IV NETWORK TRAFFIC MANAGEMENT 9

ATM traffic and congestion control, Traffic management framework, control mechanism and attributes, ABR traffic management

UNIT V NETWORK PERFORMANCE MODELING AND ESTIMATION 9

Queueing analysis, single server and multi server queues, Networks of Queues, Estimatingmodel parameters, Self-similar traffic – performance implication, modeling and estimation

TEXT BOOKS:

1.Gary C. Kesslar and Peter Southwick, "ISDN – Concepts, Facilities and Services", McGraw Hill, 3rd Edition, 1997.
2.William Stallings, "High Speed Networks-TCP/IP and ATM Design Principles", Prentice Hall Inc., 1998.

REFERENCE BOOKS:

1. William Stallings , "High-Speed Networks and Internets: Performance and Quality of Service" (2nd Edition) , 2002
2. Balaji Kumar, "Broad Band Communications" McGraw-Hill, 1995
3. **www.faadooengineers.com**

BEC007	DIGITAL IMAGE PROCESSING	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Fourier Transform and Complex Variables or equivalent				
	Course Designed by – Dept. of Electronics And Communication Engineering.				

OBJECTIVES

- To study the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques
- To study image restoration procedures.
- To study the image compression procedures.

COURSE OUTCOMES (COs)

CO1	Review the fundamental concepts of a digital image processing system
CO2	Analyze images in the frequency domain using various transforms
CO3	Evaluate the techniques for image enhancement and image restoration
CO4	Categorize various compression techniques.
CO5	Interpret Image compression standards
CO6	Interpret image segmentation and representation techniques.

UNIT I DIGITAL IMAGE FUNDAMENTAL 9

Elements of digital image processing systems, Elements of Visual perception, Image sampling and quantization, Matrix and Singular Value representation of discrete images.

UNIT II IMAGE TRANSFORMS 9

1D DFT, 2D DFT, Cosine, Sine Hadamard, Hear, Slant, KL, SVD transform and their properties.

UNIT III IMAGE ENHANCEMENT 9

Histogram – Modification and specification techniques Image smoothing, Image sharpening, generation of spatial masks from frequency domain specification, Nonlinear filters, Homomorphism filtering, false color, Pseudo color and color image processing.

UNIT IV IMAGE RESTORATION AND RECOGNITION 9

Image DEGRADATION models, Unconstrained and Constrained restoration, inverse filtering, Least mean square filter, Pattern Classes, optimal statistical classifiers, Neural networks and associated training methods and use of neural networks in image processing.

UNIT V IMAGE COMPRESSION 9

Run length, Huffman coding, Shift codes, arithmetic coding, bit plane coding, transform coding, JPEG Standard, wavelet transform, predictive techniques, Block truncation coding schemes, Facet modeling.

TEXT BOOKS:

1. Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010

REFERENCE BOOKS:

1.Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata McGraw Hill Pvt. Ltd., 2011.

2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.

3.Willliam K Pratt, "Digital Image Processing", John Willey, 2002.

4.Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition,HILearning Pvt. Ltd., 2

5.www.tutorialspoint.com/dip/

BEC003	SATELLITE COMMUNICATION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Communication Engineering II and Electromagnetic Fields and waves				
	Course Designed by – Dept. of Electronics and Communication Engineering.				

OBJECTIVES

- To enable the student to become familiar with satellites and satellite services.
- Study of satellite orbits and launching.
- Study of earth segment and space segment components
- Study of satellite access by various users.

COURSE OUTCOMES (COs)

CO1	Define orbital mechanics and launch methodologies
CO2	Describe satellite subsystems
CO3	Design link power budget for satellites
CO4	Compare competitive satellite services
CO5	Explain satellite access techniques
CO6	DTH and compression standards

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	F	g	h	i	j	K	L
2	CO1	H		M		M	M	M	H	M		L	
	CO2	M	L	H				H		L	H		
	CO3	M	H	M				M	M	M		H	H
	CO4	M	H	H		M				M		M	M
	CO5		L			M	M	M		L		M	M
	CO6				M	M	H	M					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Introduction, Types – Active and Passive Satellite, Frequency allocation, Satellite orbits,Kepler's laws, Definitions of terms for earth-orbiting Satellites, Apogee and Perigee heights, Orbit Perturbations,Geo stationary orbit, Antenna look angles, Limits of visibility, Earth Eclipse of Satellite, Sun transit outage, launching orbits.

UNIT II THE SPACE SEGMENT 9

Introduction, The Power supply, Attitude control, Spinning satellite, stabilization, MomentumWheel Stabilization, Station keeping,Thermal control, TT&C subsystem,Transponders,The Wide Band receiver, The Input Demultiplexer,The Power Amplifier, The Antenna subsystem.

UNIT III THE EARTH SEGMENT AND ANTENNAS 9

Transmit receive earth station subsystems, up-converters-High Power Amplifier-Receive chain-LNA&LNB.TVRO earth station, The isotropic radiator and antenna gain, Horn antenna,The Parabolic reflector, Double reflector antenna-Cassie grain antenna-Gregorian antenna.

UNIT IV THE SPACE LINK & SATELLITE ACCESS 9

EIRP, Transmission losses The Link budget equation, System noise, Effects of rain, up link and down link C/N ratio. Multiple access techniques-Concepts and types of TDMA, FDMA and CDMA-Comparison and contrast of TDMA, FDMAand CDMA.

UNIT V SATELLITE APPPLICATIONS 9

Satellite Mobile services, DBS, VSAT, Remote sensing, GPS, INTELSAT, INMARSAT, SARSAT, Video Conferencing and Internet connectivity

TEXT BOOKS:

2. DennisRoddy, "Satellite Communication", 4th Edition,McGrawHill International,2006.

REFERENCE BOOKS:

1.Wilbur L.Pritchard, Hendri G.Suyderhoud,Robert A.Nelson, "Satellite CommunicationSystems Engineering",PrenticeHall/Pearson, 2007.
2. N.Agarwal,"Designof GeosynchronousSpace Craft",Prentice Hall,1986.
3.BruceR.Elbert,"TheSatelliteCommunicationApplications",HandBook,ArtechHouseBostan London,1997.
4. TriT. Ha, "Digital Satellite Communication", IInd Edition,1990.
5. Emanuel F Thenakis, "Manual ofSatellite Communications", McGrawHill BookCo.,1984.
6.Robert G.Winch, "Telecommunication TransmissionSystems",McGraw-Hill BookCo., 1983.
7.BrianAckroyd,"WorldSatelliteCommunicationandEarthStationDesign",BSP Professional Books,1990.
8. G.B.Bleazard,"IntroducingSatellite communications", NCC Publication,1985.
9. www.sac.gov.in/SACSITE/Satcom_Overview.doc

NON MAJOR ELECTIVE-I

BCS 603	ARTIFICIAL INTELLIGENCE & EXPERT SYSTEMS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Data Structures, Design and Analysis of Algorithm.				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

The purpose of this course is to impart concepts of Artificial Intelligence and Expert System.

COURSE OUTCOMES (COs)

CO1	Describe the modern view of AI as the study of agents that receive percepts from the Environment and perform actions.
CO2	Demonstrate awareness of informed search and exploration methods.
CO3	Explain about AI techniques for knowledge representation, planning and uncertainty Management.
CO4	Develop knowledge of decision making and learning methods.
CO5	Describe the use of AI to solve English Communication problems.
CO6	Explain the concept Knowledge Representation.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	C	d	e	f	g	h	i	j	k	l
2	CO1		H		H								
	CO2	M			H		M						M
	CO3				H		M	M					
	CO4		M		H								M
	CO5	M			H		H						
	CO6	L	M		M		M						H

3	Category	Humanities & Social Studies (HS)	Basic Sciences & (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PROBLEMS AND SEARCH 9

Searching strategies- Uninformed Search- breadth first search, depth first search, uniform cost seart, depth limited search, iterative deepening search, bidirectional search - Informed Search-

Best first search,Greedy Best first search, A* search – Constraint satisfaction problem , Local searching strategies.

UNIT II REASONING 9

Symbolic Reasoning Under Uncertainty- Statistical Reasoning - Weak Slot-And-Filler-Structure - Semantic nets – Frames- Strong Slot-And-Filler Structure-Conceptual Dependency-Scripts-CYC.

UNIT III KNOWLEDGE REPRESENTATION 9

Knowledge Representation - Knowledge representation issues - Using predicate logic - Representing Knowledge Using Rules. Syntactic- Semantic of Representation – Logic & slot and filler - Game Playing – Minimal search- Alpha beta cutoffs –Iteratic deepening planning – component of planning system – Goal stack planning.

UNIT IV NATURAL LANGUAGE PROCESSING 9

Natural Language Processing –Syntactic processing, semantic analysis-Parallel and Distributed AI-Psychological modeling- parallelism and distributed in reasoning systems – Learning - Connectionist Models – Hopfield networks, neural networks

UNIT V EXPERT SYSTEMS 9

Common Sense –qualitative physics, commonsense ontologies- memory organization -Expert systems –Expert system shells- explanation – Knowledge acquisition -Perception and Action – Real time search- robot architecture.

TEXT BOOKS:

1. Elaine Rich, Kevin Knight, "Artificial Intelligence", 3/e, Tata McGraw Hill, 2009.
2.Russell , " Artificial intelligence :A modern Approach , Pearson Education ,3rd edition,2013

REFERENCE BOOKS:

1.Artificial Intelligence and Expert system by V.Daniel hunt, Springer press,2011.
2. Nilsson N.J.,"Principles of Artificial Intelligence", Morgan Kaufmann.1998.
3**.** http://www.ggu.ac.in/download/Class-Note13/Artificial%20Intelligence%20and%20Expert%20System24.10.13.pdf

BBM054	BIOINFORMATICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Biology for Engineers.				
	Course Designed by – Dept. of Bio Medical Engineering.				

OBJECTIVES

- To introduce Bioinformatics-Elementary commands and Protocols, ftp, telnet, http. Primer on information theory

COURSE OUTCOMES (COs)

CO1	To learn bioinformatics and the protocols.

CO2	To learn Strings-Edit distances two strings-string similarity local alignment gaps-parametric sequence alignments.
CO3	To have a clear view on Amino acid substitution matrices PAM and BLOSSUM.
CO4	To learn Ultrasonic trees-parsimony-Ultrametric problem-perfect phylogeny-phylogenetic alignment.
CO5	To DNA Mapping and sequencing-Map alignment-Large scale sequencing.
CO6	DNA Mapping and sequencing-Map alignment-Large scale sequencing and alignment.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H									
	CO2			H	H		M						
	CO3		M		H		H						
	CO4	H	M		H								`
	CO5			H		H							
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT – I BIOINFORMATICS 9

Scope of Bioinformatics-Elementary commands and Protocols, ftp, telnet, http.Primer on information theory.

UNIT – II SEQUENCING ALIGNMENT AND DYNAMIC PROGRAMMING 9

Introduction-Strings-Edit distance two strings-string similarity local alignment gaps-parametric sequence alignments-suboptimal alignments-multiple alignment-common multiple alignment methods.

UNIT – III SEQUENCE DATABASE AND THEIR USE 9

Introduction to databases-database search-Algorithms issues in database search-sequence database searchFASTA-BLAST-Amino acid substitution matrices PAM and BLOSSUM.

UNIT – IV EVOLUTIONARY TREES AND PHYLOGENY 9

Ultrasonic trees-parsimony-Ultrametric problem-perfect phylogeny-phylogenetic alignment-connection between multiple alignment and tree construction.

UNIT – V SPECIAL TOPICS IN BIOINFORMATICS **9**

DNA Mapping and sequencing-Map alignment-Large scale sequencing and alignment-Shotgun-DNA sequencing-Sequence assembly-Gene predictions-Molecular predictions with DNA strings.

TEXT BOOKS:

1.R.D.Lele '"Computer in Medicine" Tata McGraw Hill, New York, 1999.

REFERENCE BOOKS:

1.S.K.Chauhan "PC Organisation", S.K.Kataria and Sons, Delhi 2000.
2. Harold Sackamn "Bio Medical Information Technology", Academic Press, New York.
3.**https://www.lehigh.edu/~inbios21/PDF/Fall2008/Lopresti_11142008.pdf**

BEI605	**EMBEDDED SYSTEM DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Microprocessor and Microcontroller				
	Course Designed by – Dept of Electronics & Instrumentation Engineering				

OBJECTIVES

- To introduce the Building Blocks of Embedded System
- To Educate in Various Embedded Development Strategies
- To Introduce Bus Communication in processors, Input/output interfacing.
- To impart knowledge in various processor scheduling algorithms.
- To introduce Basics of Real time operating system and example tutorials to discuss on one real time operating system tool

COURSE OUTCOMES (COs)

CO1	Acquire a basic knowledge about fundamentals of microcontrollers
CO2	Acquire a basic knowledge about programming and system control to perform a specific task.
CO3	Acquire knowledge about devices and buses used in embedded networking
CO4	Develop programming skills in embedded systems for various applications.
CO5	Acquire knowledge about basic concepts of REAL Time Operating Systems
CO6	Build complex embedded system with the use of RTOS.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Basic Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT-I EMBEDDED DESIGN WITH MICROCONTROLLERS 9

Product specification – Hardware / Software partitioning – Detailed hardware and software design – Integration – Product testing – Microprocessor Vs Micro Controller – Performance tools– RTOS Micro Controller -issues in selection of processors.

UNIT-II PARTITIONING DECISION 9

Hardware / Software duality – Hardware-Software portioning- coding for Hardware- software development – ASIC revolution – Managing the Risk – Co-verification – execution environment – memory organization –memory enhancement – Firmware-speed and code density -System startup.

UNIT-III FUNCTIONALITIES FOR SYSTEM DESIGN 9

Timers, Watch dog timers – RAM, Flash Memory basic toolset – Integration of Hardware & Firmware- in System Programming, in Application Programming, IDE-Target Configuration-Host based debugging – Remote debugging – ROM emulators – Logic analyzer.

UNIT-IV CIRCUIT EMULATORS 9

Buller proof run control – Real time trace – Hardware break points – Overlay memory – Timing constraints – Usage issues – Triggers.

UNIT-V EMBEDDED DESIGN LIFE CYCLE & TESTING 9

Objective, Need, different Phases & Modeling of the EDLC, choice of Target Architectures for Embedded Application Development-for Control Dominated-Data Dominated Systems-Software &Hardware Design, PCB Design, Manufacturing & PCB Assembly-Bug tracking – reduction of risks & costs – Performance – Unit testing – Regression testing – Choosing test cases – Functional tests – Coverage tests – Testing embedded software – Performance testing – Maintenance.

TEXT BOOKS:

1. James K.Peckol, “Embedded system Design”, John Wiley & Sons, 2010

Reference:

1. Elicia White, “Making Embedded Systems”, O’Reilly Series, SPD, 2011
2. Rajkamal,”Embedded Systems”, TMH, 2009.
3. Lyla B Das,” Embedded Systems-An Integrated Approach”, Pearson2013 5. Arnold S. Berger –“Embedded System Design”, CMP books, USA 2002

BCS702	MOBILE AND PERVASIVE COMPUTING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Networks, Distributed Computing.				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

This course discuss about knowledge and skills about a new trend in mobile Computing.

COURSE OUTCOMES (COs)

CO1	Explain the concepts and features of mobile networks.
CO2	Explain the working of wireless communication protocols.
CO3	Compare the routing protocols of mobile networks.
CO4	Explain the transport and application layer protocols of mobile networks.
CO5	Outline the basics of pervasive computing.
CO6	Learn the Concept of GSM,GPRS.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		H									M
	CO2	M		H									
	CO3			H					M				
	CO4			H									M
	CO5	M		M									
	CO6								M				

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I MOBILE NETWORKS 9

Cellular Wireless Networks – GSM – Architecture – Protocols – connection establishment –Frequency Allocation – Routing – Mobility Management – Security – GPRS.

UNIT II WIRELESS NETWORKS 9

Wireless LANs and PANs – IEEE 802.11 Standard – Architecture – Services – Network – HiperLAN – BlueTooth- Wi-Fi – WiMAX.

UNIT III ROUTING 9

Mobile IP – DHCP – AdHoc– Proactive and Reactive Routing Protocols – MulticastRouting.

UNIT IV TRANSPORT AND APPLICATION LAYERS 9

Mobile TCP– WAP – Architecture – WWW Programming Model– WDP – WTLS – WTP – WSP – WAE – WTAArchitecture – WML – WMLScripts.

UNIT V PERVASIVE COMPUTING 9

Pervasivecomputing infrastructureapplications- Device Technology-Hardware, Humanmachine interfaces, Biometric, and Operating systems-Devices Connectivity-Protocols, Security, and Devices Management-Pervasive Web Application Architecture, Access from PCs and PDAs – Access via WAP.

TEXT BOOKS:

1. Jochen Schiller, "Mobile Communications", PHI, Second Edition, 2003.
2. Jochen Burkhardt, Pervasive Computing: Technology and Architecture of MobileInternet Applications, Addison Wesley Professional; 3rd edition 2007.

REFERENCE BOOKS:

1.Frank Adelstein, Sandeep KS Gupta, Golden Richard, Fundamentals of Mobile and Pervasive Computing, McGraw-Hill 2005

2. Debashis Saha, Networking Infrastructure for Pervasive Computing: EnablingTechnologies, Kluwer Academic Publisher, Springer; 1st edition, 2002

3. Introduction to Wireless and Mobile Systems by Agrawal and Zeng, Brooks/ Cole(Thomson Learning),1st Edition, 2002

4.Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, Principlesof Mobile Computing, Springer, New York, 2003.

5.http://media.techtarget.com/searchMobileComputing/downloads/Mobile_and_pervasive_computing_Ch06.pdf

NON MAJOR ELECTIVE-II

BCS701	GRID AND CLOUD COMPUTING	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Computer Networks, Distributed Computing, Data ware Housing and Data Mining.				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

- Identify the technical foundations of cloud systems architectures.
- Analyze the problems and solutions to cloud application problems.
- Apply principles of best practice in cloud application design and management.
- Identify and define technical challenges for cloud applications and assess their importance.

COURSE OUTCOMES (COs)

CO1	Understand the fundamental principles of distributed computing.
CO2	Understand how the distributed computing environments known as Grids can be built from lower level services.

CO3	Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.
CO4	Analyze the performance of Cloud Computing.
CO5	Understand the concept of Cloud Security.
CO6	Learn the Concept of Cloud Infrastructure Model.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	C	d	e	f	g	h	i	j	K	l
2	CO1		H	M	M	M						H	
	CO2			H					M	M			H
	CO3	M											
	CO4		M	M								H	
	CO5				M	M							M
	CO6	M	M	H					M			M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I GRID COMPUTING 9

Introduction - Definition and Scope of grid computing, Computational and Data Grids, Current Grid Activities – Overview of Grid Business Areas, Grid Applications, Grid Computing Anatomy- Concept of Virtual Organization, Grid Architecture- Fabric layer, Connectivity layer, Resource Layer, Collective Layer, Application Layer, Layered Grid Architecture

UNIT II CLOUD ARCHITECTURE AND MODEL 9

Technologies for Network Based system-System Models for Distributed and Cloud Computing-NIST Cloud Computing Reference ArchitectureCloud models: Characteristics-Cloud Services-Cloud Models (IaaS, PaaS, SaaS)-Public vs. Private Cloud-Cloud Solutions-Cloud ecosystem-Service Management-Computing on demand.

UNIT III CLOUD INFRASTRUCTURE 9

Architectural Design of compute and Storage Clouds-Layered Cloud Architecture Development-Design Challenges-Inter Cloud Resource Management-Resource Provisioning and Platform Deployment-Global Exchange of Cloud Resources.

UNIT IV PROGRAMMING MODEL 9

Parallel and Distributed Programming Paradigms-Map Reduce-Twister and Iterative Map Reduce-Hadoop Library from Apache-Mapping Applications-Programming Support-Google

App Engine, Amazon AWS-Cloud Software Environments-Eucalyptus, Open Nebula, Open Stack, Aneka, CloudSim.

UNIT V SECURITY IN THE CLOUD 9

Security Overview-Cloud Security Challenges and Risks-Software-as-a-Service-Security Security Governance-Risk Management-Security Monitoring-Security Architecture Design-Data Security-Application Security-Virtual Machine Security-Identity Management and Access Control-Autonomic Security.

TEXT BOOKS:

1. Joshy Joseph & Craig Fellenstein, "Grid Computing", PHI, PTR-2003(UNIT I)
2.Kai Hwang, Geoffrey C Fox,Jack G Dongarra "Distributed and Cloud Computing ,From parallel processing to the Internet of Things" Morgan Kaufmann Publishers,2012(Unit-II to Unit-V)

REFERENCE BOOKS:

1.John W.Rittinghouse and James F.Ransome, "Cloud Computing Implementation, Management and Security", CRC Press, 2010
2. Toby Velte, Anthony Velte, Robert Elsenpeter,"Cloud Computing, A Practical Approach", TMH, 2009.
3. Kumar Saurabh,"Cloud Computing –Insights into New-Era Infrastructure ", Wiley India, 2011
4. George Reese, "Cloud Applications Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly.
5. https://benzology.files.wordpress.com/2013/05/grid-computing-joshy-joseph-ebook.pdf
6.http://cloudipedia.com/files/2009/11/cloud_computing_made_easy.pdf

BCS008	**DISTRIBUTED OPERATING SYSTEM**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Fundamentals of Computing and Programming, Operating System, Parallel Computing.				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

- To provide hardware and software issues in modern distributed systems.
- To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
- To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.

COURSE OUTCOMES (COs)	
CO1	To provide hardware and software issues in modern distributed systems.
CO2	To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.
CO3	To analyze the current popular distributed systems such as peer-to-peer (P2P) systems will also be analyzed.
CO4	To know about Shared Memory Techniques.
CO5	Have Sufficient knowledge about file access.

CO6	Have knowledge of Synchronization and Deadlock.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	G	h	i	j	k	l
2	CO1	M		H									H
	CO2		H	H	M								H
	CO3	L	M	H									H
	CO4												
	CO5		M	M	H								
	CO6	M	M	H	M								M
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
								√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I MODES OF COMMUNICATION 9

System Process, Interrupt Handling, Handling Systems calls, Protection of resources &Resources Management Micro-Kernel Operating System.

UNIT II REVIEW OF NETWORK OPERATING SYSTEM9

Distributed Operating System, Issue in the design of Distributed Operating System, Overview of Computer Networks. Inter process communication, Linux, IPC Mechanism, Remote Procedure calls, RPC exception handling, Security issues, RPC in Heterogeneous Environment (case study Linux RPC)

UNIT III RESOURCE MANAGEMENT 9

Clock Synchronization, Logical clocks, Physical clocks, clock synchronization algorithms, Mutual Exclusion, Election Algorithms, Dead locks in Distributed Systems. Thrashing, Heterogeneous DSM, Resource Management (Load Balancing approach, Load Sharing approach), Process Management: process Migration, Thread.

UNIT IV OVERVIEW OF SHARED MEMORY 9

Consistency model, Page based Distributed Shared Memory, Shared –variable Distributed Memory, Object -based Distributed Memory.

UNIT V FILE MODELS 9

File access, File sharing, file-caching, File Replication, fault Tolerance, Network File System, (Case study, 8NFS on Linux Directory Services, Security in Distributed File system).

TEXT BOOKS:

1. M. Beck et al," Linux Kernel Programming",3rd edition, 2002.
2. B.W. Kernighan and R Pide, "The Unix Programming Environment ", Prentice Hall of India-2000.

REFERENCE BOOKS:

1. Silberschatz,P.B.Garvin,Gagne," Operating System Concepts", 2009.
2. https://www.cs.columbia.edu/~smb/classes/s06-4118/l26.pdf

BCS002	**NEURAL NETWORKS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Mathematics-I, Mathematics-II, Numerical Methods, Discrete Mathematics				
	Course Designed by – Dept. of Computer Science and Engineering.				

OBJECTIVES

- Basic neuron models: McCulloch-Pitts model and the generalized one, distance or similarity based neuron model, radial basis function model, etc.
- Basic neural network models: multilayer perceptron, distance or similarity based neural networks, associative memory and self-organizing feature map, radial basis function based multilayer perceptron, neural network decision trees, etc.

COURSE OUTCOMES (COs)

CO1	Be able to analyze a problem for NN solution in terms of these methods.
CO2	Have an awareness of the computational theory underlying NN.
CO3	Have a working knowledge of a typical neural network simulation
CO4	Experience in programming NN applications from scratch.
CO5	Have knowledge of sufficient theoretical background to be able to reason about the behaviour of neural networks.
CO6	Have knowledge of sufficient theoretical background to be able to reason about the behaviour of neural networks.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H		H								
	CO2		H		H								
	CO3	M	H		H								
	CO4		H	H	H								
	CO5	L	H		H		M						
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT-I BACK PROPAGATION 9

Introduction to Artificial Neural systems - Perception - Representation - Linear Separability - Learning - Training algorithm - The back propagation network - The generalized data rule - Practical considerations - BPN applications.

UNIT-II STATISTICAL METHODS 9

Hopfield nets - Cauchy training - Simulated annealing-The Boltzmann machine. Associative memory - Bidirectional associative memory -Applications.

UNIT-III COUNTER PROPAGATION NETWORK & SELF ORGANISATION MAPS 9

CRN building blocks - CPN data processing. SQM data processing - Applications

UNIT-IV ART AND SPATIO TEMPORAL PATTERN CLASSIFICATION 9

ART network description - ART1 -ART2-Application. The formal avalanche -Architecture of station temporal networks - The sequential competitive avalanche field - Applications of STNs.

UNIT-V NEO-CONGNITRON 9

Cognitron - Structure & training - The neocognitron architecture - Data processing - Performance - Addition of lateral inhibition and feedback to the neocognitron. Optical neural networks - Holographic correlators.

TEXT BOOKS:

1. James Freeman A and David Skapura M. "Neural Networks – Algorithms, Applications & Programming Techniques", Pearson Education, 2005.
2. Yegnanarayana B., "Artificial Neural Networks", Prentice Hall of India Private Ltd, 2003

REFERENCE BOOKS:

1. Neural Network Design, Martin T Hagan, 2nd edition, 2014.
2. Principle of neural science, Eric R.Kandel, 5th edition, 2012.
3. **http://hagan.okstate.edu/NNDesign.pdf**

NON MAJOR ELECTIVE-III

BBM405	BIOSENSORS AND TRANSDUCERS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Biology for Engineers.				
	Course Designed by – Dept. of Bio Medical Engineering.				

OBJECTIVES

- Understand the purpose of measurement, the methods of measurements, errors associated with measurements.
- Know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications.

COURSE OUTCOMES (COs)

CO1	Describe the purpose and methods of measurements.
CO2	Explain different display and recording devices for various applications.
CO3	Know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications
CO4	Remember and understand the concepts, types, working and practical applications of important biosensors.
CO5	Know some of the commonly used biomedical transducers.
CO6	Know the different display and recording devices.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M	H	H	M	H			L	M	
	CO2	M	H	M	H	H	M	H			L	M	
	CO3	M	H	M	H	H	M	H			L	M	
	CO4	M	H	M	H	H	M	H			L	M	
	CO5	M	H	M	H	H	M	H			L	M	
	CO6	M	H	M	H	H	M	H			L	M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I SCIENCE OF MEASUREMENT 9

Units and Standards - calibration methods - statics calibration - classification of errors, error analysis - statistical methods - odds and uncertainity.

UNIT II CHARACTERISTICS OF TRANSDUCERS 9

Static characteristics - accuracy, precision, sensitivity, linearity etc - mathematical model of transducers - zero first - order and second - order transducers - response to impulse step, ramp and sinusoidal inputs.

UNIT III VARIABLE RESISTANCE TRANSDUCERS 9

Principle of operation, construction details, characteristics and applications of resistance potentiometers, strain gauges, resistance thermometers, thermistors, hot-wire aneometer, piezoresistive sensors and humidity sensors.

UNIT IV BIOSENSORS - PHYSIOLOGICAL RECEPTORS - J RECEPTORS 9

Chemoreceptors, Baroreceptors, Touch receptors, Biosensors - Working Principle and Types, Applications.

UNIT V OTHER TRANSDUCERS 9

Piezoelectric tranducers, magnetostrictive transducer, IC sensor digital transducers - smart sensor - fibre optic transducers.

TEXT BOOKS:

1. Doeblin. E. O, Measurment Systems, McGraw Hill Book Co. 1998

REFERENCE BOOKS:

1. Renganathan S, Transducer Engineering, Allied Publishers, Chennai,2000.
2.https://www1.ethz.ch/lbb/Education/Biosensors/Lecture_1_overview.pdf

BEI704	**VIRTUAL INSTRUMENTATION**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Nil				
	Course Designed by – Dept of Electronics & Instrumentation Engineering				

OBJECTIVES

- To provide knowledge on design of process control by using virtual instrumentation techniques
- To provide knowledge in process analysis by VI tools.
- To give basic knowledge in describing function analysis.
- Get adequate knowledge VI tool sets

COURSE OUTCOMES (COs)	
CO1	To describe about virtual instrumentation.
CO2	Get adequate knowledge VI tool sets
CO3	To describe data acquisition
CO4	To get introduced to VI programming techniques
CO5	To understand VI programming techniques
CO6	To get an adequate knowledge application of virtual instrumentation

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	B	c	d	e	f	G	h	i	j	k	L
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Basic Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)				
					√								
4	Approval	37^{th} – 40^{th}Meetings of Academic Council, May 2015 – Sept 2016											

UNIT I INTRODUCTION 9

Virtual Instrumentation: Historical perspective - advantages - block diagram andArchitecture of a virtual instrument - Conventional Instruments versus TraditionalInstruments - data-flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II VI PROGRAMMING TECHNIQUES 9

VIs and sub-VIs, loops and charts, arrays, clusters and graphs, case and sequenceStructures, formula nodes, local and global variables, State machine, string and file I/O,Instrument Drivers, Publishing measurement data in the web.

UNIT III DATA ACQUISITION 9

Introduction to data acquisition on PC, Sampling fundamentals, Input/output techniques and buses. Latest ADCs, DACs, Digital I/O, counters and timers, DMA, Software andHardware installation, Calibration, Resolution, Data acquisition interface requirements –Issues involved in selection of Data acquisition cards – Data acquisition cards with serialCommunication - VI Chassis requirements. SCSI, PCI, PXI system controllers, EthernetControl of PXI. Networking basics for office & Industrial applications, VISA and IVI.

UNIT IV VI TOOLSETS 9

Use of Analysis tools, Fourier transforms, power spectrum, correlation methods,Windowing and filtering. Application of VI in process control designing of equipments like oscilloscope, Digital multimeter, Design of digital Voltmeters with transducer input Virtual Laboratory, Web based Laboratory

UNIT V APPLICATIONS 9

Distributed I/O modules- Application of Virtual Instrumentation: Instrument Control,Development of process database management system, Simulation of systems using VI, Development of Control system, Industrial Communication, Image acquisition and processing, Motion control. Development of Virtual Instrument using GUI, Real-time systems, Embedded Controller, OPC, HMI / SCADA software, Active X programming.

TEXT BOOKS:

1. Gary Johnson, Lab VIEW Graphical Programming, Second edition, McGraw Hill, New York, 1997.
2. Lisa K. wells & Jeffrey Travis, Lab VIEW for everyone, Prentice Hall, New Jersey, 1997.

REFERENCE BOOKS:

1. Kevin James, PC Interfacing and Data Acquisition: Techniques for Measurement, Instrumentation and Control, Newness, 2000.

BET603	**TELECOMMUNICATION SWITCHING NETWORKS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Computer Networks				
	Course Designed by – Dept. of Electronics and Telecommunication Engineering.				

OBJECTIVES

- To learn about the concepts of switching system and networks in detail.

COURSE OUTCOMES (COs)

CO1	To learn about the various switching systems
CO2	To learn in detail about time division switching.
CO3	To know about traffic management.
CO4	To understand about various signaling in telecommunication systems
CO5	To analyse various telecommunication networks
CO6	To estimate the performance of telecommunication networks.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M				M					
	CO2	H	H	L	L								
	CO3	M	M	H	M	M					M		
	CO4	M		L						M		M	M
	CO5	H	M					M		M			
	CO6	M		M		M	M		H	M	M		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SWITCHING SYSTEMS 9

Introduction-Message switching-Circuit switching-Manual switching-Functions of switching system- Strowger step by step system-Register translator-Senders-Distribution frames-Cross bar systems-General trunking-Electronic switching-Reed electronic systems-Digital switching systems.

UNIT II TIME DIVISION SWITCHING 9

Introduction-Space and time switching-Time division switching networks-grades of services-Time division switching networks-non blocking networks-synchronization.

UNIT III TELECOMMUNICATION TRAFFIC 9

Introduction-Unit of traffic-Congestion-Traffic measurement-A mathematical model-Local calls systems-Queuing systems.

UNIT IV TELECOMMUNICATION SIGNALLING 9

Introduction-Customer line signaling- Audio frequency junction and trunk circuits-FDM carrier systems-PCM signaling- Inter register signaling- Common channel signaling principles-CCITT signaling, CCITT signaling, Digital customer line signaling.

UNIT V TELECOMMUNICATION NETWORKS 9

Introduction-Analog networks-Integrated digital networks-Integrated service digital networks-Cellular radio networks-Intelligent networks-Private networks-numbering-charging-Routing-Network management.

TEXT BOOKS:

1. J.E FLOOD, "Telecommunication Switching, Traffic and Networks" Pearson Education.

REFERENCE BOOKS:

1. T.V.Swaminathan, “Telecommunication Switching System &Networks”, PHI.
2.**http://www.newagepublishers.com/samplechapter/000969.pdf**

OPEN ELECTIVE-I

BBA008	TOTAL QUALITY MANAGEMENT	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Quality Engineering& Professional Courses				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

- To introduce to the student about the basic terms related to quality and concepts of quality management
- To familiarize the student about the basic principles of total quality management
- To acquaint the student with the basic statistical tools used in process control
- To introduce to the student about the various tools used in implementing and checking total quality management

COURSE OUTCOMES (COs)

CO1	By understanding about various quality terms, it will be helpful for the student to maintain quality in his/her organization
CO2	The student will be able to formulate new plans/procedures to be implemented to achieve the desired quality status by knowing about the various principles of quality management
CO3	The student will be able to analyze the periodical data in quality control using statistical tools
CO4	The total quality management tools will help the student to understand the procedures in measuring the quality of the organization/process and will also enable him/her to identify the parameters that are improving/depriving the quality
CO5	By knowing about the quality ISO systems, the student will be maintain processes/documentation properly so that the quality maintained by his/her organization gets recognized
CO6	To familiarize the student about the different quality systems used in auditing the quality of a company/industry/organization

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	C	d	e	f	g	H	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies	Basic Sciences & Maths (BS)	Engg Sciences	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation

UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership –Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

U**NIT IV TQM TOOLS 9**

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, and FMEA –Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System –Elements, Implementation of Quality System, Documentation, Quality Auditing, TS16949, ISO 14000 – Concept, Requirements and Benefits

TEXT BOOKS:

1. Dale H.Besterfiled, et al., “Total Quality Management”, Pearson Education, Inc.2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCE BOOKS:

1. Evans. J. R. & Lindsay. W,M “The Management and Control of Quality”, (5th Edition), South Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. “Total Quality Management”, McGraw-Hill, 1991.
3. Oakland.J.S. “Total Quality Management”, Butterworth Heinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan, N.S. “Quality Management – Concepts and Tasks”, New Age International 1996.
5. Zeiri. “Total Quality Management for Engineers”, Wood Head Publishers, 1991.

	PRINCIPLES OF MANAGEMENT AND	**L**	**T**	**P**	**C**

BBA001	ORGANIZATIONALBEHAVIOUR				
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Management& Professional Courses				
	Course Designed by – Department of Management Studies				

OBJECTIVES

- Familiarize the students with the fundamental concepts of Management and to highlight the approaches in organization behavior

COURSE OUTCOMES (COs)

CO1	Understanding the concepts of Management
CO2	Knowledge on Management Functions
CO3	Understanding the Organization Theory & Approach.
CO4	Knowledge on the Concepts of Motivation
CO5	Clear insight on the factors contributing to discipline
CO6	In-depth Understanding about the concepts of Group Behavior

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H					H					H	
	CO2		H		M					H			
	CO3	M							M		H		
	CO4			M	H							H	
	CO5							M					
	CO6				H								L

3	Category	Humanities & Sciences(HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT -I NATURE OF MANAGEMENT 9

Definition – theory and practice – effective management – Management : Science of Art – Management in India. Development of Management thoughts – Taylor's – Henry Fayol – Hawthrone experiment – Barnard & Social system – Herbert Simon – Peter Drucker – Various approaches – Management thoughts.

UNIT- II MANAGEMENT PROCESS 9

Co-ordination – Functions of management – Managers and environment – External and internal Business Ethics – Planning – Fundamentals – Definitions & Features – Steps in planning – types of planning – Objectives – Concepts and features – Hierarchy of objectives – role – Process of MBO – Policy & Strategy – Decision making process – Individual Vs Group Decisions.

UNIT- III ORGANIZATION STRUCTURE 9

Organizing – Theory & Approach –Authority & Responsibility – Delegation – Centralization & Decentralization – Line & Staff Relationship – Staffing – Fundamentals – System approach – Manpower Planning – Recruitment & Selection – Training and development – Performance appraisal – Direction – Fundamentals Motivation – Theories of Motivation-Maslow's Hersberg's MaClelland's theory X,Y & Z leadership – Theories and Styles – Communication – Type – Controlling – System and Process.

UNIT- IV ORGANIZATIONAL BEHAVIOUR 9

Definition – Organization – Managerial Role and Functions – Organizational Approaches, Individual behaviour – Causes – Environmental effect – Behaviour and performance, perception – Organizational implications, Personality – Contributing factors – Dimension, Motivation – Need Theories – Process Theories – Job satisfaction, Learning and Behaviour – Learning Curves, Work Design and Approaches.

UNIT -V GROUP BEHAVIOUR 9

Groups – Contributing factors –Group Norms, types – Causes – Intergroup relations – Conflict and Resolution – Change Process –Resistance to change.

TEXT BOOKS:

1. Herald Knootz and Heinz weihrich, 'Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition, 2004.
2. Ties AF, Stoner and R. Edward Freeman, "Management" Prentice Hall of India Pvt. Ltd., New Delhi -110011, 1995.

REFERENCE BOOKS :

1. Joseph I. Massie 'Essentials of Management', Prentice Hall of India Pvt. Ltd, New Delhi - 110011, 2004.
2. L.M. Prasad "Principles and Practice of Management", Sultan Chand & Sons.2001
3. Uma Sekaran, "Organizational Behaviour", Tata McGraw Hill, 2007.

.BBA004	ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Basic Economics& Professional Courses				
	Course Designed by – Dept. of Electronics & Communication Engineering				

OBJECTIVES

- Acquire knowledge of economics to facilitate the process of economic decision making
- Acquire knowledge on basic financial management aspects
- Develop the skills to analyze financial statements

COURSE OUTCOMES (COs)	
CO1	Evaluate the economic theories, cost concepts and pricing policies
CO2	Understand the market structures and integration concepts
CO3	Understand the measures of national income, the functions of banks and concepts of globalization
CO4	Apply the concepts of financial management for project appraisal
CO5	Understand accounting systems and analyze financial statements using ratio analysis
CO6	Understand the impact of inflation, taxation, depreciation. Financial planning, economic basis for replacement, project scheduling, and legal and regulatory issues are introduced and applied to economic investment and project-management problems.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					M				M		
	CO2	M	L	H					L				
	CO3	H			H					H			H
	CO4	M				H		M				M	
	CO5		L										
	CO6						H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
								√	
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ECONOMICS, COST AND PRICING CONCEPTS9

Economic theories – Demand analysis – Determinants of demand – Demand forecasting – Supply – Actual cost and opportunity cost – Incremental cost and sunk cost – Fixed and variable cost – Marginal costing – Total cost – Elements of cost – Cost curves – Breakeven point and breakeven chart – Limitations of break even chart – Interpretation of break even chart – Contribution – P/V-ratio, profit-volume ratio or relationship – Price fixation – Pricing policies – Pricing methods.

UNIT II CONCEPTS ON FIRMS AND MANUFACTURING PRACTICES 9

Firm – Industry – Market – Market structure – Diversification – Vertical integration – Merger – Horizontal integration

UNIT III NATIONAL INCOME, MONEY AND BANKING, ECONOMIC ENVIRONMENT 9

National income concepts – GNP – NNP – Methods of measuring national income – Inflation – Deflation – Kinds of money – Value of money – Functions of bank – Types of bank – Economic liberalization – Privatization – Globalization

UNITIV CONCEPTS OF FINANCIAL MANAGEMENT 9

Financial management – Scope – Objectives – Time value of money – Methods of appraising project profitability – Sources of finance – Working capital and management of working capital

UNITV ACCOUNTING SYSTEM, STATEMENT AND FINANCIAL ANALYSIS9

Accounting system – Systems of book-keeping – Journal – Ledger – Trail balance – Financial statements – Ratio analysis – Types of ratios – Significance – Limitations .

TEXT BOOKS:

1. Prasanna Chandra, "Financial Management" (Theory & Practice) TMH
2. Weston & Brigham, "Essentials of Managerial Finance"

REFERENCE BOOKS:

1.Pandey, I. M., "Financial Management"
2.James C. Van Horne."Fundamentals of Financial Management"-

BBA009	**INTELLECTUAL PROPERTY RIGHTS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Value Education and Professional Ethics & Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

Strong intellectual property rights (IPR) protection is crucial to fostering trade, and achieving the goals and benefits of global integration. Countries with high standards of IPR protection tend to attract more investment, stimulate more innovation, thereby developing more rapidly. Countries with inadequate protection are often vulnerable to infringements of intellectual property rights that hinder trade flow and economic development.

Hence, the objective is to introduce IPR to the UG Engineering and Technology students.

	COURSE OUTCOMES (COs)
CO1	Understand the principles, function and basic legal rules of IP Law.
CO2	Recognize the relevant criteria for generating and protecting intellectual works.
CO3	Recognize the intellectual property likely to be produced in the academic and professional environment.
CO4	Demonstrate appreciation and critical awareness of pertinent IP issues in the academic and professional lives.

CO5	Understand the relevance and impact of IP Law on academic/scientific works/studies.												
CO6	Understand the different forms of infringement of intellectual property rights.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					H					H	
	CO2		H		M					H			
	CO3	M							M		H		
	CO4			M	H							H	
	CO5							M					
	CO6	H			H					M			L
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
												√	
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I PROPERTIES AND TYPES 9

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i). Movable Property ii. Immovable Property and iii. Intellectual Property.

UNIT II PATENTS AND RIGHTS 9

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures..

UNIT III INTERNATIONAL TRADE 9

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV WTO 9

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V CASE STUDIES 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TEXT BOOKS:

1. Subbaram N.R. "Handbook of Indian Patent Law and Practice ", S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.

REFERENCES:

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.
4. www.ipmatters.net/features/000707_gibbs. html.
5.http://www.metastudio.org/Science%20and%20Ethics/file/readDoc/535a76367d9d331598f49e2d/34_Hb_on_IPR.pdf

OPEN ELECTIVE-II

BEI701	LOGIC AND DISTRIBUTED CONTROL SYSTEM	L	T	P	C
	Total Contact Hours - 45	3	1	0	4
	Prerequisite – Microcontroller &Control System				
	Course Designed by – Dept of Electronics & Instrumentation Engineering				

OBJECTIVES

- To give an introductory knowledge on Programmable Logic Controller (PLC) and their Programming languages
- To give adequate knowledge about applications of PLC
- To give basic knowledge about Computer Controlled Systems
- To give basic knowledge on the architecture and local control unit of Distributed Control System(DCS)
- To give adequate information with respect to interfaces used in DCS

COURSE OUTCOMES (COs)

CO1	To describe the networks used in PLC and DCS.
CO2	Get adequate knowledge about operator interface used in DCS.
CO3	To describe the HART in DCS
CO4	To describe the field bus in DCS
CO5	To understand the systems used in distributed control system.
CO6	To get an adequate knowledge application of PLC

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M

	CO6	H			H	H		M				L	L	M					
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)	Basic Sciences (ES)		Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)		Open Elective (OE)		Project/Term Paper/ Seminar/ Internship (PR)				
							√												
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016																	

UNIT I PROGRAMMABLE LOGIC CONTROLLER 9

Evolution of PLCs – Components of PLC – Architecture of PLC – Discrete and analog I/O modules – Programming languages -Ladder diagram – Function block diagram (FBD) - Programming timers and counters

UNITII APPLICATIONS OF PLC 9

Instructions in PLC – Program control instructions, math instructions, data manipulation Instructions, sequencer and shift register instructions – Case studies in PLC

UNIT III COMPUTER CONTROLLED SYSTEMS 9

Basic building blocks of computer controlled systems – Data acquisition system – Supervisory control – Direct digital control- SCADA: - Hardware and software, Remote terminal units, Master Station and Communication architectures.

UNIT IV DISTRIBUTED CONTROL SYSTEM 9

DCS – Various Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities

UNIT V INTERFACES IN DCS 9

Operator interfaces - Low level and high level operator interfaces – Displays - Engineering interfaces – Low level and high level engineering interfaces – Factors to be considered in selecting DCS – Case studies in DCS

TEXT BOOKS:

1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, Third Edition, 2010
2. Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986
3. D. Popovic and V.P.Bhatkar,' Distributed computer control for industrial Automation'Marcel Dekker, Inc., Newyork, 1990.

REFERENCE BOOKS:

1. T.A. Hughes, Programmable Controllers, Fourth edition, ISA press, 2005
2. Krishna Kant, Computer Based Industrial Control, Second edition, Prentice Hall of India,New Delhi, 2010.

3. John W. Webb and Ronald A. Reis, 'Programmable Logic Controllers, Fifth edition, Prentice Hall of India, New Delhi, 2010.
4. John R. Hackworth and Frederick D. Hackworth Jr, Programmable Logic Controllers,Pearson, New Delhi, 2004.
5. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3,4. 60870.5 and Related Systems", Newnes, 1st Edition, 2004.
6.E.A.Parr, Programmable Controllers, An Engineer's Guide, Elsevier, 2013.

BET008	**WIRELESS NETWORKS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Communication Engineering-II,Computer Networks				
	Course Designed by – Dept. of Electronics &Tele Communication Engineering				

OBJECTIVES

- To study about Wireless networks, protocol stack and standards.
- To study about fundamentals of 3G Services, its protocols and applications.
- To study about evolution of 4G Networks, its architecture and applications.

COURSE OUTCOMES (COs)

CO1	Conversant with the latest 3G/4G and Wi-MAX networks and its architecture.
CO2	Design and implement wireless network environment for any application using latest wireless protocols and standards.
CO3	Implement different type of applications for smart phones and mobile devices with latest network strategies
CO4	Compare and contrast multiple division techniques, mobile communication systems, and existing wireless networks.
CO5	Classify network protocols, ad hoc and sensor networks, wireless MANs, LANs and PANs;
CO6	Apply wireless ID technologies, in particular RFID work.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					M				M		
	CO2	M	L	H					L				
	CO3	M			M					H			L
	CO4	L				H		M				M	
	CO5		M										
	CO6						H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT- I WIRELESS LAN 9

Introduction-WLAN technologies: Infrared, UHF narrowband, spread spectrum -IEEE802.11: System architecture, protocol architecture, physical layer, MAC layer, 802.11b, 802.11a – Hiper LAN: WATM, BRAN, HiperLAN2 – Bluetooth: Architecture, Radio Layer, Baseband layer Link manager Protocol, security - IEEE802.16-WIMAX: Physical layer, MAC, Spectrum allocation for WIMAX

UNIT- II MOBILE NETWORK LAYER 9

Introduction - Mobile IP: IP packet delivery, Agent discovery, tunneling and encapsulation, IPV6- Network layer in the internet- Mobile IP session initiation protocol - mobile ad-hoc network: Routing, Destination Sequence distance vector, Dynamic source routing

UNIT –III MOBILE TRANSPORT LAYER 9

TCP enhancements for wireless protocols - Traditional TCP: Congestion control, fast retransmit/fast recovery, Implications of mobility - Classical TCP improvements: Indirect TCP, Snooping TCP, Mobile TCP, Time out freezing, Selective retransmission, Transaction oriented TCP - TCP over 3G wireless networks.

UNIT- IV WIRELESS WIDE AREA NETWORK 9

Overview of UTMS Terrestrial Radio access network-UMTS Core network Architecture: 3G-MSC, 3G-SGSN, 3G-GGSN, SMS-GMSC/SMS-IWMSC, Firewall, DNS/DHCP-High speed Downlink packet access (HSDPA)- LTE network architecture and protocol.

UNIT- V 4G NETWORKS 9

Introduction – 4G vision – 4G features and challenges - Applications of 4G – 4G Technologies: Multicarrier Modulation, Smart antenna techniques, OFDM-MIMO systems, Adaptive Modulation and coding with time slot scheduler, Cognitive Radio.

TEXT BOOKS:

1.Jochen Schiller, "Mobile Communications", Second Edition, Pearson Education 2012.(Unit I,II,III)

2. Vijay Garg, "Wireless Communications and Networking", First Edition, Elsevier 2007.(Unit IV,V)

REFERENCE BOOKS:

1.Erik Dahlman, Stefan Parkvall, Johan Skold and Per Beming, "3G Evolution HSPA and LTE for Mobile Broadband", Second Edition, Academic Press, 2008.

2.Anurag Kumar, D.Manjunath, Joy kuri, "Wireless Networking", First Edition, Elsevier 2011.

3.Simon Haykin , Michael Moher, David Koilpillai, "Modern Wireless Communications", FirstEdition, Pearson Education 2013

BEI012	ANALOG INTEGRATED CIRCUIT DESIGN	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Linear Integrated Circuits				
	Course Designed by – Dept of Electronics & Instrumentation Engineering				

OBJECTIVES

To have an adequate knowledge in the measurement techniques for power and energy, power and introduce the meters used to measure current & voltage.

COURSE OUTCOMES (COs)

CO1	To describe about single stage amplifier.
CO2	To study about energy meters are included
CO3	To provide elaborate discussion about potentiometer & instrument transformers.
CO4	To provide detailed study of resistance measuring methods.
CO5	To provide detailed study of inductance and capacitance measurement.
CO6	To study about circuit realization of the various building blocks.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Basic Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SINGLE STAGE AMPLIFIERS 9

Basic MOS physics and equivalent circuits and models, CS, CG and Source Follower cascade and folded cascade configurations, differential amplifiers and current mirror configurations.

UNIT II HIGH FREQUENCY AND NOISE OF CHARACTERISTICS AMPLIFIERS 9

Current mirrors, cascade stages for current mirrors, current mirror loads for differential pairs. Miller effect, association of poles with nodes, frequency response of CS, CG and source follower, cascade and differential pair stages Statistical characteristics of noise, noise in single stage amplifiers, noise in differential amplifiers.

UNIT III FEEDBACK AND OPERATIONAL AMPLIFIERS9

Properties and types of negative feedback circuits, effect of loading in feedback networks, operational amplifier performance parameters, One-stage Op Amps, Two-stage Op Amps, Input range limitations, Gain boosting, slew rate, power supply rejection, noise in Op Amps.

UNIT IVSTABILITY AND FREQUENCY COMPENSATION9

General considerations, multiple systems, Phase Margin, Frequency Compensation, and Compensation of two stage Op Amps, Slewing in two stage Op Amps, and Other compensation techniques.

UNIT V BANDGAP REFERENCES 9

Supply independent biasing, temperature independent references, PTAT current generation, Constant-Gm Biasing.

TEXT BOOKS:

1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", Tata McGraw Hill, 2001
2. Willey M.C. Sansen, "Analog Design Essentials", Springer, 2006.

REFERENCE BOOKS:

1.Grebene, "Bipolar and MOS Analog Integrated circuit design", John Wiley & sons, Inc., 2003.

2.Phillip E.Allen, DouglasR.Holberg, "CMOS Analog Circuit Design", Second edition, OxfordUniversity Press, 2002

3.Recorded lecture available at http://www.ee.iitm.ac.in/~ani/ee5390/index.html

4.Jacob Baker "CMOS: Circuit Design, Layout, and Simulation, Third Edition", Wiley IEEEPress 2010 3rd Edition

CURRICULUM AND SYLLABUS

CHOICE BASED CREDIT SYSTEM

B.TECH ELECTRICAL AND ELECTRONICS ENGINEERING

I – VIII SEMESTERS

SEMESTER I						
Course Code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN101	HS	English – I	3	1	0	3
BMA101	BS	Mathematics – I	3	1	0	3
BPH101	BS	Engineering Physics - I	3	0	0	3
BCH101	BS	Engineering Chemistry – I	3	0	0	3
BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
BME102	ES	Engineering Graphics – C	1	0	3	3
BEE101	ES	Basic Electrical and Electronics Engineering	2	0	0	2
PRACTICAL						
BCS1L1	ES	Computer Practice Laboratory –I	0	0	3	1
BEE1L1	ES	Basic Electrical and Electronics Engineering Practices Laboratory	0	0	3	1
BPC1L1	BS	Physics and Chemistry Laboratory#	0	0	3/3	0
BSS1L7	HS	Yoga to be conducted during week ends	0	0	2	1

Total Number of Contact Hours = 35Total Number of Credits= 23

#Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)

SEMESTER II						
Course Code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN201	HS	English – II	3	1	0	3
BMA201	BS	Mathematics – II	3	1	0	3
BPH201	BS	Engineering physics – II	3	0	0	3
BCH201	BS	Engineering Chemistry – II	3	0	0	3
BCS201#	ES	Internet Programming	2	0	0	2
BFI201	HS	Foreign/Indian Language	3	0	0	3
BSS201	HS	Personality Development	2	0	0	2
BBT202*	BS	Biology for Engineers	2	0	0	2
BME203*	ES	Basic Mechanical Engineering	2	0	0	2
BCE201*	ES	Basic Civil Engineering	2	0	0	2
PRACTICAL						
BCS2L1	ES	Internet Practices Lab	0	0	3	1
BCM2L1*	ES	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	3	1
BPC2L1	BS	Physics and Chemistry Laboratory	0	0	3/3	1
BSS2L4/ BSS2L5/ BSS2L6	HS	NCC/ NSS/NSO to be conducted during week ends	0	0	2	1

Total Number of Contact Hours = 35Total Number of Credits= 29

*Syllabus is same as that of first semester.

*Any one of the following courses:BFR201–French, BGM201–German, BJP201– **Japanese**, BKR201 – Korean, BCN201 – Chinese, BTM201 - Tamil

SEMESTER – III						
Course Code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BMA301	HS	Mathematics – III	3	2	0	4
BEE301	PC	Circuit Theory	4	0	0	4
BEE302	PC	Electrical machines – I	3	0	0	3
BEE303	PC	Electron Devices	3	0	0	3
BEE304	PC	Electromagnetic Theory	3	0	0	3
BEE306	PC	Digital Electronics	3	0	0	3
PRACTICAL						
BEE3L2	PC	Electrical Machines Laboratory - I	0	0	3	2
BEE3L5	PC	Electron Devices Laboratory	0	0	3	2
BEE3L6	PC	Programming Language (C& C++) Laboratory	0	0	3	2
Total Number of Contact Hours = 35Total Number of Credits= 26						

SEMESTER – IV						
Course Code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BMA401	BS	Applied Probability and Statistics	3	2	0	4
BEE401	PC	Electrical Machines - II	3	0	0	3
BEE402	PC	Electrical Network analysis & Synthesis	3	0	0	3
BEE403	PC	Linear Integrated circuits	3	0	0	3
BME405	PC	Thermal Engineering & Fluid mechanics	3	0	0	3
BCE406	HS	Environmental Studies	3	0	0	3
PRACTICAL						
BEE4S1	PR	Technical Seminar - 1	0	0	2	1
BEE4L1	PC	Electrical machines Laboratory – II	0	0	3	2
BEE4L2	PC	Linear & Digital Integrated Circuits Laboratory	0	0	3	2
BME4L3	PC	Thermal Engineering & Fluid mechanics Laboratory	0	0	3	2
Total Number of Contact Hours = 35Total Number of Credits= 26						

SEMESTER - V						
Course Code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BMA502	HS	Numerical methods	3	2	0	4
BEE501	PC	Control System	4	0	0	4
BEE502	PC	Power Electronics	3	0	0	3
BEE504	PC	Electrical Machine design	4	0	0	4
BEE505	PC	Power Generation Systems	3	0	0	3
	CE	Core Elective-I	3	0	0	3
PRACTICAL						
BEE5C1	PR	Comprehension I	0	0	0	1
BEE5L1	PC	Control System Laboratory	0	0	3	2
BEE5L2	PC	Power Electronics Laboratory	0	0	3	2
Total Number of Contact Hours = 28Total Number of Credits= 26						

SEMESTER – VI						
Course Code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEE601	PC	Transmission and Distribution	4	0	0	4
BEE603	PC	Microprocessor and Microcontroller	3	0	0	3
BEE604	PC	Digital Signal Processing	3	0	0	3
BEE605	PC	Measurement and Instrumentation	3	0	0	3
BSS601	HS	Value Education & Professional Ethics	3	0	0	3
	NE	Non –Major Elective-I	3	0	0	3
	CE	Core Elective-II	3	0	0	3
PRACTICAL						
BEE6L1	PC	Microprocessor and Microcontroller Laboratory	0	0	3	2
BEE6L2	PC	Measurement and Instrumentation Laboratory	0	0	3	2
Total Number of Contact Hours = 35Total Number of Credits= 26						

SEMESTER – VII						
Course Code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BMA701	PC	Operations Research for Engineers	4	0	0	4
BEE701	PC	Power System Analysis	4	0	0	4
BEE703	PC	Electrical Drives and Control	4	0	0	4
	NE	Non Major Elective-II	3	0	0	3
	CE	Core Elective-III	3	0	0	3
	OE	Open Elective-I	3	0	0	3
PRACTICAL						
BEE7P1	PR	Term paper	0	0	4	2
BEE7L1	PC	Power System Using PC Laboratory	0	0	3	2
BEE7L3	PC	Electrical Drives & Control Laboratory	0	0	3	2
BEE7V1	PR	In plant Training (End of 6thSem- 15 days)	0	0	0	1
Total Number of Contact Hours = 31Total Number of Credits= 28						

SEMESTER – VIII						
Course Code	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
	OE	Open elective-II	3	0	0	3
	NE	Non Major Elective-III	3	0	0	3
PRACTICAL						
BEE8C1	PR	Comprehension II	0	0	0	1
BEE8P1	PR	Project Work	0	0	18	9
Total Number of Contact Hours = 35Total Number of Credits= 16						

OVERALL CREDITS: 200

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	4	9	-	3	-	3	-	-	19	09.5
2	Basic Sciences (BS)	9	12	4	4	4	-	-	-	33	16.5
3	Engineering Sciences (ES)	10	8	-	-	-	-	-	-	18	09.0
4	Professional Core (PC)	-	-	22	18	18	17	16	-	91	45.5
5	Core Electives (CE)	-	-	-	-	3	3	3	-	9	04.5
6	Non major Electives (NE)	-	-	-	-	-	3	3	3	9	04.5
7	Open Electives (OE)	-	-	-	-	-	-	3	3	6	03.3
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	-	1	1	-	3	10	15	07.5
	Total Credit	23	29	26	26	26	26	28	16	200	100%
	Total Contact Hour	32	35	31	31	30	28	30	24	241Hrs	

LIST OF ELECTIVES

CORE ELECTIVES-I (CE-I)						
SL.NO	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
1.	BEE015	Electrical Special Machines	3	0	0	3
2.	BEE051	Distributed generation and Microgrid	3	0	0	3
3.	BEE012	Solid State Relays	3	0	0	3
4.	BEE053	Power System Protection and Switch Gear	3	0	0	3
5.	BEE013	High Voltage Engineering	3	0	0	3
CORE ELECTIVES-II (CE-II)						
SL.NO	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
1.	BEE052	Electrical Machine Modeling and Analysis	3	0	0	3
2.	BEE016	Flexible AC Transmission Systems	3	0	0	3
3.	BEE048	Renewable Energy Sources	3	0	0	3
4.	BEE003	Advanced Control System	3	0	0	3
5.	BEE011	High Voltage DC Transmission	3	0	0	3
CORE ELECTIVES-III (CE-III)						
SL.NO	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
1.	BEE047	Power System Operation and Control	3	0	0	3
2.	BEE044	Power Quality Management	3	0	0	3
3.	BEE019	Smart Grid	3	0	0	3
4.	BEE043	Solar Energy Utilization	3	0	0	3
5.	BEE033	Electric and Hybrid Vehicles	3	0	0	3
NON MAJOR ELECTIVES –I (NE-I)						
SL.NO	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
1.	BEE045	Instrumentation and Control in power Plant Industries	3	0	0	3
2.	BEE049	Design of Embedded Systems	3	0	0	3
3.	BEE009	Robotics and Automation	3	0	0	3
4.	BEC612	Principles of communication Engineering	3	0	0	3
5.	BEE042	Electronic Integrated Circuits	3	0	0	3

NON MAJOR ELECTIVES –II (NE-II)						
SL.NO	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
1.	BEE007	Bio-Medical Instrumentation	3	0	0	3
2.	BEE014	Fuzzy Logic and Neutral Network	3	0	0	3
3.	BEE027	Micro Controller Based System Design	3	0	0	3
4.	BBM405	Biosensors and Transducer	3	0	0	3
5.	BEC013	Automotive Electronics	3	0	0	3

NON MAJOR ELECTIVES –III (NE-III)						
SL.NO	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
1.	BEI704	Virtual Instrumentation	3	0	0	3
2.	BEE026	Micro Electro Mechanical Systems	3	0	0	3
3.	BEE050	Process control Engineering	3	0	3	3
4.	BEE022	Fibre Optics and Laser Instrumentation	3	0	0	3
5.	BBA005	Energy Engineering And Management	3	0	0	3

OPEN ELECTIVES –I (OE-I)						
SL.NO	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
1.	BBA004	Engineering Economics and Financial accounting	3	0	0	3
2.	BBA008	Total Quality Management	3	0	0	3
3.	BBA001	Principles of Management and Organizational Behavior	3	0	0	3
4.	BEE031	Web Design	3	0	0	3
5.	BEE046	Java Programming	3	0	0	3

OPEN ELECTIVES –II (OE-II)						
SL.NO	**COURSE CODE**	**COURSE TITLE**	**L**	**T**	**P**	**C**
THEORY						
1.	BBA007	Engineering Economics and Cost Analysis	3	0	0	3
2.	BBA002	Entrepreneurship Development	3	0	0	3
3.	BBA003	Marketing Management	3	0	0	3
4.	BEE029	Cloud Computing	3	0	0	3
5.	BEE030	Cyber Security	3	0	0	3

BEN101	ENGLISH - I	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Dept of English				

OBJECTIVES

To make the students learn the basic modes of communication for fluency and attainment of confidence in speech, reading and writing.

COURSE OUTCOMES (COs)

CO1	Understand the importance of being responsible, logical, and thorough.
CO2	Respond to the situations where short reports and instructions are required.
CO3	Explain "how things work", and what to suggest when "things don't work
CO4	Develop our confidence and authority in the practical use of language.
CO5	Understand the importance of being responsible, logical, and thorough.
CO6	e to Face interviews and competitive examinations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H	H	M	L	L	H	H	H	H
	CO2							L					
	CO3	H						H		H			H
	CO4	H	M				M	L	H	H			H
	CO5							L					
	CO6	H		H	H	H	H	L		H	H	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I STRUCTURES 12

Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT II TRANSCODING 12

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT IIIREPORTING 12

Degrees of comparison – Positive, Comparative, Superlative - questions- SI units -Lab reports - Physics chemistry, workshop and Survey report for introducing new product in the market.

UNIT IV FORMAL DOCUMENTATION 12

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT V METHODOLOGY 12

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives , prepositional relatives.

TEXT BOOK:

1. Department Of Humanities and Social Sciences Division, Anna University, Oxford University Press, 2013.

REFERENCES:

1. S.P.Danavel, English and Communication for Students of Science and Engineering,Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007.
3. Murali Krishna and Sunitha Moishra, Communication Skills for Engineers . Pearson, New Delhi, 2011.

BMA101	**MATHEMATICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – + 2 Level Mathematics				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To make the students learn Mathematics in order to formulate and solve problems effectively in their respective fields of engineering.

COURSE OUTCOMES (COs)

CO1	Study the fundamentals of mathematics
CO2	Students learn multiple integral techniques
CO3	Students gain knowledge in application of variables
CO4	Find area and volume based on a function with one or more variables.
CO5	Apply matrix operations to solve relevant real life problems in engineering.
CO6	Formulate a mathematical model for three dimensional objects and solve

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	D	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2			M		H							
	CO3		H				M						
	CO4								L				
	CO5							H			L		
	CO6											L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT 1 MATRICES 12

Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes- Envelopes- Applications of Evolutes and Envelopes.

UNIT 1V FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives- Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobians- Taylor's expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates- Area as double integral- Volume as triple integral.

TEXT BOOK:

1. Ravish R.Singh and Mukkul Bhatt, "Engineering Mathematics-I" First Reprint, Tata McGraw Hill Pub Co., New Delhi. 2011.
2. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi. 2007.

REFERENCES:

1. Ramana.B.V. "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, "Advanced Engineering Mathematics", 7th Edition, Pearson Education, 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons, New York, 2003.
4. Murray R.Spiegel, "Advanced Calculus", Schaum's Outline Series, First Edn, McGraw Hill Intl Book Co.,New Delhi, 1981.

PH101	ENGINEERING PHYSICS I	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES:

To enhance the fundamental knowledge in Physics and its applications relevant to various stre of Engineering and Technology

COURSE OUTCOMES (COs)

CO1	Understand the Principles and Laws of Physics
CO2	To understand the impact of Crystal Physics
CO3	Learn the Properties of Elasticity and Heat transfer.
CO4	Acquire Knowledge on Quantum Physics.
CO5	Understand the concepts on Laser & Ultrasonic's and its Applications
CO6	Understand the Principle of Laser and its Applications in Engineering and Medicine.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	A	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M			H		
	CO2		L	H		M				M		L	H
	CO3												
	CO4	H		M	L						L		M
	CO5		L	L								L	L
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity-Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress - strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and

Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion –Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO2, Semiconductor lasers (homo junction & hetero junction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TEXT BOOKS:

1. Jayaraman D Engineering Physics I. Global Publishing House, 2014.
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai Publishers, 2009.
4. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
4. http://ocw.mit.edu/courses/find-by-topic
5. http://nptel.ac.in/course.php?disciplineId=122
6. https://en.wikipedia.org/wiki/Engineering_physics

BCH101	**ENGINEERING CHEMISTRY - I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level Chemistry				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Understand the principles of water characterization and treatment for portable and industrial purposes.
CO2	To impart knowledge on the essential aspects of Principles of polymer chemistry and engineering applications of polymers

CO3	Having a sound knowledge in the Field of the Conventional and non-Conventional energy
CO4	To impart knowledge on the essential aspects of electrochemical cells, emf and applications of EMF measurements
CO5	To make the students understand the Principles of corrosion and corrosion control .
CO6	To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I WATER TECHNOLOGY 9

Introduction-Characteristics : Hardness of water – types - temporary and permanent hardness - estimation by EDTA method Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –Domestic water treatment – disinfection methods (Chlorination, Ozonation , UV treatment) Boiler feed water – requirements – disadvantages of using hard water in boilers Internal conditioning (Calgon Conditioning method) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

UNIT II POLYMERS 9

Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization– Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III ELECTRO CHEMISTRY 9

Introduction CELLS: types of Electrochemical cells , Electrolytic cells – Reversible and irreversible cells EMF – measurement of EMF– Single electrode potential – Nernst equation Reference electrodes : Standard Hydrogen electrode -Calomel electrode Ion selective electrode :Glass electrode and measurement of pH using Glass electrode Electrochemical series – significance Titrations :Potentiometer titrations (redox - Fe^{2+}vs dichromate titrations) Conduct metric titrations (acid-base – HCI vs, NaOH titrations)

UNIT IV CORROSION AND CORROSION CONTROL 9

Introduction: Chemical corrosion Definition - Chemical Corrosion - Electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion control – sacrificial anode and impressed cathodic current methods – Protective coatings :Paints– constituents of the paint and their functions Metallic coatings – electroplating of Gold and electro less plating of Nickel.

UNIT V NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES9

Introduction : Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor Solar energy conversion – solar cells – wind energy Fuel cells – hydrogen – oxygen fuel cell Batteries :Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries :Lead–acid storage battery –working –uses Nickel–cadmium battery - working –uses Solid – state battery : Lithium battery

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara "A text book of engineering chemistry" S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES :

1. B.K.Sharma "Engineering chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Electrochemistry

BCS101	FUNDAMENTALS OF COMPUTING AND PROGRAMMING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES

Students will understand the basics of computers and solve computer oriented problems using various computing tools.

COURSE OUTCOMES (COs)

CO1	Learn the fundamental principles in computing.
CO2	Learn to write simple programs using computer language
CO3	To enable the student to learn the major components of a computer system.
CO4	Computing problems
CO5	To learn to use office automation tools.
CO6	To interpret and relate programs

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H					H						
	CO2		L	H		M							
	CO3		L		S								
	CO4	M		M	W		M						
	CO5		L	L									
	CO6	H					H						
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION TO COMPUTER 9

Introduction- Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers- Basic Computer Organization-Number system. Computer Software: Types of Software—System software-Application software-Software Development Steps

UNIT II PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program – Purpose – Algorithm – Flowcharts– Pseudo code Introduction to Office Packages: MS Word, Spread Sheet, Power Point, MS Access, Outlook.

UNIT III INTRODUCTION TO C 9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions. Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV ARRAYS AND STRUCTURES 9

Overview of C-Constants, Variables and Data types-Operators and Expressions -Managing Input and Output operators-Decision making-Branching and Looping.

UNIT V INTRODUCTION TO C++ 9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TEXT BOOKS:

1. Ashok, N.Kamthane,"Computer Programming", Pearson Education (2012).
2. Anita Goel and Ajay Mittal,"Computer Fundamentals and Programming in C", Dorling V Kindersley (India Pvt Ltd).,Pearson Education in South Asia,(2011).
3. Yashavant P. Kanetkar, "Let us C",13th Edition,BPB Publications(2013).
4. Yashavant P. Kanetkar,"Let us C++"10th Edition, BPB Publications (2013**).**

REFERENCES:

1. Pradeep K.Sinha, Priti Sinha "Foundations of Computing", BPB Publications (2013).
2. Byron Gottfried, "Programming with C", 2nd edition, (Indian Adapted Edition), TMH Publication.
3. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in 'C' First Edition, Oxford University Press(2009).
4. The C++ Programming Language , 4th Edition, Bjarne Stroustrop, Addison-Wesley Publishing Company (2013).

BFR 101	FRENCH	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

Language gives access and insights into another culture. It is a fundamental truth that culture define themselves through languages.

COURSE OUTCOMES (COs)

CO1	Introduce the basics of the language to beginners
CO2	Understand a dialogue and dialogue presentation
CO3	To develop their knowledge as well as their communicative skills so as to be able to respond in simple everyday contexts.
CO4	Synchronies I includes documents which initiate the learners to another world, anothe culture and which acclimatize them to the authentic use of the French language through the exploitation of written and iconographic documents. The Indian context been used.
CO5	Grammatical and lexical notions as well as activities required for communication learnt by the students.
CO6	Interpreting skills and confidence in the language.
CO6	Interpreting skills and confidence in the language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

		√							
4	Approv-al	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 8

At the airport: Savoir– faire: exchanging greetings, self introduction, introducing another, welcoming someone, identifying someone - Grammar: verbs 'to be', 'to call oneself', subject pronouns, interrogation

UNIT II GRAMMAR 8

At the University: Savoir-faire: enquiring after one's welfare, taking leave, expressing appreciation -Grammar: definite & indefinite articles, gender of nouns, adjectives, present tense of regular 'er' verbs, 'to have', 'to learn', negation, irregular verbs

UNIT III CONVERSATION 8

At the café: Savoir –faire: speaking about one's likes, giving information, expressing admiration, asking information about someone - Grammar: Interrogative adjectives, irregular verbs, possessive and interrogative adjectives

UNIT IV PROPOSAL WRITING 7

At the beach: Savoir faire: proposing an outing, accepting/ refusing the proposal - Grammar: singular & plural, indefinite pronoun, demonstrative adjectives, negation, irregular verbs

UNIT V FORMAL LETTERS 7

A concert: Savoir –faire: inviting, accepting, expressing one's inability to accept an invitation

UNIT VI REGULAR & IRREGULAR VERBS 7

Grammar: Present tense of more irregular verbs, contracted articles, future tense, interrogative adverbs, **At Nalli's** Savoir- faire: asking the price of an article, protesting against the price, Grammar: possessive adjectives, Exclamative adjectives, imperative tense

REFERENCES:

1. Course Material: Synchronie I –Méthode de Français
2. Madanagobalane -Samita Publications, Chennai, 2007

BGM 101	**GERMAN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

At the end of this course, students shall be able to obtain good knowledge of the language read, write and speak German, whereby the emphasis is laid on speech.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.

CO4	Will understand German lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

Course structure:

A. German Language (speaking, reading, writing, grammar and test)
B. Life in Germany (shopping, restaurant, doctor, government, bank, post)
C. The German Way (introduction, doing business, conversation, meetings, dining)
D. Germany (Culture, Climate)

UNIT I PRONOUNCIATION 9

Welcome: Introduction to the Language, Spelling and Pronunciation (The alphabets and numbers) Greetings, ordering, requesting, saying thank you - Grammar – **the article "the", conjugation** of verbs

UNIT II SELF INTRODUCTION 9

Shopping - Grammar – adjectives, endings before nouns, practice. Self introduction

UNIT III TRAINING 9

Addresses, Occupations, Studies - Grammar - **'to be', the definite/indefinite** articles, individual Training

UNIT IV ORAL 9

Leisure Time, Sports, Hobbies - Grammar – position of a verb in a main clause , oral practice

UNIT V NARRATION 9

At a Restaurant, Food and Drink - Grammar – the personal pronoun in the Nominative and Accusative, Narrating an event

RESOURCES:

1. Sprachkurs Deutsch 1 (Verlag Diesterweg), New Delhi Learning Centre

BJP 101	**JAPANESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Japanese language, Japanese culture and heritage
To impart knowledge Japanese lifestyle.
To give sufficient exposure to develop basic conversational skills.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Japanese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CULTURAL HERITAGE 9

Introduction-history and origin of Japanese language-Japan and its cultural heritage-Self introduction-counting numbers (1-100)-time-conversation with the use of audio devices, grammar– usage of particles wa, no, mo and ka

UNIT II USAGE 9

Greetings, seasons, days of the week and months of the year-numbers (up to 99,999)-grammar–

usage of kore, sore, are, kono, sono, ano, koko and kochira, arimasu and imasu-i-ending and na-ending adjectives-use of audio and drills for practice

UNIT III ORAL 9

Asking the price–associated vocabulary-usage of particles ni, ga and ne- use of audio and drills for practice-Introduction to basic Kanji characters- use of audio and drills for practice

UNIT IV ART AND CULTURE 9

Family relationships- colours-Kanji (numbers) and festivals of Japan-religion-Japanese art and culture-ikebana, origami-introduction to hiragana- use of audio and drills for practice

UNIT V DRILLS AND PRACTICE 9

Vocobulary associated with directions-asking way-particles – e, de, mo, koko, soko, asoko, doko, nani, mae, ushiro, ue, shita- use of audio and drills for practice-introduction to katakana

TEXT BOOKS

1. Japanese Hiragana and Katakana for beginners, Timothy G. Stout, 2011
2. Genki I: An integrated course in elementary Japanese, Eri Banno and Yuko Ikeda, 2011

REFERENCE BOOKS

1. Japanese Reader collection Volume I, Yumi Boutwell and Clay Boutwell, Kotoba books, 2013
2. Living Language Japanese Complete Edition beginners through advanced course, Living Language, 2012

BKR 101	**KOREAN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Korean language, Korean culture and heritage
To impart knowledge on Korean lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Korean lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L

	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)				
		√											
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I PLANNING 9

Asking/giving reasons for studying Korean, making plans for the holiday, writing letters, describing past travel experiences and future travel plans, shopping in a grocery store, shopping in electronics store, storytelling Grammar: would like to (do), want to (do), construct future tense.

UNIT II MODIFIERS 9

Asking about feelings, asking about problems and giving advice, brief introductions - Grammar: Noun modifier, please try doing (something), irregular adjective/verb

UNIT III PLACING ORDERS 9

Asking about hobbies, asking about abilities (sports), job requirements, Ordering things for delivery, ordering a meal at a restaurant - Grammar: Sentence ending for the honorific form, please do something for me, have tried (something),

UNIT IV DESCRIPTIONS 9

Asking about evening plans, making plans with others, making preparations - Asking about rooms, describing your room to your classmates, describing your house. Grammar: to know/not know how to do something, must (do), have to (do), should,

UNIT V GRAMMAR 9

Describing your plans and giving reasons, cancelling appointments. Grammar: Shall we~? / Should we~?, with, and, irregular verbs/adjective, so, because, cannot, intend to, plan to, or hope to, (more) than, the most, tag question/is n't it? ,will (do)

COURSE MATERIAL:

Korean for Non-Native Speakers (Student Book 1B) Korean Language Education Center, Sogang University

BCN 101	**CHINESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				
OBJECTIVES					

To have a basic knowledge of Chinese language, Chinese culture and heritage To impart knowledge on Chinese lifestyle and heritage.	
COURSE OUTCOMES (COs)	
CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Chinese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT 1 RISE OF DIALECTS **9**

History, Origins, Old and middle Chinese, Rise of northern dialects

UNIT II VARIETIES **9**

Influences 3 Varieties of Chinese. 1.Classification 2.Standard Chinese and 3.Nomenclature

UNIT III CHARACTERS **9**

Chinese characters, Homophones, Phonology

UNIT IV TRANSCRIPTIONS **9**

Tones, Phonetic transcriptions, Romanization, Other phonetic transcriptions

UNIT V GRAMMAR **9**

Grammar and morphology, Vocabulary, Loanwords, Modern borrowings and loanwords

REFERENCES:

1. Hannas, William C. (1997), Asia's Orthographic Dilemma, University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-1892-0" 978-0-8248-1892-0.

2. Qiu, Xigui (2000), Chinese Writing, trans. Gilbert Louis Mattos and Jerry Norman, Society for the Study of Early China and Institute of East Asian Studies, University of California, Berkeley, ISBN HYPERLINK http://en.wikipedia.org/wiki/Special:BookSources/978-1-55729-071-7,978-1-55729-071-7.
3. Ramsey, S. Robert (1987), The Languages of China, Princeton University Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-691-01468-5" 978-0-691-01468-5.
4. Schuessler, Axel (2007), ABC Etymological Dictionary of Old Chinese, Honolulu: University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-2975-9"978-0-8248-2975-9.
5. R. L. G. " Language borrowing Why so little Chinese in English?" The Economist. June 6, 2013.

BME 102	ENGINEERING GRAPHICS - C	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – +2 Level Maths + Physical Science				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

- To develop graphical skills in students for communication of concepts, design ideas of engineering products, and expose them to existing standards related to technical drawings.
- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science

COURSE OUTCOMES (COs)

CO1	To visualize two dimensional graphic representation of three dimensional objects and buildings
CO2	To produce two dimensional graphic representation of three dimensional objects and buildings
CO3	To comprehend and visualize 3D views of objects.
CO4	To understand and generate the different curves used in engineering applications.
CO5	To learn and write program in “C”.
CO6	**:** To introduce the fundamental of CAD Graphics used in design.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H											H
	CO2	M	H										M
	CO3			L									M
	CO4						L		H	H			L
	CO5			L						H			L
	CO6			L							H		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI BASIC CURVES,PROJECTION OF POINTS ANDSTRAIGHT LINES 9

Conics-construction of ellipse, parabola and hyperbola by eccentricity method-construction of involutes of square and circle-Drawing of tangent and normal to the above curves-Scales-Basic drawing conventions and standards- Orthographic projection principles-Principal planes-First angleprojection-Projectionofpoints.Projectionofstraightlines(only first angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method.

UNITII PROJECTIONSOFPLANES ANDSOLIDS 9

Projectionofplanes(Polygonalandcircularsurfaces)inclinedtoboththeprincipal planes. Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method

UNITIII ORTHOGRAPHICPROJECTIONS,ISOMETRIC PROJECTIONS& FREEHANDSKETCHING 9

Orthographic projection of Simplepartsfrom3Ddiagram-Principlesofisometric projection and isometric view-isometric scale- Isometric projections of simple solids and truncated solids-Prisms, pyramids, cylinders, cones.

UNITIVPROJECTIONOFSECTIONEDSOLIDS AND DEVELOPMENT OF SURFACES 9

Sectioningofsolidsinsimpleverticalpositionwhenthecuttinglaneisinclinedtotheoneof the principal planes and perpendicular to the other-obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids-Prisms, pyramids cylinders and cones.

UNITVPERSPECTIVEPROJECTION, BUILDINGDRAWING ANDCOMPUTERAIDEDDRAFTING 9

Perspective projection of cubes and cylinders by visual ray method .Introduction-components of simple residential or office building-specifications-plan and elevation of different types of Residential buildings and office buildings. Introduction to drafting packages and basic commands used in AUTO CAD.Demonstration of drafting packages.

TEXT BOOKS:

1. N.D.Bhatt and V.M.Panchal, "Engineering drawing", charotar publishinghouse, 50th edition,2010.
2. K.V.Natarajan "ATextbook of Engineering Graphics", Dhanalakshmi Publishers, Chennai,2009.

REFERENCES:

1. K.R.Gopalakrishna, "Engineering drawing", (Vol-I&II combined) Subhasstores, Bangalore, 2007.
2. K.Venugopal and V.PrabhuRaja,"Engineering Graphics",New Age International Private limited, 2008.
3. Luzzader, Warren.J.,and Duff, John.M.,, "Fundamentals of Engineering Drawing with an introduction to Interactivecomputergraphicsfordesignandproduction",Easterneconomyedition, Prentice Hall of India Pvt Ltd, NewDelhi,2005

BEE 101	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Engineering Mathematics, Engineering Physics-I & II				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To understand the laws of electrical engineering.

COURSE OUTCOMES (COs)

CO1	Students will gain knowledge regarding the various laws and principles associated with electrical systems.
CO2	Students will gain knowledge regarding electrical machines and apply them for practical problems.
CO3	Students will gain knowledge regarding various types semiconductors.
CO4	Student will gain knowledge digital electronics.
CO5	Student will gain knowledge on electronic systems.
CO6	Students will acquire knowledge in using the concepts in the field of electrical engg. projects and research.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L			
	CO2		H	M			L		L	L			
	CO3		H	M			L		L				
	CO4	M	H	M			L		L	L			
	CO5	M	H	M			L		L				
	CO6		H				L		L	H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ELECTRIC CIRCUITS 6

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem –Thevenin's and Norton's Theorem - Problems.

UNIT II ELECTRICAL MACHINES 6

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT III BASIC MEASUREMENT SYSTEMS 6

Introduction to Measurement Systems, Construction and Operating principles of PMMC, Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method – and Energy meter.

UNIT IV SEMICONDUCTOR DEVICES 6

Basic Concepts of semiconductor devices – PN Junction Diode Characteristics and its Applications – HWR, FWR –Zener Diode – BJT (CB, CE, CC) configuration & Characteristics.

UNIT V DIGITAL ELECTRONICS 6

Number system – Logic Gates – Boolean Algebra– De-**Morgan's Theorem –** Half Adder & Full Adder – Flip Flops.

TEXT BOOKS:

1. N.Mittal "Basic Electrical Engineering". Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
3. Jacob Millman and Christos C-Halkias, "Electronic Devices and Circuits", Tata McGraw Hill

REFERENCE BOOKS:

1. Edminister J.A. "Theory and Problems of Electric Circuits" Schaum's Outline Series. McGrawHill Book Compay, 2nd Edition, 1983.
2. Hyatt W.H and Kemmerlay J.E. "Engineering Circuit Analysis", McGraw Hill International Editions, 1993.
3. D. P. Kothari and I. J. Nagrath" Electric Machines"Tata McGraw-Hill Education, 2004
4. Millman and Halkias, "Integrated Electronics", Tata McGraw Hill Edition, 2004.

BCS 1L2	**COMPUTER PRACTICE LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	1
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Department of Computer Science &Engineering				
OBJECTIVES: To impart basic computer knowledge					
COURSE OUTCOMES (COs)					
CO1	Demonstrate major algorithms and data				
CO2	Implementation of array operations				
CO3	Implementation of binary tree.				
CO4	Implementation of linked list				

CO5	Students will able to do analyse data using spread sheet
CO6	Student will able to understand the basics of C programming.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	H		H		L		H	H	H
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

A) WORD PROCESSING **6**

Document creation, Text manipulation with Scientific Notations. Table creation,Table formatting and Conversion. Mail merge and Letter Preparation. Drawing-Flow Chart

B) SPREAD SHEET **9**

Chart-Line Xy Bar and Pie – Formula-Formula Editor-Spread sheet-Inclusion of Object, Picture and Graphics Protecting the document and sheet-Sorting and Import/Export features.

C) SIMPLE C PROGRAMMING* **15**

Data types, Expression Evaluation, Condition Statement. Arrays structures and Unions – Functions

D) SIMPLE C++PROGRAMMING **15**

-Classes and Objects
-Constructor and Destructor

***For Programming exercises Flow chart and Pseudo code are essential.**

BEE1L1	**BASIC ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Basic Electrical and Electronics Engineering				
	Course Designed by – Department of Electrical & Electronics Engineering				
OBJECTIVES: To enhance the student with knowledge on electrical and electronic equipments.					
COURSE OUTCOMES (COs)					

CO1	Students will able to handle basic electrical equipments.
CO2	Students will able to do staircase wiring.
CO3	Students will able to understand domestic wiring procedures practically.
CO4	Student will able to assemble electronic systems.
CO5	Students will understand all the fundamental concepts involving electrical engineering
CO6	Students will understand all the fundamental concepts involving electronics engineering

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	
	CO5	M	H	M			L		L		M	H	
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

I LIST OF EXPERIMENTS FOR ELECTRICAL ENGINEERING LAB

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

II LIST OF EXPERIMENTS FOR ELECTRONICS ENGINEERING LAB

1. Study of electronic components and equipments.
   a. Resistor colour coding using digital multi-meter.
   b. Assembling electronic components on bread board.
2. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

BEN 201	ENGLISH II	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – English I				
	Course Designed by – Department of English				

OBJECTIVES

Students will be able to actively participate in group discussions. Students will have Telephonic Skills, Giving Directions and Information Transfer

COURSE OUTCOMES (COs)

CO1	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)
CO2	To make students comprehend the habit of intelligent Reading as well as Computer- based competitive exams glob
CO3	To achieve a reasonably good level of competency in Report Writing.
CO4	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)
CO5	To achieve a reasonably good level of competency in group discussions
CO6	To achieve a reasonably good level of competency in public speaking

	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	M	L	H	L	M			H		M	L	
	CO2			H	L				H		M	L	
	CO3			H	L	M			H		H	L	
	CO4			H	L	M			H		M	L	
	CO5			H	L	M			H		M	L	
	CO6			H	L	M			H		M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ORIENTATION 12

Numerical adjectives - Meanings in context - Same words used as different parts of speech - Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II ORAL SKILL 12

Listening to audio cassettes - C.Ds , News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - and Giving Instructions - Reading Comprehension answering questions. Inferring meaning.

UNIT III THINKING SKILL 12

Self- introduction describing –Group Discussion – Debate –Role play- Telephone- Things- etiquette- Recommendation and Sequencing jumbled sentences to make a suggestions-paragraph-

advertisement and notice, Designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV WRITING SKILL 12

Definitions - Compound nouns - Abbreviations and acronyms – (a) business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) Letters to the editor (giving suggestions on an issue) .

UNIT V FORMAL INFORMATION 12

Editing **–** Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

TEXT BOOK:

1. Meenakshi Raman, Sangeetha Sharma , Technical English for Communication: Principle and Practice, OUP, 2009.

REFERENCE BOOKS:

1. Sumanth , English for Engineers, Vijay Nicole , Imprints Pvt ltd.2013.
2. Meenakshi Raman and SangeethaSharma , Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binod Mishra , Communication skills for engineers and scientists , PHI Learning Pvt Ltd, New Delhi, 2010.

BMA 201	**MATHEMATICS – II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – Mathematics I				
	Course Designed by – Department of Mathematics				

OBJECTIVES

Ability to apply these principles of mathematics in projects and research works.

COURSE OUTCOMES (COs)

CO1	Student shall be able to Solve differential equations, simultaneous linear equations, and some special types of linear equations related to engineering.
CO2	Relate the use of mathematics in applications of various fields namely fluid flow, heat flow, solid mechanics, electrostatics, etc.
CO3	Ability to test hypothesis
CO4	Find intensity of degree of relationship between two variables and also bring out regression equations.
CO5	Understand to solve matrix problems related to real life problems.
CO6	Formulate mathematical models

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		L									
	CO2		H				H		L	L		M	
	CO3		H				H		L	L		M	

	CO4					M						M	
	CO5										M	M	
	CO6										M		
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
				√									
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I ORDINARY DIFFERENTIAL EQUATION 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – **Cauchy's** and L**egendre's linear equations** - simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient, divergence and curl –Directional derivatives –Irrotational and solenoidal vector fields – vector integration– **Green's theorem in a plane , Gauss divergence theorem and** S**toke's theorem (**without proofs) – simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) – Harmonic and orthogonal properties of analytic functions – Harmonic conjugate – construction of analytic functions – conformal mapping: W= Z+C, CZ, 1/Z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration – **Statement and application of Cauchy's integral theorem and Cauchy's integral formula** –Taylor and Laurent expansions – Singular points – Residues – Residue theorem –Application of Residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V STATISTICS 12

Mean, Median, Mode – Moments – Skewness and Kurtosis – Correlation – Rank Correlation – Regression –Chi square test for contingency tables.

TEXT BOOK:

1. R.M.Kannan and B.Vijayakumar" Engineering Mathematics–II "2nd Edition, SRB Publication, Chennai 2007.
2. Bali.N.P and Manish Goyal , "Engineering Mathematics", 3rd Edition, Laxmi Publications (P) Lltd, 2008 .
3. Grewal .B/S "Higher Engineering Mathematics", 40th Editon, Khanna Publications, Delhi, 2007

REFERENCES :

1. Ramana.B.V, "Higher Engineering Mathematic", Tata McGraw Hill Publishing Company,

New Delhi, 2007.
2. Gupta SC, and VK.Kapoor, "Fundamentals Mathematical Statistics", 11th edition, Sultan Chand Sons, New Delhi, 2014.

BPH201	ENGINEERING PHYSICS -II	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING PHYSICS -I				
	Course Designed by – Department of Physics				

OBJECTIVES

- To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications
- To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

COURSE OUTCOMES (COs)

CO1	Understand about properties and advancements of conducting materials.
CO2	Understand the principle and properties semiconducting materials.
CO3	Acquire Knowledge on Magnetic and dielectric Materials.
CO4	To Know about the creation of new materials with novel properties
CO5	To Understand the impact of modern materials in technical uses.
CO6	Learn new engineering materials and its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L								
	CO5		L	L									
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theo-

ry – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration – – Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence-optical Kerr effect – Classification of Biomaterials and its applications.

TEXT BOOKS:

1. Jayaraman D Engineering Physics II. Global Publishing House, 2014.
2. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
3. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

REFERENCES:

1.Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4 http://ocw.mit.edu/courses/find-by-topic
5 http://nptel.ac.in/course.php?disciplineId=122
6 https://en.wikipedia.org/wiki/Engineering_physics

BCH 201	**ENGINEERING CHEMISTRY-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING CHEMISTRY –I				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)	
CO1	Students will understand the concepts and further industrial applications of surface chemistry
CO2	To impart knowledge about the Industrial importance of Phase rule and alloys
CO3	To make the students to be conversant with Analytical techniques of chemistry and their importance
CO4	To have an idea and knowledge about the Chemistry of Fuels and
CO5	Understanding of engineering materials
CO6	All about bonding and molecular structures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L		H		H				M	
	CO2		H			H		H					
	CO3	H		L		H		H				M	
	CO4			L		H		H					
	CO5			L		H		H					
	CO6			L		H		H		H		M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I SURFACE CHEMISTRY **9**

Introduction **:** Adsorption , absorption , desorption , adsorbent, adsorbate and sorption – (definition only) Differences between adsorption and absorption Adsorption of gases on solids – factors affecting adsorption of gases on solids – Adsorption isotherms –Frendlich adsorption isotherm and Langmuir adsorption isotherm Role of adsorbents in catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II PHASE RULE AND ALLOYS **9**

Introduction **:**Statement of Phase Rule and explanation of terms involved – one component system – water system – Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) – eutectic temperature – eutectic composition – Pattinsons Process of desilverisation of Lead Alloys: Importance, ferrous alloys –nichrome and stainless steel – 18/8 stainless steel -heat treatment of steel – annealing – hardening – tempering normalizing – carburizing - nit riding . Non- ferrous alloys: Brass and Bronze

UNIT III ANALYTICAL TECHNIQUES 9

Introduction: Type of Spectroscopy - Atomic spectroscopy – molecular spectroscopy - Explanation IR spectroscopy – principles – instrumentation (block diagram only) – applications - finger print region UV-visible spectroscopy — principle – instrumentation (block diagram only) – Beer-**Lambert's law**- – estimation of iron by colorimetry– Atomic absorption spectroscopy- principle - instrumentation (block diagram only) - estimation of Nickel by Atomic absorption spectroscopy Flame photometry– principles – instrumentation (block diagram only) - estimation of sodium ion by Flame photometry

UNIT IV FUELS 9

Introduction **:** Calorific value – types of Calorific value - gross calorific value – net calorific value Analysis of Coal –- Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) Synthetic petrol – Bergius processes – Gaseous fuels-water gas, producer gas, CNG and LPG (definition and composition only) Flue gas analysis – importance - Orsat apparatus

UNIT V ENGINEERING MATERIALS 9

Introduction: Refractory's – classification – acidic, basic and neutral refractory's – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Manufacture of Refractory's: alumina bricks and Magnesite bricks, Abrasives – natural and synthetic abrasives Natural type : Siliceous - quartz ; Non –siliceous – diamond Synthetic Abrasives : silicon carbide and boron carbide. Lubricants: Liquid lubricants - Properties – viscosity index, flash and fire points, cloud and pour points, oiliness, Solid lubricants – graphite and molybdenum sulphide

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand &Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub. Co.Ltd, New Delhi,(2008)
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Spectroscopy

BCS 202	INTERNET PROGRAMMING	L	T	P	C
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Dept of Information Technology				

OBJECTIVES

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying computer science.

COURSE OUTCOMES (COs)

CO1	To enable the student to learn the major components of a computer system.
CO2	To know the correct way of solving problem.
CO3	To identify efficient way of solving problem.
CO4	To learn to use office automation tools.
CO5	To implement office automation tools
CO6	To learn and write program in "C".

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I BASIC INTERNETCONCEPTS 6

Internet principles-IP addressing-Internet Service Provider (ISP)-URL-Basic web concepts-World Wide Web (WWW)-Intranet and Extranet-Internet Protocols: HTTP, TCP, UDP, FTP, Telnet-Domain Name System(DNS)-E mail-Next generation internet.

UNITII WEBDESIGNBASICS 6

Introduction to HTML–Structure of HTML Document– Tags-Headings–Links–Images–Lists– Tables –Forms–Frames-Style sheets and its types.

UNITIII DYNAMIC HTML 6

Introduction to Dynamic HTML-Object model and collections-Event model-Filters and transition-Data binding-Data control-Activex control.

UNITIV CLIENT ANDSERVERSIDEPROGRAMMING 6

VBScript &JavaScript: Introduction-Operators–Data type-Control structures-Looping–Classes and Objects–Arrays-Functions-Events-Example programs.

UNITV INTERNETAPPLICATIONS 6

Onlinedatabase-functionsofonlinedatabase-MeritsandDemerits-InternetInformationSystems (IIS)-EDI applications in business and its types-Internet commerce-Types and Applications .

TEXT BOOKS:

1. Deitel, Deitel and Nieto, ''Internet and World Wide Web- How to program'', Pearson Education Publishers, 5th edition, 2008.
2. Elliotte Rusty Harold, ''Java Network Programming'', O'Reilly Publishers, 2010
3. Java Script: A Beginners Guide John Pollock 4thEdition, TMH Edition (2013)
4. VB Script Beginners Guide, Jyoti B. Giramkar, Create Space Independent Publishing (2014)

REFERENCES:

1... Krishnamoorthy & S.Prabhu, ''Internet and Java Programming'', New Age International Publishers, 2010.
2. Thomno A.Powell, ''The Complete Reference HTML and XHTML'', fourth edition, Tata McGraw Hill, 2001
3. E Commerce Kamlesh K.Bajaj, Debjani Nag, Tata McGraw Hill, Second edition, 2010

BSS201	**PERSONALITY DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	1	1	0	2
	Prerequisite – +2 Level Knowledge				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To make students groom their personality and prove themselves as good Samaritans of the soci

COURSE OUTCOMES (COs)

CO1	Individual or in-group class presentations pertaining to the applications of conce theories or issues in human development..
CO2	Scores obtained from essay and or objective tests.
CO3	Attendance, classroom participation, small group interactions.
CO4	Research and write about relevant topics.
CO5	Design and complete a research project that can take the form of a developme interview, an observation or assessment through service learning.
CO6	Develop and maintain a Reflection

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	L		H				M					
	CO2		H	H				M					
	CO3							M	H				
	CO4									H	H		

	CO5							M			H	H	
	CO6							M					L
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)				
		√											
4	Approv-al	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 6

The concept personality- Dimensions of theories of Freud & Erickson- personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analyses.

UNIT II ATTITUDE & MOTIVATION 6

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages –Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III SELF-ESTEEM 6

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV OTHER ASPECTS OF PERSONALITY DEVELOPMENT 6

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills -Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics –Good manners and etiquette.

UNIT V EMPLOYABILITY QUOTIENT 6

Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TEXT BOOKS:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition, Prentice Hall.

REFERENCE BOOKS:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill

1988.
2. Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

BBT202	**BIOLOGY FOR ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – Basic Science				
	Course Designed by – Department of Industrial Bio Technology				

OBJECTIVES

Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system**.**

COURSE OUTCOMES (COs)

CO1	Graduates within the first five years will be able to grasp and apply biological engineering principles, procedures needed to solve real-world problems.
CO2	To understand the fundamentals of living things, their classification, cell structure and biochemical constituents
CO3	To apply the concept of plant, animal and microbial systems and growth in real life situations
CO4	To comprehend genetics and the immune system
CO5	To know the cause, symptoms, diagnosis and treatment of common diseases
CO6	To give a basic knowledge of the applications of biological systems in relevant industries

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M					
	CO2		H							H			
	CO3			H							M		
	CO4										H		
	CO5												
	CO6						H						M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNITI INTRODUCTION TO LIFE 6

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell-Introduction to biomolecules: definition-general classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome.

UNIT II BIODIVERSITY 6

Plant System: basic concepts of plant growth-nutrition-photosynthesis and nitrogen fixation-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions-Microbial System: history-types of microbes-economic importance and control of microbes.

UNIT III GENETICS AND IMMUNE SYSTEM 6

Evolution: theories of evolution-**Mendel's** cell division–mitosis and meiosis-evidence of e **laws of inheritance**-variation and speciation- nucleic acids as a genetic material-central dogma immunity-antigens-antibody-immune response.

UNIT IV HUMAN DISEASES 6

Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis

UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION 6

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines-cloning-drug discovery-biological neural networks-bioremediation-biofertilizer-biocontrol-biofilters-biosensors-biopolymers-bioenergy-biomaterials-biochips-basic biomedical instrumentation.

TEXT BOOKS:

1. A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

REFERENCE BOOKS

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
3. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

BME201	BASIC MECHANICAL ENGINEERING	L	T	P	C
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

- The program educational objectives (PEOs) for the mechanical-engineering program are

to educate graduates who will be ethical, productive, and contributing members of society.

- The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- The ability to apply principles of engineering, basic science, and mathematics to design and realize physical systems, components, or processes

COURSE OUTCOMES (COs)

CO1	an ability to apply knowledge of mathematics
CO2	an ability to apply knowledge of science, and engineering
CO3	Ability to design and conduct experiments, as well as to analyze and interpret data.
CO4	an ability to function on multi-disciplinary teams
CO5	ToprovidebasicKnowledgeofbasicmanufacturingprocess.
CO6	ability to identify, formulate, and solve engineering problems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ENERGY RESOURCESANDPOWER GENERATION 6

RenewableandNon-renewableresources-solar,wind,geothermal,steam,nuclearandhidepowerplants-Layout, majorcomponentsandworking.ImportanceofEnergystorage,Environmentalconstraintsofpowergeneration usingfossil fuelsandnuclearenergy.

UNIT II IC ENGINES 6

Classification,workingprinciplesof petrol anddiesel engines-twostroke andfourstroke cycles,functionsofmain componentsofI.Cengine.Alternatefuelsandemissioncontrol.

UNIT III REFRIGERATION AND AIR-CONDITIONINGSYSTEM 6

Terminologyof Refrigerationand Air-Conditioning,PrincipleofVaporCompression& Absorption-system- Layoutoftypicaldomesticrefrigerator-window&Splittyperoomairconditioner.

UNITIV MANUFACTURING PROCESSES 6

BriefdescriptionofMouldmakesandcastingprocess,Metalforming,Classification typesofforging, forging operations, Briefdescription ofextrusion,rolling,sheetforging,anddrawing.Briefdescription ofwelding,brazing andsoldering.Principalmetalcuttingprocessesandcuttingtools,Brief description-ofCentrelatheandradial drillingmachine.

UNITV MECHANICALDESIGN 6

Mechanicalpropertiesofmaterial-Yieldstrength,ultimatestrength,endurancelimitetc.,Stress-Strain curvesof materials.Stresses inducedinsimpleelements.Factorofsafety-Design ofShaftsandbelts. Typesofbearingsand itsapplications.Introductionto CAD/CAM/CIM&Mechatronics.

TEXTBOOKS:

1. T.J.Prabhuetal, "BasicMechanicalEngineering", SciTechPublications(p)Ltd,2000

REFERENCES:

1. NAGPAL,G.R,"PowerplantEngineering",KhannaPublishers,2004.
2. RAO.P.N,"ManufacturingTechnology",TataMcGraw-HillEducation,2000.
3. Kalpakjian,"ManufacturingEngineeringandTechnology",AdissoWesleypublishers,1995.
4. Ganesan.V,"Internalcombustionengines",TataMcGraw-HillEducation,2000.
5. C.P.Arora,"RefrigerationandAir Conditioning",TataMcGraw-HillEducation,2001.
6. V.B.Bhandari,"DesignofMachineelements",TataMcGraw-HillEducation,2010.

BCE 201	**BASIC CIVIL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Civil Engineering				

OBJECTIVES: Understand the basic concepts of civil engineering.

COURSE OUTCOMES (COs)

CO1	Will gain knowledge in Design, concept preparation
CO2	Loading calculation
CO3	Structural component design
CO4	Drawing and chart preparation
CO5	Will understand the components of buildings.
CO6	Will learn the engineering aspects to dams , water supply and sewage disposal.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			H		L					
	CO2					H	H						
	CO3							H	L				
	CO4									L			
	CO5										H	L	
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CIVIL ENGINEERING MATERIALS 8

Introduction – Civil Engineering – Materials – Stones – Bricks – Sand – Cement – Plain Concrete – Reinforced Cement Concrete – Steel Sections – Timber – Plywood – Paints – Varnishes (simple examples only)

UNIT II SURVEYING 5

Surveying – objectives – classification – principles of survey-Measurement of distances – Chain survey – Determination of areas – Use of compass – Use of leveling Instrument – (simple examples only)

UNIT III FOUNDATION FOR BUILDING 5

Bearing Capacity of Soil – Foundation – Functions – Requirement of good foundations – Types of foundations – Merits & Demerits.

UNIT IV SUPERSTRUCTURE 7

Stone Masonry – Brick Masonry – Columns – Lintels – Beams – Roofing – Flooring – Plastering– White Washing (Simple examples only)

UNIT V MISCELLANEOUS TOPICS 5

Types of Bridges –Dam- purpose – selection of site - Types of Dams – Water Treatment & Supply sources – standards of drinking- distribution system. – Sewage Treatment (simple examples only)

TEXT BOOKS:

1. Raju.K.V.B, Ravichandran .P.T, "Basics of Civil Engineering", Ayyappa Publications, Chennai, 2012.
2. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, (1st ed. 2005).
3. Dr.M.S.Palanisamy, "Basic Civil Engineering" (3rded. 2000), TUG Publishers, New Delhi/Tata McGrawHill Publication Co., New Delhi

REFERENCE BOOKS:

1. Rangwala.S.C, "Engineering Materials", Charotar Publishing House, Anand, 41st Edition: 2014.
2. National Building Code of India, Part V, "Building Materials", 2005
3. Ramesh Babu"A Textbook on Basic Civil Engineering" (1998). Anuradha Agencies, Kumbakonam.
4. RamamruthamS., "Basic Civil Engineering", DhanpatRai Publishing Co. (P) Ltd. (1999).

BCS2L1	INTERNET PRACTICES LABORATORY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Internet Programming				
	Course Designed by – Dept of Information Technology				

OBJECTIVES

- To impart a sound knowledge on the principles of computers involving the different application oriented topics required for all engineering branches.
- Graduates will demonstrate the ability to apply knowledge of mathematics to develop and analyze computing systems.
- Graduates will have a solid understanding of the theory and concepts underlying con science.

COURSE OUTCOMES (COs)

CO1	To enable the student to learn the major components of a computer system.
CO2	To know the correct and efficient way of solving problem.
CO3	To identify and implement the correct and efficient way of solving problem.
CO4	To learn to use office automation tools.
CO5	To infer from use office automation tools.
CO6	To learn and write program in "C".

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M		M			L	L	M
	CO2	H	M	M	H	H		M			L	L	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H		M			L	L	M
	CO5	H	M	M	H	H		M			L	L	M
	CO6	H			H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. HTML (Hypertext Mark-up Language):

Basics of HTML.
How to create HTML Document
Steps for creating a simple HTML Program.

a) Favorite Personality
b) Resume Preparation

2. ADVANCED HTML: Advanced Topics of HTML

a) Time Table

b) Table Creation

3. JAVASCRIPT:

Script Basics.

Incorporating JavaScript into Web page.

a) Star Triangle

b) Temperature Converters

Script Basics.

Incorporating JavaScript into Web page.

a) Star Triangle

b) Temperature Converters

4. VBSCRIPT:

VBScript Basics.

Incorporating VBScript into HTML.

a) Changing Background Color

b) Simple Calculator

5. WEB DESIGN:

Inserting External Media in the Web Page.

a) Forms and Links

b) Frames with Links and Lists

To export a Dream weaver Document as XML File, checking entries, working in frames, windows control, the java script URL.

BCM1L1	**BASIC CIVIL & MECHANICALENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Department of Mechanical Engineering& Civil Engineering				

OBJECTIVES

To provide exposure to the students with hands on experience on various basic Civil & Mechanical Engineering practices.

COURSE OUTCOMES (COs)

CO1	Learn Basic concepts
CO2	Students will get exposure regarding pipe connection for pumps & turbines and to study the joint used in roofs, doors, windows and furniture's.
CO3	Students will get exposure regarding smithy, foundry operations and in latest welding operations such as TIG, MIG, CO2, spot welding etc.,
CO4	Students will get hands on experience on basic welding techniques, machining and sheet metal works.
CO5	Students will get hands on experience on basic machining techniques
CO6	Students will get hands on experience on basic sheet metal techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H	L										
	CO2				H								
	CO3					H	L	L					
	CO4		H				M		L			H	

	CO5		H				M		L			H	
	CO6		H				M		L			H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS

I. CIVILENGINEERINGPRACTICE

Buildings:

a) Studyofplumbingandcarpentrycomponentsofresidentialandindustrial-buildings.Safetyaspects.

PlumbingWorks:

a) Studyofpipe-linejoints,itslocationandfunctions:valves,taps,couplings,unions,reducers,elbowsin householdfittings.

b) Studyofpipeconnectionsrequirementsforpumpsandturbines.

c) Preparationofplumbinglinesketchesforwatersupplyandsewageworks.

d) Hands-on-exercise:Basicpipeconnection ofPVCpipes&G.I.Pipes–Mixedpipematerialconnection–Pipe connectionswithdifferentjoiningcomponents.

e) Demonstrationofplumbingrequirementsofhigh-risebuildings.

CarpentryusingHandtoolsandPowertools:

a) Studyofthejointsinroofs,doors,windowsandfurniture.

b) Hands-on-exercise:Woodwork,jointsbysawing,planningandcutting.

c) Preparationofhalfjoints,MortiseandTenonjoints.

II MECHANICALENGINEERINGPRACTICE

Welding:

a) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

BasicMachining:

a) Simple Turning and Taper turning

b) Drilling Practice

SheetMetalWork:

a) Forming&Bending:

b) Modelmaking–Trays,funnels, etc.

c) Differenttypeofjoints

d) Preparationofair-conditioningducts

e) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

Machineassemblypractice:

a) Assembling,dismantlingand Studyofcentrifugalpump

b) Assembling,dismantlingand Studyofairconditioner

c) Assembling,dismantlingandStudyoflathe

Moulding:

a) Mouldingoperationslikemouldpreparationfor gearandstepconepulleyetc

Fitting:

a) FittingExercises–Preparationofsquarefittingandvee–fittingmodels.

Demonstration:

a) Smithyoperations,upsetting,swaging,settingdownandbending.Example–Exercise–Productionofhexagonalheaded bolt.

b) Gaswelding.

REFERENCES:

1. K. Jeyachandran, S. Nararajan& S, Balasubramanian, "A Primer on Engineering Practices Laboratory" ,Anuradha Publications, (2007).
2. T.Jeyapoovan, M. Saravanapandian& S. Pranitha, "Engineering Practices LabManual",Vikas Publishing House Pvt. Ltd. (2006)
3. H. S. Bawa, "Workshop Practice",Tata McGraw–Hill Publishing Company Limited,(2007).
4. A. Rajendra Prasad & P. M. M. S Sarma, "Workshop Practice", SreeSai Publication, (2002).
5. P. Kannaiah& K.L. Narayana, "Manual on Workshop Practice", Scitech Publication, (1999).

BPC 2L1	**PHYSICS AND CHEMISTRY LABORATORY**									**L**	**T**	**P**	**C**
	Total Contact Hours – 45									0	0	3	1
	Prerequisite – Physics and Chemistry												
	Course Designed by – Department of Physics & Chemistry												
OBJECTIVES: To impart knowledge to the students in practical physics and chemistry													
COURSE OUTCOMES (COs)													
CO1	Students will understand the concept of hall effect												
CO2	Students will understand the concept of semiconductors. .												
CO3	Student will understand the working of spectrometer.												
CO4	Student will able practically understand the chemical reactions.												
CO5	Students will Study the magnetic hysteresis and energy product												
CO6	Students understand the Determination of Band gap of a semiconductor												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)

			√						
4	Approv-al	37th Meeting of Academic Council, May 2015							

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BMA301	**MATHEMATICS - III**	**L**	**T**	**P**	**C**
	Total Contact Hours-75	**3**	**2**	**0**	**4**
	Prerequisite – Maths I & II				
	Course Designed by – Department of Mathematics				
OBJECTIVES					
To equip students with adequate knowledge of Mathematics to formulate problems in Engineering, and solve them analytically					
COURSE OUTCOMES (COs)					
CO1	Solve PDE of second and higher order with constant coefficients.				

CO2	Expand given functions by using the concept of Fourier series.
CO3	Solve many of the Engineering models of Heat equations and Wave equations which are PDEs with boundary conditions.
CO4	Solve many problems in Automobile, Medicine, and Electronic Engineering which are differential equations of linear or non-linear.
CO5	Solve differential equations by Laplace transforms

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					M				L		
	CO2	M		H					L			M	
	CO3	M			H								
	CO4	M						M			H		L
	CO5		L										

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Core Elective (CE)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective(OE)	Project/Term Paper/ Seminar/ Internship (PR)
			X						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+6

Formation - Solutions of standard types of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 9+6

Dirichlet's conditions - General Fourier series - Half-range Sine and Cosine series - Parseval's identity - Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9+6

Classification of second order linear partial differential equations - Solutions of one - dimensional wave equation, one-dimensional heat equation - Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates.

UNIT IV LAPLACE TRANSFORMS 9+6

Transforms of simple functions - Basic operational properties - Transforms of derivatives and integrals - Initial and final value theorems - Inverse transforms - Convolution theorem - Periodic functions - Applications of Laplace transforms for solving linear ordinary differential

equations upto second order with constant coefficients and simultaneous equations of first order with constant coefficients.

UNIT V FOURIER TRANSFORMS 9+6

Statement of Fourier integral theorem - Fourier transform pairs - Fourier Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

TEXT BOOKS:

1. Kreyszig, E."Advanced Engineering Mathematics" 8th Edition, John Wiley and Sons, (Asia) Pvt., Ltd, Singapore, 2000.[Units I, II, & V]
2. Monty J.Strauss, Gerald L.Bradley, and Karl L.Smith. "Calculus" 3rd Edn.[Prentice Hall] University Bookstore, New Delhi. [Units III & IV]

REFERENCES:

1. Narayanan, S.Manicavachangam Pillay, T.K.Ramanaiah, G."Advanced Mathematics for Engineering Students", Volume2 and 3(2nd Edition), S.Viswanathan (Printers &Publishers Pvt, Ltd.,) 1992.
2. Venkataraman, M.K "Engineering Mathematics" Volumes3-A&B, 13th Edition National Publishing Company, Chennai, 1998.
3. Grewal, B.S.,"Higher Engineering Mathematics" (35thEdition), Khanna Publishers, Delhi, 2000.
4. George B. Thomas and Ross L.Finney. "Calculus and Analytical Geometry" 9th Edn. Narosa Indian Student Edition, New Delhi.
5. Dennis G.Zill and Warren S.Wright. "Advanced Engineering Mathematics". 3rd Edn. Jones & Bartlett Publishers, UK. 1992.

BEE301	**CIRCUIT THEORY**	**L**	**T**	**P**	**C**
	Total Contact Hours-60	4	0	0	4
	Prerequisite – Basic Electrical & Electronics Engg				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To develop problem solving skills and understanding of circuit theory through the application of techniques and principles of electrical circuit analysis to common circuit problems.

COURSE OUTCOMES (COs)

CO1	To develop an understanding of the fundamental laws and elements of electric circuits.
CO2	To develop the ability to apply circuit analysis to DC and AC circuits
CO3	To understand advanced mathematical methods such as Laplace and Fourier transforms along with linear algebra and differential equations techniques for solving circuits problem
CO4	To learn the "alphabet" of circuits, including wires, resistors, capacitors, inductors, voltage and current sources, and operational amplifiers.
CO5	Introduce students to different methods involves in analysis both linear and non-linear networks;

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	H	H	L	M	L			H	M	M
	CO2	M	H	H	M	M	H	M	M		L	M	M
	CO3	H	M		H	H		M			L	L	M
	CO4	H	M		H	H	L	M	M		L	M	M
	CO5	M	M	M	M	H		M			L	L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)	
							X						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I BASIC CIRCUIT CONCEPTS 12

Circuit elements – Kirchhoff's Law – V-I Relationship of R,L and C – Independent Sources – Dependent sources – Simple Resistive circuits – Networks reduction – Voltage division – current source transformation.- Analysis of circuit using mesh current and nodal voltage methods.

UNIT II SINUSOIDAL STEADY STATE ANALYSIS 12

Phasor – Sinusoidal steady state response concepts of impedance and admittance – Analysis of simple circuits – Power and power factors — Solution of three phase balanced circuits and three phase unbalanced circuits –-Power measurement in three phase circuits.9+

UNIT III NETWORK THEOREMS (BOTH AC AND DC CIRCUITS) 12

Superposition theorem – The venin's theorem - Norton's theorem-Reciprocity theorem- Maximum power transfer theorem.

UNIT IV TRANSIENT RESPONSE FOR DC CIRCUITS 12

Transient response of RL, RC and RLC Circuits using Laplace transform for DC input with sinusoidal input.

UNIT V RESONANCE AND COUPLED CIRCUITS 12

Series and parallel resonance – their frequency response – Quality factor and Bandwidth - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits.

TEXT BOOKS:

1. Sudhaker A. and Shyam Mohan S.P, "Circuits and Network Analysis and Synthesis" Tata McGrew Hill Co. Ltd., New Delhi, 1994.

2. Hyatt W.H. and Kemmerlay J.E. „Engineering Circuits Analysis“, McGrew Hill International Editions,1993.

REFRENCE BOOKS:

1. Edminister J.A. “Theory and Problems of Electric Circuits “Schaum’s outline series, McGrew hill Book Company 2nd edition, 1983.
2. http://nptel.ac.in/courses/108102042/

BEE302	ELECTRICAL MACHINES–I	L	T	P	C
	TotalContactHours-45	3	0	0	3
	Pre requisite -Basic Electrical Engineering				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

Objective

To give the students a fair knowledge on the working of various DC machines & Transformers

COURSE OUTCOMES (COs)

CO1	To familiarize the constructional details, the principle of operation, prediction of performance, the methods of testing the transformers and three phase transformer connections.
CO2.	To introduce the principles of electromechanical energy conversion in singly and multiply excited systems.
CO3.	To study the working principles of electrical machines using the concepts of electromechanical energy conversion principles and derive expressions for generated voltage and torque developed in all Electrical Machines.
CO4.	To study the working principles of DC machines as Generator and Motor, types, determination of their no-load/load characteristics, starting and methods of speed control of motors.
CO5.	To estimate the various losses taking place in D.C. machines and to study the different testing methods to arrive at their performance.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	L	H	M	M	L	L	L	L	L
	CO2	H	H	L	L	M	M	M	L	L	L	L	L
	CO3	H	H	L	L	H	M	M	L	L	L	L	L
	CO4	H	H	L	L	H	M	M	L	L	L	L	L
	CO5	H	H	L	L	H	M	M	L	L	L	L	L

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ELECTRO MAGNETIC INDUCTION & BASIC CONCEPTS IN ROTATING MACHINES 9

Introduction to magnetic circuits – Magnetically induced EMF and force – AC operation of magnetic circuits –. Energy in magnetic systems – Field energy & mechanical force – Single and Multiple excited systems. MMF of distributed windings – Magnetic fields in rotating machines – Generated voltages – Torque.

UNIT II DC GENERATORS 9

Constructional features of DC machine – Principle of operation of DC generator – EMF equation – Types of excitation – No load and load characteristics of DC generators – commutation – armature reaction – Parallel operation of DC generators.

UNIT III DC MOTORS 9

Principle of operation of DC motors-Back EMF – Torque equation –Types of DC motors-Speed – Torque characteristics of DC motors – Starting of DC motors: 2 point starter, 3 point starter, 4 point starter – Speed control: Field control, Armature control, voltage control, Thyristor control – Losses and efficiency – Applications

UNIT IV TRANSFORMERS 9

Principle of operation – Constructional features of single phase and three phase transformers – EMF equation – Transformer on No load and Load –Phasor diagram --equivalent circuit – Regulation - three phase transformer connections- parallel operation of single phase and three phase transformer- Auto transformers

UNIT V TESTING OF DC MACHINES& TRANSFORMERS 9

Losses and efficiency –Condition for maximum efficiency – Testing of DC machines: Brake test, Swinburne's test, Retardation test, Hopkinson's test- Testing of transformer: polarity test, load test, open circuit and short circuit test, Sumpner's test – All day efficiency.

TEXT BOOKS

1. Kothari.D.P and Nagrath.I.J., "Electrical Machines", Tata McGraw Hill Publishing Co.Ltd, New Delhi, 5th edition 2002.
2. Bimbhra.P.S, Electrical Machinery, Khanna Publishers, IL
3. Stephen L. Herman"Electrical transformers and rotating machines " Prentice Hall of India. 1st edition 2012.

4. Theraja B.L. “Electrical Technology: Volume II. S. Chand and Co., New Delhi – 2012.

REFERENCES

1. Dr. Murugesh Kumar.K. “DC Machines & Transformers”, Vikas Publishing House PvtLtd.,2nd edition 2003.
2. Fitgerald, A.E., Charles Kingsely Jr. Stephen D.Umans, “Electric Machinery” McGraw Hill Books Company, 6 th edition 2002.
3. Hill Stephen, Chapman.J, “Electric Machinery Fundamentals”, McGraw Hill Book Co., New Delhi, 4th edition 2005.
4. Albert E Clayton and Hancock.N.N, “The performance and design of direct current Machines”, Oxford and IBH publishing company Pvt. Ltd., New Delhi 1990.
5. http://nptel.ac.in/courses/108105017/

BEE303	**ELECTRON DEVICES**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite-NIL				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

Gain basic knowledge about low power semiconductor devices and its function.

COURSE OUTCOMES (COs)

CO1	To acquaint the students with construction, theory and characteristics of the p-n junction diode
CO2	Familiarize with the structure of basic electronic devices.
CO3	To acquaint the students with construction, theory and characteristics of the Field effect transistor
CO4	To acquaint the students with construction, theory and characteristics of the Power control / regulator devices
CO5	To acquaint the students with construction, theory and characteristics of the LED, LCD and other photo electronic devices

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M									L		
	CO2			H	L	H	M	H	M	H	L		
	CO3		L									H	
	CO4	M				M			H	H			L
	CO5		L		M								

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core(PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval		37th Meeting of Academic Council, May 2015						

UNIT I ELECTRON DEVICES 9

Concept of electronic current in vacuum, gas and solid – Effect of electric and magnetic field on electron and other charged particles – Cathode ray tube – Electrostatic and magnetic deflection.

UNIT II SOLID STATE ELECTRONICS 9

Review of energy band structure of Ge, Si and GaAs –electron, hole generation and recombination – drift and diffusion currents – Continuity equation – Hall effect – PN junction – current equation – junction capacitance – breakdown characteristics – varactor, tunnel, fast recovery, scottkly and zener diodes.

UNIT III BIPOLAR JUNCTION TRANSISTOR 9

Ebers-Moll equation – Input / Output characteristics – Switching characteristics – 'h' parameters – low Frequency equivalent circuits – RF transistors – Power transistors.

UNIT IV FET, UJT AND SCR 9

Theory and characteristics of JFET and MOSFET – low frequency and high frequency equivalent circuits – theory and characteristics of UJT, SCR and TRIAC.

UNIT V CCD AND OPTOELECTRONIC DEVICES 9

Charge transfers and charge coupled devices – Theory and applications – semiconductor optoelectronic devices – LED, LASER diode, LCD, Photo diode, solar cell.

TEXT BOOKS:

1. Setha,''Applied Electronics",S.Chand,2006.
2. Malvino, "Electronic Principle", Tata McGrew-Hill. 2008.

REFERENCES

1. Sze, SM, "Physics of Semiconductor Devices", Wiley Eastem, 1981.
2. Boylestad and Nashelsky, "electronic Devices and Circuit Theory", PHI 6th Edition, 1999.
3. Mothersheed, "Electronic Devices and Circuits", Prentice Hall of India 1999.
4. Streetman, B, "Solid State Electronics Devices", Prentice Hall of India, 4th Edition. 1995.
5. John D. Ryder, "Electronic Fundamentals And Applications, Integrated and Discrete System", 5thEdition , Prentice Hall of India, 1999.
6. David Newman, "Semiconductor Physics and Devices – Basic Principles, Tata McGrew-Hill. 1999.
7. http://nptel.ac.in/courses/108106075/

BEE304	ELECTROMAGNETIC THEORY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engg Mathematics-I, Engg Physics -I, Engg Physics-II ,Basic Electrical Engineering				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

The purpose of this course is to enable the students to have a sound knowledge about the theory and problems in Electromagnetic Fields.

COURSE OUTCOMES (COs)

CO1	Apply vector calculus to understand the behavior of static electric fields in standard configurations.
CO2	To lay the foundations of electromagnetism and to understand the concepts of Electrostatics and their applications.
CO3	To understand the concepts of Magneto statics and their applications.
CO4	Apply the concepts of induction to evaluate inductance and applications.
CO5	To understand the concept of Electromagnetic Fields, waves and wave propagation.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/ POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M							M			M
	CO2	H	H							M			M
	CO3	H	H							M			M
	CO4	H	H							M			M
	CO5	H	H							M			M
	CO6	H	H							M			M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Core Elective (CE)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar / Internship (PR)
					√				
4	Approval		37th Meeting of Academic Council, May 2015						

UNITI ELECTROSTATICS 9

The field concept – sources of electromagnetic fields – Co-ordinate Systems– Coulomb's law – electric field intensity – electric field due to point charge, line charge, surface charge and volume charge distribution – electric flux density – Gauss's law – electric potential – potential gradient – divergence theorem – Poisson's and Laplace equations.

UNIT IIELECTROSTATICSAPPLICATIONS 9

Conductor and dielectrics – field due to dipole – moment – boundary conditions and conductor surfaces – capacitor – capacitance of system of conductors – energy density and pressure in electric fields – force between charges – charge in motion – conduction current – displacement.

UNIT IIIMAGNETOSTATICS 9

Force on a current element – Biot Savart's law – force between current carrying conductors– Ampere's law – magnetic potential – boundary conditions at the magnetic surfaces – examples

UNITIV MAGNETOSTATICS APPLICATIONS 9

Faraday's law of electromagnetic induction – induction of solenoids, toroids, transmission lines and cable – Mutual inductance of series and parallel circuits – energy stored in magnetic fields – electromagnets – forces and torques on closed circuits – magnetic circuits – examples.

UNIT V ELECTROMAGNETIC FIELDS AND WAVE PROPAGATION9

Modified amperes circuital law – maxwell's equation in point and integral forms – wave equation – plane waves in free space – polarization – reflection and transmission of waves – pointing theorems and slepain vector – energy in electromagnetic fields.

TEXT BOOKS

1. K.A.Gangadhar, "Field Theory" – Khanna Publishers, New Delhi. 1997
2. William Hayt, "Engineering Electromagnetics" – McGraw Hill, New York 1996

REFERENCES

1. S. Selly, "Introduction to electromagnetic fields" – McGraw Hill, 1958
2. http://nptel.ac.in/downloads/115101005/

BEE306	**DIGITAL ELECTRONICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite: Basic Electronics Engineering, Electron Devices				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To develop a strong foundation in the field of Digital Electronics. The subject gives the students an in depth knowledge about Digital logic families, Combinational circuits and enable them to analyze and design any sequential circuits. Also this subject gives knowledge about various memory devices &VHDL

COURSE OUTCOMES (COs)

CO1	To study various number systems , simplify the logical expressions using Boolean functions
CO2	To study implementation of combinational circuits
CO3	To design various synchronous and asynchronous circuits
CO4	To introduce asynchronous sequential circuits and PLCs
CO5	To introduce digital simulation for development of application oriented logic circuits

Mapping of Course Outcomes with Program outcomes (POs)

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M		H	L	L	M
	CO2	H	M	M	H	H		M		H	L	L	M
	CO3	H	M		H	H		M		H	L	L	M
	CO4	H	M		H	H		M		H	L	L	M
	CO5	H	M	M	H	H		M		H	L	L	M
3	Category	Humanities& Social Studies (HS)	Basic Sciences & Maths(BS)	Engg Sciences(ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective(OE)	Project/ Term Paper Seminar/ Internship (PR)				
					√								
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I NUMBER SYSTEMS AND DIGITAL LOGIC FAMILIES 9

Review of number systems, binary codes, error detection and correction codes (Parity and Hamming code- Digital Logic Families, comparison of RTL, DTL, TTL, ECL and MOS families -operation, characteristics of digital logic family.

UNIT II COMBINATIONAL CIRCUITS 9

Combinational logic - representation of logic functions-SOP and POS forms, K-map representation minimization using K maps - simplification and implementation of combinational logic – multiplexers and demultiplexers - code converters, adders, subtractors.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Sequential logic- SR, JK, D and T flip flops - level triggering and edge triggering - counters - asynchronous and synchronous type - Modulo counters - Shift registers - design of synchronous sequential circuits – Moore and Melay models- Counters, state diagram; state reduction; state assignment.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS AND PROGRAMMABLELOGIC DEVICES 9

Asynchronous sequential logic circuits-Transition table, flow table-race conditions, hazards &errors in digital circuits; analysis of asynchronous sequential logic circuits-introduction to Programmable Logic Devices: PROM – PLA –PAL.

UNIT V VHDL 9

RTL Design – combinational logic – Sequential circuit – Operators – Introduction to Packages –Subprograms – Test bench. (Simulation /Tutorial Examples: adders, counters, flipflops, FSM, Multiplexers / Demultiplexers).

TEXT BOOKS:

1. Raj Kamal, ‘ Digital systems-Principles and Design’, Pearson Education 2nd edition, 2007.
2. M. Morris Mano, ‘Digital Design with an introduction to the VHDL’, Pearson Education,

2013.
3. Comer "Digital Logic & State Machine Design, Oxford, 2012.

REFERENCES:

1. Mandal "Digital Electronics Principles & Application, McGraw Hill,2nd edition,2013.
2. Floyd and Jain, 'Digital Fundamentals', Pearson Education, 8th edition, 2003.
3. Anand Kumar, "Fundamentals of Digital Circuits, PHI, 2nd edition ,2013.
4. Charles H.Roth,Jr,Lizy Lizy Kurian John, 'Digital System Design using VHDL, Cengage, 2nd edition,2013.
5. John M.Yarbrough, 'Digital Logic, Application & Design', Thomson, 3rd edition 2002.
6. Gaganpreet Kaur, VHDL Basics to Programming, Pearson, 1 st edition2013.
7. http://nptel.ac.in/courses/117106086/1

BEE3L6	**PROGRAMMING LANGUAGE(C and C++) LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite- Fundamentals of computing and programming, Programming Language.				
	Course designed by -Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To master the high level fundamental programming techniques in C language and C++. This will help you to write, debug and analyze the programs in C and C++.

COURSE OUTCOMES (COs)

CO1	Understand the basic terminology used in high level programming.
CO2	To learn all fundamental programming techniques in C language and C++.
CO3	To use different data types in a computer program.
CO4	To design programs involving decision structures, loops, functions and other aspects
CO5	To understand the difference between procedural oriented programming and object oriented programming.
CO6	To Gain knowledge in designing and troubleshooting various programming applications using C and C++

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/ POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M	H		L	L	M
	CO2	H	L	M	L	H	H	M			M	H	H
	CO3	H	L	H	L	H	L	H	H	H	M	H	H
	CO4	H	M	H	L	M	L	H	H	H	M	M	
	CO5	H	H	M	H	M	M	M	M	L	H	L	M
	CO6	L	L		H	H		M	L		L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths(BS)	Engg Sciences(ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elec-tive(NE)	Open Elective(OE)	Project/ Term Paper Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Manipulation of Matrices in C language: Inverse, Trace, Determinants ,Transpose and Multiplication of multi dimensional matrices
2. Manipulation of Strings in C language: Word searching, Concatenation of strings, Sorting of strings using Pointers, Upper case to Lower case conversion and vice versa
3. Manipulation of Linked Lists in C language: Adding, inserting, deleting, finding the element and displaying the elements of linked lists.
4. Manipulation of Structures in C language: Creation and Processing of Employee records in a firm consisting of Name, Date of Birth, Age, Gender, Address, Qualification, Designation and Salary
5. File Processing in C language: Concatenation of two files and Merging of two files into a third file.
6. Implementation of Class in C++: array with class, data swapping and nesting of member functions.
7. Implementation of Constructors and Destructors in C++: Dynamic initialization, Copy Constructors, Dynamic Constructors and Destructors.
8. Programming exercises on Operator overloading in C++: Unary and Binary overloading and overloading using Friend functions.
9. Programming exercises on Inheritances in C++: Single, Multiple, Multilevel and Hybrid Inheritances in C++
10. Programming exercises on Polymorphism: array of pointers, pointers to functions, pointers to objects and run time polymorphism in C++
11. Implementation of Class templates in C++: Multiple parameters and generic data types.
12. Implementation of Function templates in C++: Multiple parameters, generic data types and Bubble sort implementation.

TEXT BOOKS

1. Byron Gottfried, "Programming with C", 2nd edition, (Indian Adapted Edition), TMH publication-2006
2. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in 'C'"-First Edition, Oxford University Press-2009
3. Bjarne Stroustrop, "The C++ Programming Language" ,4th Edition,,Addison-Wesley Publishing Company-2013

REFERENCE BOOKS

1. Yashavant P. Kanetkar, "Let us C",13th Edition,BPB Publications- 2013.
2. Yashavant P. Kanetkar,"Let us C++"10th Edition, BPB Publications -2013.
3. http://www.tutorialspoint.com/cprogramming/

BEE3L2	**ELECTRICAL MACHINES LABORATORY – I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	PREREQUISTIE-Basic Electrical and Electronics Engineering Practices Laboratory				
	Course designed by -Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To expose the students to the operation of D.C. machines and transformers and give them Experimental skill.

COURSE OUTCOMES (COs)

1.	To rig up circuits for testing a given machine.
2.	To obtain the performance characteristics of machines

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	L	H	M	M	L	L	L	L	L
	CO2	H	H	L	L	M	M	M	L	L	L	L	L

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Open Circuit characteristics of DC shunt generator
2. Load characteristics of separately excited generator
3. Load characteristics of DC shunt generator
4. Load characteristics of DC shunt generator
5. Speed control of DC shunt motor
6. Swinburne's test
7. Hopkinson's test
8. Load test on single phase transformer
9. Open Circuit and short circuit test on single phase transformer
10. Sumpener's test
11. Parallel operation of single phase transformers
12. Three phase transformer connections, scott connections.
13. Field's test on DC series motor
14. Separation of no load losses In a single phase transformer

15. Study of DC starters

REFERENCES

1. DEPARTMENT LABORATORY MANUAL

BEE3L5	**ELECTRON DEVICES LABORATORY**	**L**	**T**	**P**	**C**
	Total contact hours 45	0	0	3	2
	Prerequisite- Basic Electronics Engineering				
	Course designed by -Dept. of Electrical & Electronics Engineering				

OBJECTIVES

This laboratory course will give a thorough knowledge about the basics of circuit analysis.

COURSE OUTCOME

1.	To provide practical experience with electrical circuits and verifying circuit theorems.
2.	To enable the students to understand the behavior of semiconductor device based on experimentation

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	L	H	M	M	L	L	L	L	L
	CO2	H	H	L	L	M	M	M	L	L	L	L	L

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Vérification of superposition theorem
2. Vérification of reciprocity theorem
3. Verification of the Thevinin's and Norton's theorem
4. Verification of Maximum power transfer theorem
5. Power Measurement by three Ammeter and three voltmeter method
6. Power measurement by two wattmeter method
7. Characteristics of Semiconductor diode and Zener diode
8. Characteristics of a NPN Transistor under common emitter , common collector and common base configurations
9. Characteristics of JFET(Draw the equivalent circuit)

10. Characteristics of UJT and generation of saw tooth waveforms
11. Study of CRO
12. Phase Angle Measurement using CRO

REFERENCES

1. DEPARTMENT LABORATORY MANUAL

BMA 401	**APPLIED PROBABILITY AND STATISTICS**	**L**	**T**	**P**	**C**
	Total Contact Hours-75	3	2	0	4
	Prerequisite –Mathematics-II				
	Course Designed by – Dept. of Mathematics				

OBJECTIVES

To impart knowledge about important concepts of Probability and Reliability, tools in SQC to solve problems in Electrical & Electronics Engineering.

COURSE OUTCOMES (COs)

CO1	Solve Engineering problems in Electrical & Electronic Engineering by making use of Probability, Reliability and Hazard functions.
CO2	Use control charts to find tolerance limits in electric circuits.
CO3	How Design of Experiments are to be analysed.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	L	H	M	M	L	L	L	L	L
	CO2	H	H	L	L	M	M	M	L	L	L	L	L
	CO3	H	H	L	L	H	H	M	L	L	L	L	L

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/Seminar/Internship (PR)
			X						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PROBABILITY AND RANDOM VARIABLES 9+6

Probability concepts, Random variables, MGF, Binomial, Poisson, Geometric, Normal, Uniform, and Exponential Distributions.

UNITII TWO DIMENSIONAL RANDOM VARIABLES 9+6

Marginal and Conditional distributions, covariance, correlation, regression and transfor-

mation of random variables, application of central limit theorem.

UNIT III RELIABILITY ENGINEERING 9+6

Concepts of Reliability, Hazard function, series and parallel systems, reliability and availability of Markov systems, maintainability, preventive maintenance.

UNIT IV CONTROL CHARTS 9+6

Control charts for measurements and attributes- $\overline{X}$ Chart , R-Chart , np-chart, p-chart, Control Charts for fixed sample size and variable sample size. Stability and Capability, Seven Quality Control tools and its applications.

UNIT V DESIGN OF EXPERIMENTS 9+6

Completely Randomised Design, Randomised Block Design and Latin Square Design. Factorial Experiment- 2^2 Experiment.

TEXT BOOKS

1. S.C.Gupta andV.K.Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons, New Delhi ,2003. [Units I & II]
2. S.C. Gupta and V.K. Kapoor, "Applied Statistics". Sultan Chand and Sons, New Delhi 2004 [Units IV & V]
3. Tirupathi R.Chandrupatta. "Quality and Reliability in Engineering". Book Vistas, New Delhi. [Unit III]

REFERENCE BOOKS

1. Miller U and Frieund JE. "Probability and Statistics for Engineers", PHI 1999
2. Douglas C.Montgomory and George C.Runger. "Applied Statistics and Probability for Engineers" 5th Edn. 2010. Wiley India Pvt Ltd. New Delhi.
3. Douglas C.Montgomory. "Design and Analysis of Experiments" 7th Edn. 2012. Wiley India Pvt Ltd. New Delhi
4. Albert Leon Garcia, "Probability and Random Processes for Electrical Engineering". 2nd Edn. Pearson Education, Chennai-600 113

BEE401	**ELECTRICAL MACHINES-II**	**L**	**T**	**P**	**C**
	TotalContactHours-45	3	0	0	3
	Prerequisite- Electrical Machines-I				
	Course designed by –Dept. of Electrical & Electronics Engineering				
OBJECTIVES					
To give the students a fair knowledge on the working of various Ac machines and the characteristics					
COURSE OUTCOMES					
CO1.	To impart knowledge on Construction and performance of salient and non – salient type synchronous generators.				
CO2.	To impart knowledge on Principle of operation and performance of synchronous motor.				
CO3.	To impart knowledge on Construction, principle of operation and performance of induction machines.				

CO4.	To impart knowledge on Starting and speed control of three-phase induction motors.
CO5.	To impart knowledge on Construction, principle of operation and performance of single phase induction motors and special machines.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	L	L	H	M	M	L	L	L	L
	CO2	H	M	M	L	L	H	M	M	L	L	L	L
	CO3	H	M	M	L	L	H	M	M	L	L	L	L
	CO4	H	M	M	L	L	M	M	M	L	L	L	L
	CO5	H	M	M	L	L	L	M	M	L	L	L	L

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective(OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I SYNCHRONOUS GENERATOR 9

Constructional details – Types of rotors – emf equation – Synchronous reactance – Armature reaction – Voltage regulation – EMF, MMF, ZPF –Synchronizing and parallel operation – Synchronizing torque - Change of excitation and mechanical input – Two reaction theory – Determination of direct and quadrature axis synchronous reactance using slip test – Operating characteristics .

UNIT II SYNCHRONOUS MOTOR 9

Principle of operation – Torque equation – Operation on infinite bus bars - V-curves – Power input and power developed equations – Starting methods – Current loci for Constant power input, constant excitation and constant power developed.

UNIT III THREE PHASE INDUCTION MOTOR 9

Constructional details – Types of rotors – Principle of operation – Slip – Equivalent circuit – Slip-torque characteristics - Condition for maximum torque – Losses and efficiency – Load test - No load and blocked rotor tests -Separation of no load losses – Double cage rotors – Induction generator – Synchronous induction motor.

UNIT IV SINGLE PHASE INDUCTION MOTOR AND STARTING METHOD 9

Constructional details of single phase induction motor – Double revolving field theory and operation – Equivalent circuit – No load and blocked rotor test – Performance analysis – Starting methods of single-phase induction motors .Need for starting – Types of starters – Rotor resistance, Autotransformer and Star-delta starters – Speed control method

UNIT V FRACTIONAL HORSE POWER MOTOR 9

Shaded pole induction motor - Linear reluctance motor - Repulsion motor - Hysteresis motor - AC series motor-variable reluctance motor -permanent magnet stepper motor –hybrid stepper motor- permanent magnet D.C motor- permanent magnet A.C motor .

TEXT BOOKS

1.D.P. Kothari and I.J. Nagrath, 'Electric Machines', Tata McGraw Hill Publishing Company Ltd, 2002.

2. P.S. Bhimbra, 'Electrical Machinery', Khanna Publishers, 7th Edition, 2011.

3. B.R Gupta," Fundamentals of Electric Machines ". New Age International (P) Limited 3rd Edition 2005

REFERENCES

1. A.E. Fitzgerald, Charles Kingsley, Stephen.D.Umans, 'Electric Machinery', Tata McGraw Hill publishing Company Ltd, 2003.

2. J.B. Gupta, 'Theory and Performance of Electrical Machines', S.K.Kataria and Sons,2002.

3. K. Murugesh Kumar, 'Electric Machines', Vikas Publishing House Pvt Ltd, 2002.

BEE402	**ELECTRICAL NETWORK ANALYSIS & SYNTHESIS**	**L**	**T**	**P**	**C**
	Total Contact Hours-45	3	0	0	3
	Prerequisite - Knowledge In Basic Electrical Circuit Analysis & Circuit Theory				
	Course Designed by – Dept of Electrical & Electronics Engineering				

OBJECTIVES

The course provides a comprehensive knowledge to Maintain and improves their technical competence towards the control plant engineering.

COURSE OUTCOMES (COs)

CO1	To successfully understand the basics of Network Analysis & Synthesis theory.
CO2	To make the students learn how to synthesize an electrical network from a given impedance/admittance function.
CO3	Students will be able to analyze the various electrical and electronic networks using the techniques they learn.
CO4	Students will be able to construct a circuit to suit the need.
CO5	Able to analyze resonant circuits both in time and frequency domains.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	L	L	M		M			M	L	M
	CO2	H	H	L	L	M					L	L	
	CO3	H	M		H	H		M			L	L	
	CO4	H	M		H	H		M					
	CO5	H	M	M	H	H		M			L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences(ES)	Professional Core(Pc)	Core Elective (CE)	Non-Major Elective(NE)	Open Elective(OE)	Project/ Term Paper Seminar/ Internship (PR)
					X				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I NETWORK THEORY 9

Network graph, tree and cut sets – tie sets and cut sets schedules – Y shift and I shift – Primitive impedance and admittance matrices.

UNIT II LAPLACE AND FREQUENCY DOMAIN ANALYSIS 9

S Domain network, Driving and Transfer impedence and their properties – Transform network analysis – Poles and Zeros of network functions – Time response from pole zero plots- Frequency response of RLC network – Frequency response from pole zero plots.

UNIT III TWO PORT NETWORKS 9

Characterization of two port networks in term of Z, Y, H, T parameters and A, B, C, D parameters – Network equivalence – relation between network parameters – analysis of T ladder bridge – T and lattice networks – Transfer function of terminated two port networks.

UNITIV ELEMENTSOFNETWORKSSYNTHESIS 9

Reliability of one port network – Hurwitz polynomial and properties – Positive and Real function and properties – synthesis of RL, RC and LC networks.

UNIT V DESIGN OF FILTERS 9

Filters and attenuator – Design of constant K, M – derived and composite filters – qualitative treatment of a active filters – Butterworth and Chebyshev filters.

TEXT BOOKS:

1. Sudhakar and Shyammohan,"Network Analysis & Synthesis".
2. Paranjothi S.R. "Electrical Circuit Analysis", New Age International, 2nd Edition 1994.
3. Van Valkenberg M.E. "network Analysis" – Prentice Hall of India Pvt Ltd. Delhi, 3rd edition 1994.

REFERENCE BOOKS:

1. EuoF.F."Network Analysis and Synthesis" – Wiley international Edition, 2nd edition – 1996.
2. http://www.mathworks.com/access/helpdesk/help/toolbox/Network theory/

BCE406	ENVIRONMENTAL STUDIES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3

	Prerequisite – Physical Sciences
	Course Designed by – Dept of Civil Engineering

OBJECTIVES

1. To study the nature and facts about environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context
CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		M	L	M	M		L	L	M
	CO2		M	H		H	M	M	H	M	L	L	M
	CO3		M	H		H	M	M	H	M	L	L	M
	CO4			M		H	M	M	M				M
	CO5			M		M	M	M	M				

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths(BS)	Engg Sciences(ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					X				
4	Approval	37th Meeting of Academic Council, May 2015 38th Meeting of Academic Council, January 2016.							

UNIT I THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES9

Definition, scope and importance, Need for public awareness.

Natural Resources : Renewable And Non – Renewable Resources

Natural resources and associated problems

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.
c) Mineral resources : Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing , effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.
f) Land resources : Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 8

Concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-

Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III BIODIVERSITY AND ITS CONSERVATION 7

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a megadiversity nation, Hot-spots of biodiversity -Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution 7

Definition, Causes, effects and control measures of ;- Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management : floods earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8

From Unsustainable to Sustainable development, Urban problems related to energy, nuclear accident and holocaust, case studies, wasteland reclamation, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection Act, Forest Conservation Act, Issues involved in enforcement of environmental Legislation, public awareness –

Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel – oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes – Noise produced by

fire crackers – Noise pollution – Noise level standards for fire crackers – Intensity of sound – Impact on hearing – Safety measures.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations, population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXTBOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, 1989.
4. Benny Joseph, "Environmental Studies"., TATA McGraw Hill, 2010

REFERENCES

1. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, EnviroMedia 2009
2. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
4. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno Science Publications 2013
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB),2001.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
8. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
9. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publish Co. Pvt. Ltd. 345p.
12. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut.
13. http://eng.mft.info/uploadedfiles/gfiles/c8e31c9e52d84c3.pdf

BEE403	**LINEAR INTEGRATED CIRCUITS**	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –nil				
	Course Designed by – Dept of Electrical & Electronics Engineering				

OBJECTIVES	
Ability to understand and analyze linear and digital electronic circuits.	
COURSE OUTCOMES (COs)	
CO1	To study the IC fabrication procedure.
CO2	To study characteristics; realize circuits; design for signal analysis using Op-amp ICs.

CO3	To study the applications of Op-amp.
CO4	To study internal functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits, ADCs.
CO5	To understand the applications of special function IC's

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	H		M	H	H	L	L	M
	CO2	H	M	M	H	H		M	H	H	L	L	M
	CO3	H	M		H	H		M	H	H	L	L	M
	CO4	H	M		H	H		M	H	H	L	L	M
	CO5	H	M	M	H	H		M	H	H	L	L	M

3	Category	Humanities& Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INTEGRATED CIRCUITS 9

Classification, chip size and circuit complexity, basic information of Op-amp, differential op-amp, ideal and practical Op-amp, Op-amp characteristics, DC and AC characteristics, 741 op-amp and its features, modes of operation-inverting, non-inverting, Slew rate- Methods of improving slew rate.

UNIT II OP-AMP APPLICATIONS 9

Basic application of Op-amp, instrumentation amplifier, V to I and I to V converters, Differentiators and Integrators, Comparators, Schmitt trigger, Multivibrators , Log and antilog amplifiers ,Non-Linear Function Generator, Triangle Wave Generator.

UNIT III TIMERS & PHASE LOCKED LOOPS 9

Introduction to 555 timer, functional diagram, monostable and astable operations and applications, Voltage Controlled Oscillator, PLL - introduction, block schematic, Principles and description of individual blocks of 565- Applications.

UNIT IV D-A AND A- D CONVERTERS 9

Introduction ,High speed sample and hold circuit , basic DAC techniques, weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, Different types of ADCs - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC. DAC and ADC specifications, voltage to time and voltage to frequency converters.

UNIT V SPECIAL FUNCTION ICS 9

Voltage regulators-linear and switched mode types, Frequency to voltage converters, Tuned amplifiers, Power amplifiers, Video amplifiers, Fiber optics ICs and optocouplers

TEXT BOOKS

1. D. Roy Chowdhury , "Linear Integrated Circuits" , New Age International (p) Ltd, 2nd edition,2003.
2. Ramakanth A. Gayakwad "Op-Amps & Linear ICs", PHI, 4th edition,1987.

REFERENCES:

1. R.F. Coughlin and Fredrick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits",PHI, 6th edition 1977.
2. David A. Bell, "Operational Amplifiers & Linear ICs", Oxford University Press, 2nd edition,2010.
3. Design with Operational Amplifiers and Analog Integrated Circuits - Sergio Franco, McGraw Hill,3rd edition,2002.
4.http://nptel.ac.in/video.php?subjectId=108106068

BME405	THERMAL ENGINEERING &FLUID MECHANICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite- Basic Mechanical Engineering				
	Course designed by- Dept. of Mechanical Engineering				

OBJECTIVES

To understand the concepts of Energy in general and Heat and Work in particular, to understand the fundamentals of quantification and grade of energy, to understand fluid statics and fluid dynamics and to study the applications of mass, momentum and energy equation in fluid flow.

COURSE OUTCOMES (COs)

CO1	To understand a thermodynamic system, closed and open systems, state, equilibrium, process, cycle and system properties, thermo dynamic laws and apply it to solve problems.
CO2	To study and analyze the efficiency of IC engines and compressor and to solve problems.
CO3	To understand the thermodynamics of refrigerators and heat pumps.
CO4	To study the fluid flow and the various theorems and concepts associated with that.
CO5	Ability to understand to identify, formulate, and to solve problems of dimensional analysis, pumps and turbines.

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	L		M		M		M			M		M
	CO2	L				H	H	M	M		M		H
	CO3	L	H			H	H	L	L		M		H
	CO4	M	H	L		H	H	L	M		M		H
	CO5	L	M	M		H		M			M	L	M

3	Category	Humanities& Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BASIC CONCEPTS AND LAWS OF THERMODYNAMICS 9

Systems zeroth law, first law of thermodynamics – concept of internal energy and enthalpy applications of closed and open systems, second law of thermodynamics – concept of entropy – clausius inequality and principle of increase in irreversible processes.

UNIT II IC ENGINE AND COMPRESSORS 9

Basic IC engine and gas turbine cycles, compressors – single stage Multi stage, reciprocating, vane gear, roots, compressor(constructional features and applications only).

UNIT III THERMODYNAMICS OF REFRIGERATORS AND PUMPS 9

Properties of steam – Rankine cycle – one dimensional flow through nozzles and applications to jet and rocket propulsions – basic thermodynamics of refrigerators and heat pumps.

UNIT IV BASIC CONCEPTS AND FLOW OF FLUIDS 9

Introduction – classification – types of fluids – properties – properties – law of pressure – manometer – mechanical gauges – types of fluid flow – continuity equation – energy equation – Beroulli's theorem – orifice and mouth piece.

UNIT V DIMENSIONAL AND MODEL ANALYSIS 9

Introduction – dimensional analysis – Rayleigh's method and Bukingham's method – similitude dimensionless numbers – model studies, pump turbines – type of pumps – reciprocating pumps – constructional details – coefficient of discharge – slip – power required – centrifugal pump – working principle – working principle.

TEXT BOOKS:

1. Nag P.K, "Engineering Thermodynamics", Tata McGraw Hill, Fourth Edition, 1993.
2. Kothandaraman C.P, "Thermal Engineering", Dhanpat Rai and Co, 2013
3. Kumar K.L. "Fluid Mechanics" Eurasia Publishers, 1990.
4. Rajput R.K., "Fluid Mechanics and Hydraulic Machines", S. Chand & Co. India, 1998.

REFERENCE BOOKS

1. Shames I.H. "Mechanics of Fluids", Kogakusha Publications. Tokyo 1998.
2. Reynolds, "Thermodynamics", McGraw Hill Publications, 1996

	TECHNICAL SEMINAR	**L**	**T**	**P**	**C**

BEE4S1	Total Contact Hours – 30	0	0	2	1
	PREREQUISTIE- Professional courses				
	Course designed by -Dept of Electrical & Electronics Engineering				

OBJECTIVE

- The purposeof technical seminar is to train the students in preparing and presenting technical topics.
- The students are expected to give a presentation on their topics of interest which will be assessed by a Faculty in charge, for this purpose during the current semester as per the academic regulations.
- It is an Opportunity to clarify, deepen the understanding in the subject,and alsoincrease confidence and presentation skills.
- The student shall be capable of identifying topics of interest related to the program of study and make presentation

BEE4L1	**ELECTRICAL MACHINES LABORATORY-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	PREREQUISTIE-Basic Electrical and Electronics Engineering Practices Laboratory				
	Course designed by -Dept. of Electrical & Electronics Engineering				

OBJECTIVE

To expose the students to the operation of synchronous machines and induction motors and give them experimental skill

COURSE OUTCOMES (COs)

1.	Understand the characteristics and performance of AC machines.
2.	Gain knowledge about speed control techniques of induction machines.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	L	H	M	M	L	L	L	L	L
	CO2	H	H	L	L	M	M	M	L	L	L	L	L

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS:

1. Regulation of alternator by EMP and MMF method
2. Regulation of alternator by potier ASA method
3. Regulation of salient pole alternator – slip test
4. Load test on alternator
5. Study of A.C. starters
6. V and inverted V curve of synchronous motor.
7. Brake test of three phase squirrel cage induction motor.
8. No load and blocked rotor tests on three phase induction motor and circle diagram and equivalent circuit
9. Load test on single phase induction motor.
10. Equivalent circuit and predetermination of performance of single phase induction motor.
11. Load test on three phase induction motor
12. Load test on three phase slip ring induction motor
13. Synchronizing and parallel operation by dark lamp, bright lamp and synchronoscope methods

REFERENCES

1. Departmental Lab Manual

BME4L3	**THERMAL ENGINEERING & FLUID MECHANICS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite- Basic Mechanical Engineering				
	Course designed by Dept. of Mechanical Engineering				

OBJECTIVES

To equip students with the knowledge of the initiation of combustion in Internal Combustion Engines, their classification, basic operating cycle and the functioning of various parts.

COURSE OUTCOMES (COs)

CO1	To apply theoretical concepts developed in course work of thermodynamics to hands-on experiments.
CO2	To apply theoretical concepts developed in course work of fluid mechanics to hands-on experiments.
CO3	To conduct thermodynamics experiments and analyze experimental data.
CO4	To understand the operation of all thermodynamic and fluid mechanic equipment's
CO5	To gain knowledge in designing and troubleshooting various problems in engines

Mapping of Course Outcomes with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1		S		M	S		M	H		S	S	M
	CO2				L	S	H	M				S	S
	CO3	S	L	S	S		L	S	H	H	M	H	S
	CO4	S	M	S	S		L	S	H	H	M	M	
	CO5	S	H	M	H	M	M	M	M	L	H	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Load test on a diesel engine
2. Performance test on a refrigerator
3. Performance test on a reciprocating pump and on a centrifugal pump
4. Performance test on a air – compressor, air pressure measure and regulation
5. Plain turning and taper turning operation on a lathe
6. Drilling and tapping on a radial drilling machine
7. Round to hexagon on a milling machine.

BEE4L2	**LINEAR & DIGITAL INTEGRATED CIRCUITS LABORATORY**	**L**	**T**	**P**	**C**
	Total contact hours 45	0	0	3	2
	Prerequisite- Basic Electronics Engineering				
	Course designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVE

- Analyze and design various applications of Op-Amp
- Design and construct waveform generation circuits
- Design timer and analog and digital circuits using op amps.
- To design combinational logic circuits using digital IC's

COURSE OUTCOME

CO1	Ability to design the techniques of DC power supply suitable to electronic circuits.
CO2	Analyze the performance characteristics of linear ICs.
CO3	Design amplifier, oscillator, signal conditioning circuits, combinational circuits andSequential circuits for given requirement

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			H	H		H	M		L	
	CO2			H		H		L		L			M
	CO3	H	H	H	M	H		L			L		
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/ Term Paper Seminar/ Internship PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS:

1. Inverting and non inverting amplifier.
2. Differentiator and Integrator.
3. Monostable multivibrator.
4. Astable multivibrator.
5. Adder and subtractor.
6. D/A and A/D converter.
7. Schmitt trigger.
8. Sine, rectangular and triangular wave generator.
9. Multiplexer and Demultiplexer using logic gates
10. Design and Implementation of code converters using logic gates.
11. Simulation of IC circuits using PSPICE/SIMULINK
12. Study of VCO and PLL ICs:
13. Voltage to frequency characteristics of NE/ SE 566 IC.
14. Frequency multiplication using NE/SE 565 PLL IC.

REFERENCES

1. Department Lab Manual

BMA502	**NUMERICAL METHODS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 75	3	2	0	4
	Prerequisite – Engg Mathematics-I, Engg Mathematics -III,				
	Course Designed by – Dept. of Mathematics				
OBJECTIVES					
To train the students with Mathematical techniques to solve problems in Engineering with numerical data					

COURSE OUTCOMES (COs)													
CO1	Solve a single equation and a system of linear equations by different methods and get exact solution and iterative solution.												
CO2	Interpolate a dependent variable based on a given set of values by a suitable method.												
CO3	Find integral value and differential coefficient based on a given set of values.												
CO4	Solve initial value problem of ODE and boundary value problems of PDE.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	L	H	M	M	M	L	L	L	L
	CO2	H	H			H	M	M	M		L		
	CO3	H	H			H	M	M	M			L	L
	CO4	H	H	L	L	H	M	M	M	L	L	L	L
3	Category	Humanities & Social Studies(HS)		Basic Sciences &Maths(BS)		Engg Sciences(ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/ Term Paper Seminar/Internship (PR)
				√									
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT-1 SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9+6

Iterative method, Newton–Raphson methods for single variable- Solutions of linear system by Gaussian, Gauss-Jordan, Jacobian and Gauss-Siedel methods, Inverse of Matrix by Gauss Jordan method, Eigen value of a Matrix power and Jacobian methods.

UNIT-II INTERPOLATION (FINITE DIFFERENCES) 9+6

Newton's Divided Difference Formula, Lagrange's Interpolation-Forward and Backward Difference Formula-Stirling's and Bessel's Central Difference Formula.

UNIT-III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+6

Numerical Differentiation with interpolation polynomials, Numerical Integration by Trapezoidal Simpson's(both 1/3 and 3/8)rule, Double integrals using Trapezoidal and Simpson's rule.

UNIT-IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+6

Single Step methods, Taylors Series, Euler and Modified Euler, Runge-Kutta methods of first and second order Differential equations, Multi Step methods, Milne and Adam's-Bashforth

predictor and corrector method.

UNIT-V BOUNDARY VALUE PROBLEMS FOR ODE AND PDE 9+6

Finite difference for the second order Ordinary Differential Equations, Finite Difference solutions for one dimensional heat equations(both Implicit and Explicit), One Dimensional wave equation, Two Dimensional, Laplace and Poisson Equation.

TEXT BOOKS:

1. Sastry.SS "Introductory Numerical Methods" PHI, 2010[Units I to III]
2. Jain K.K. Iyengar, S.R.K and Jain, R.K. "Numerical Methods for Scientific and Engineering Computation" 3rd edition, New Age International Publications and Co. 1993.[Units IV & V]

REFERENCES

1. Grewal, B.S. "Higher Engineering Mathematics (36th edition)" Khanna Publication Delhi 2001.
2. Curtis F.Gerald. "Applied Numerical Analysis" 7th Edn. Pearson Education, Chennai-600113. 2007
3 Dennis G.Zill and Warren S.Wright. "Advanced Engineering Mathematics". 3rd Edn. Jones & Bartlett Publishers, UK. 1992.

BEE501	**CONTROL SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engg Mathematics-I, Engg Mathematics -III, Circuit Theory and Network Analysis and Synthesis				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To provide an introduction to the analysis of linear control systems. This will permit to exploit time domain and frequency domain tools

COURSE OUTCOMES (COs)

CO1	To understand the concept of control components, Control system concept and Electrical analogy of mechanical systems
CO2	To understand the use of transfer function models for the analysis of physical systems.
CO3	To Gain knowledge in various time domain tools for analysis and design of linear control systems and compensators.
CO4	To Gain knowledge in various frequency domain tools for analysis and design of linear control systems and compensators.
CO5	To Understand the methods to analyze the stability of systems from transfer function forms.
CO6	To Understand the concept of state variable analysis and modeling of the system by the state variable technique.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M	H	M					L	L	M
	CO2	H	H	M	H	H					L	L	M

	CO3	H	M	M	H	H					L	L	M
	CO4	H	M	M	H	H					L	L	M
	CO5	H	M	M	H	H					L	L	M
	CO6	H	H	M	H	H					L	L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar / Internship (PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I SYSTEMS AND THEIR REPRESENTATION 12

Basic elements in control systems – Open and closed loop systems – Electrical analogy of mechanical systems – Transfer function – Synchros – AC and DC servomotors – Block diagram reduction techniques – Signal flow graphs.

UNITII TIME RESPONSE ANALYSIS 12

Test signals – step response of first order and second order systems – time domain specifications – response with P, PI, PID controller – type and order of a system – steady state error and generalized error coefficients.

UNIT III FREQUENCY RESPONSE ANALYSIS 12

Frequency domain specifications – estimation of the specification for a second order system – Bode plot – polar plot — closed loop response from open loop response

UNIT IV STABILITY AND COMPENSATOR DESIGN 12

Definition – characteristics equation – Routh Hurwitz criterian – Nyquist stability criterion – gain margin and phase margin – root locus – compensator design using bode plot-matlab basics for control systems.

UNIT V STATE VARIABLE ANALYSIS 12

Concept of state variables – State models for linear and time invariant Systems – Solution of stateand output equation in controllable canonical form – Concepts of controllability and observability– Effect ofstate feedback.

TEXT BOOKS:

1. Katsuhiko Ogata, "Modern Control Engineering" 5th Edition, Prentice Hall of India Private Ltd., New Delhi, 2012.
2. Nagrath I J and Gopal.M., "Control Systems Engineering", 5th Edition, New Age International (P) Ltd, Publishers 2012.

REFERENCE:

1. M. Gopal, "Control Systems: Principles and Design", 3rd Edition, McGraw, Hill, 2014
2. Benjamin C Kuo, "Automatic Control system", Prentice Hall of India Private Ltd., New Delhi 2012.

3. R.C. Dorf and R.H. Bishop, "Modern Control Systems", 12th Edition, Prentice,Hall, 2010.
4. http://www.mathworks.com/access/helpdesk/help/toolbox/control/
5 http://nptel.ac.in/courses/108101037/

BEE502	POWER ELECTRONICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Electrical Engineering, Basic Electronics Engineering & Electronic Integrated Circuits.				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To enable the students to gain a fair knowledge on characteristics and applications of power electronic devices and circuits

COURSE OUTCOMES (COs)

CO1	To learn the characteristics of different types of power electronic devices
CO2	To understand the operation of controlled rectifiers
CO3	To understand the operation of choppers & its types
CO4	To understand the operation of inverters & its types
CO5	To learn the operation of control circuits and applications of power electronic Circuits

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				M	L						
	CO2	H				M	L						
	CO3	H				M	L						
	CO4	H				M	L						
	CO5	H				M	L						

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elec-tive(NE)	Open Elective(OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I POWER SEMICONDUCTOR DEVICES 9

Construction, Principle of operation Power diodes , power transistors SCR, TRIAC, GTO, MOSFET, IGBT – driver circuit, turn – on method – commutation series and parallel connections

UNIT II PHASE CONTROLLED CONVERTERS 9

Converter inverters operation – Single phase and three phase controlled rectifiers(half and full converters) with R,RL and RLE load effect of source inductance and firing circuits – Dual converters – single phase & three phase dual converters

UNIT III DC TO DC CHOPPER 9

Voltage, current load commutated chopper – step-up chopper and firing circuits – one, two and four quadrant chopper application to DC driving control

UNIT IV INVERTERS 9

Series inverter – parallel inverter – current source inverter – voltage source inverter - Modified McMurray, auto sequential inverter– PWM inverter – UPS.

UNITV AC CHOPPER,CYCLOCONVERTER&VOLTAGE CONTROLER 9

Single phase AC chopper, multistage sequence control – step up and step down cyclo-converter – three phase to single phase and single phase to three phase cyclo-converter – triggering circuit based on micro controller – single phase AC voltage controller with R, RL, RLE.

TEXT BOOKS:

1. P.S. Bhimbra "Power Electronics", Khanna publishers
2. Singh, "Power Electronics", TMH New Delhi.
3. Rashid M.H. "Power Electronics circuits, Devices and application" Prentice Hall International 1995.

REFERENCE BOOKS:

1. Sen P.C. "Power Electronics". TMH, New Delhi.
2. Lander. W, "Power Electronics", McGraw Hill.
3. http://www.ni.com/tutorial/14674/en/

BEE504	**ELECTRICAL MACHINE DESIGN**	**L**	**T**	**P**	**C**
	TotalContactHours-60	4	0	0	4
	Prerequisite- Basic Electrical and Electronics Engineering Practices Laboratory				
	Course Designed by – Dept. of Electrical & Electronics Engineering				
OBJECTIVE					
To provide sound knowledge about constructional details and design of various electrical machines.					
COURSE OUTCOME					
CO1	To study mmf calculation and thermal rating of various types of electrical machines.				
CO2	To design armature and field systems for D.C. machines				

CO3	To design core, yoke, windings and cooling systems of transformers.
CO4	To design stator and rotor of induction machines
CO5	To design stator and rotor of synchronous machines and study their thermal behavior

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	L	H	M	M	L	L	L	L	L
	CO2	H	H	L	L	M	M	M	L	L	L	L	L
	CO3	H	H	L	L	H	M	M	L	L	L	L	L
	CO4	H	H	L	L	H	M	M	L	L	L	L	L
	CO5	H	H	L	L	H	M	M	L	L	L	L	L

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences(ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective(OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNITI INTRODUCTION 12

Major considerations in Electrical Machine Design - Electrical Engineering Materials – Space factor – Choice of Specific Electrical and Magnetic loadings - Thermal considerations - Heat flow – Temperature rise - Rating of machines – Standard specifications.

UNIT-II DCMACHINES 12

Output Equations – Main Dimensions - Magnetic circuit calculations – Carter's Coefficient - Net length of Iron –Real & Apparent flux densities – Selection of number of poles – Design of Armature – Design of commutator and brushes – performance prediction using design values.

UNIT-III TRANSFORMERS 12

Output Equations – Main Dimensions - KVA output for single and three phase transformers – Window space factor – Overall dimensions – Operating characteristics – Regulation – No load current – Temperature rise in Transformers – Design of Tank - Methods of cooling of Transformers.

UNIT-IV INDUCTIONMOTOR 12

Output equation of Induction motor – Main dimensions – Length of air gap- Rules for selecting rotor slots of squirrel cage machines – Design of rotor bars & slots – Design of end rings – Design of wound rotor -– Magnetic leakage calculations – Leakage reactance of polyphase machines- Magnetizing current - Short circuit current – Circle diagram - Operating character-

istics.

UNIT-V SYNCHRONOUS MACHINES 12

Output equations – choice of loadings – Design of salient pole machines – Short circuit ratio – shape of pole face – Armature design – Armature parameters – Estimation of air gap length – Design of rotor –Design of damper winding – Determination of full load field mmf – Design of field winding – Design of turbo alternators – Rotor design.

TEXT BOOKS

1. Sawhney, A.K., 'A Course in Electrical Machine Design', Dhanpat Rai & Sons, New Delhi, 1984.
2. Sen, S.K., 'Principles of Electrical Machine Designs with Computer Programmes', Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi, 1987.

REFERENCES

1. A.Shanmugasundaram, G.Gangadharan, R.Palani, 'Electrical Machine Design Data Book', New Age Intenational Pvt. Ltd., Reprint 2007.

BEE505	**POWER GENERATION SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisites: Basic knowledge about working of alternators and electric power system				
	Course Designed by – Dept of Electrical & Electronics Engineering				

OBJECTIVES

To understand the working of different types of power generation systems and to realize the necessity for interconnected operation of different power stations.

COURSE OUTCOMES (COs)

CO1	To learn generation of electrical power from different types of power plants like thermal ,nuclear and hydro power stations.
CO2	To understand the concepts of generation of electrical power using non-conventional energy resources
CO3	To learn the economics connected with power generation
CO4	To understand the measurement of various parameter in power plant and their control
CO5	To understand the significance of various components of the power generation plants

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	H		H	M	L	M	L	H	H	H
	CO2	H	H	M		H	M	M	M	M	H	M	H
	CO3	H	H	H		H	M	M	H	M	H	M	H
	CO4	H	H	M		H	H	M	M	L	H	H	H
	CO5	H	H	H		H	M	M	M	H	H	H	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences(ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
		-	-	-	-	X	-	-	-
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ECONOMICS OF GENERATION 9

Load and load duration curve – Load, demand and diversity factors – Plant capacity and plant use factors – choice of type of generation – choice of size and number of unit – cost of energy generated – Tariffs.

UNIT II THERMAL, NUCLEAR AND HYDRO POWER PLANTS 9

Location, Layout and working of steam ,diesel and gas power plants - Principles of nuclear power generation, Types of nuclear power plants and their comparison, Layout and working of nuclear power plants, Advantages and disadvantages of nuclear energy- Layout and working, Types of hydroelectric power plants, Advantages of hydro generation, Environmental issues.

UNIT III POWER PLANT INSTRUMENTATION 9

Importance of instrumentation in power plants, P & I diagram of boiler- Measurements of non-electrical parameters, flow of feed water, air, steam, radiation detector, smoke density measurement-analyzers, flue gas oxygen analyzer, chromatography, PH meter, pollution monitoring instruments.

UNIT IV BOILER, TURBINE-MONITORING AND CONTROL 9

Combustion control - furnace draft control-drum level control- deaerator control- boiler interlocks-speed, vibration, temperature monitoring control of turbine- lubrication and cooling system of turbine.

UNIT V NON CONVENTIONAL PLANTS 9

Introduction to the concept of distributed generation –basics on distributed generation Technologies- Effect on system operation. Basic concepts, Principle of working and layout of MHD, Solar, Wind, Tidal, Biomass and Geothermal Power Generation Systems.

TEXT BOOKS

1. Nagpal.G.R, “Power plant engineering”,Khanna Publishers,New Delhi,2001.
2. Uppal.S.L, “Electrical Power”, Khanna Publishers, New Delhi, 1997.

REFERENCES

1. Soni, Gupta, Bhatnagar, “A Course in Electrical Power”, Dhanpat Rai & Sons, Delhi.1992.
2. Sam.G,Dukelow, “The control of boilers”, Instrument Society ofAmerica,1991
3. Nagrath.I.J,andKothari.D.P, “Modern Power System Analysis”, Tata McGrawHill, 3rd Edition,2003.
4. Wadhwa, C.L., “Generation, Distribution and Utilization of Electric Energy”, New

Age International Ltd.,3rd Edition,2011
5. Gupta.B.R, "Generation of Electrical energy" , Eurasia Publishing House(p)Ltd,New Delhi,2003
6. Deshpande.M.V, "Elements of Electrical Power Station design", Pitman, NewDelhi.1991.
7. Anne-Marie Borbely, Jan F.Kreider, "Distributed Generation", CRC PressLLc, 2001.
8. Jain.R.K,"Mechanical and industrial Measurements",KhannaPublishers,New Del hi,1995.
9. http://nptel.ac.in/courses/108102047/

BEE5C1	**COMPREHENSION I**	**L**	**T**	**P**	**C**
	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses up to fifth semester				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

- To provide a complete review of Electrical &Electronics Engineering topics covered up to fifth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to fifth semester.

BEE5L1	**CONTROL SYSTEMS LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	2
	Prerequisite – Engg Mathematics-I, Engg Mathematics -III, Circuit Theory and Network Analysis and Synthesis				
	Course Designed by – Dept of Electrical & Electronics Engineering				

OBJECTIVES

To introduce control system lab experiments using hardware and software tools which provide path towards the engineering applications.

COURSE OUTCOMES (COs)

CO1	Ability to understand and analyse the impact of PID controllers on linear system.
CO2	Ability to conduct control system experiments and analyse the concepts
CO3	Ability to design compensators
CO4	Ability to determine control system's parameters and transfer function parameters.
CO5	Ability to use Matlab software for control system concepts.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M			H	M				M			M

	CO2	M			H	M				M			M
	CO3	M		M	H	M				M			M
	CO4	H			H	M				M			M
	CO5	M			H	H	H			H			H

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective(OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Determination of transfer function parameters of a DC servo motor.
2. Determination of transfer function parameters of AC servo motor.
3. Effect of P, PI and PID controllers on second order system.
4. Digital simulation of linear systems
5. Design of lag and lead compensators.
6. Closed loop control system
7. Stability analysis of linear systems.
8. Synchro Transmitter and Receiver characteristics.
9. MATLAB programming
   a. Determination of Transfer function from poles and zeros.
   b. Determination of Poles and zeros from transfer function.
   c. Step and ramp response of first order system.
10. Simulation of second order system using MATLAB
11. Bode, Root Locus, Nyquist plots of Linear Time Invariant system using MATLAB.

REFERENCE

1. LAB manual prepared by Department of Electrical & Electronics Engineering
2. http://www.mathworks.com/access/helpdesk/help/toolbox/control/

BEE5L2	**POWER ELECTRONICS LABARATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Concepts of Gate Firing, Theoretical concepts of SCR, TRIAC, DIAC and Inverters.				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To study the characteristics of various power electronic devices & how it is interfaced with motors.

COURSE OUTCOMES (COs)

CO1	To learn the output characteristics of SCR, DIAC & TRIAC.
CO2	To observe and learn the output waveform of Choppers
CO3	To learn the output waveform of Series and Parallel Circuits.
CO4	To learn the interface with universal motor.
CO5	To learn the output waveform of single phase cycloconverter.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		L		H	H				M			
	CO2		L		H	H				M			
	CO3		L		H	H				M			
	CO4		L		H	H				M			
	CO5		L		H	H				M			

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. DIAC Characteristics
2. SCR Characteristics
3. TRIAC Characteristics
4. Commutation Circuits Of SCR Trainer
5. Phase Controlled Characteristics Of SCR Trainer
6. MOSFET Based step up Chopper
7. MOSFET Based step down Chopper
8. Single phase Series Inverter
9. Single phase Parallel Inverter
10. Single Phase Cycloconverter
11. Speed control of Universal Motor

REFERENCES:

1. Manual prepared by Dept.of EEE

BEE601	**TRANSMISSION AND DISTRIBUTION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engineering Mathematics, Electro Magnetic Theory, Circuit Theory and Network Analysis and Synthesis				

	Course Designed by – Dept. of Electrical & Electronics Engineering

OBJECTIVES

To learn the usage of passive elements in various Power Transmission Systems, To design a Transmission and distribution electric power system.

COURSE OUTCOMES (COs)

CO1	To Describe transmission elements in power system network.
CO2	Summarize the modelling of transmission and distribution components and analyze its Performance.
CO3	Apply the concepts of transmission line into real time transmission networks.
CO4	Identify major components of power transmission and distribution systems.
CO5	Know and appreciate the key factors in equipment specification and network design.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	H	H	M	M	M	M	L	M	L	M
	CO2	H	M	H	H	H	M	M	M	L	M	L	M
	CO3	H	M	H	H	H	H	M	M	L	M	L	M
	CO4	M	M	H	H	H	H	M	M	L	M	L	M
	CO5	H	M	M	H	H	M	M	M	L	M	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective(NE)	Open Elective(OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I STRUCTURE OF ELECTRICAL POWER SYSTEMS 12

Structure of AC power system- single line diagram- EHVAC and HVDC transmission advantages and disadvantages –comparison of AC and DC transmission- Substations- various bus bar arrangement in substations– Economic choice of conductor size- Kelvin's law

UNIT II ELECTRICAL DESIGN OF TRANSMISSION LINES 12

Resistance, inductance and capacitance calculations in single and three phase transmissions lines –stranded and bundled conductors – symmetrical and unsymmetrical spacing, transposition- self and mutual GMD – skin and proximity effect

UNIT III PERFORMANCE OF TRANSMISSION LINES 12

Equivalent circuit for short, medium and long transmission lines – analysis- efficiency and

regulation – tuned power lines, attenuation and surge impedance loading – power circle diagram for receiving end and sending end –voltage control of line – shunt and series compensation.

UNIT IV CABLES AND INSULATORS 12

Underground cables – types, construction – capacitance of the cables – insulation resistance – dielectric stresses and grading – dielectric losses – capacitance and inter sheath grading – thermal characteristics – capacitance of three core cable – Insulators – types - advantages – voltage distribution in suspension insulators – string efficiency – method of improving string efficiency.

UNIT V MECHANICAL DESIGN OF TRANSMISSION LINES 12

Sag and Tension- Sag calculation for equal and unequal level supports – effect of wind and ice – Consideration in mechanical design of lines – stringing chart- corona characteristics.

TEXT BOOKS:

1. Mehta V.K, Rohit Mehta "Power system" S. Chand & Co ltd, 2005.
2. D. P. Kothari and I J Nagrath, 'Modern Power System Analysis', Tata McGraw – Hill, 2nd Edition, 2008.
3. Singh S N, 'Electric Power Generation Transmission and distribution', PHI India, 2nd Edition, 2008.

REFERENCE:

1. C.L. Wadhwa: Electrical Power Systems, 3rd Edn, New Age International Publishing Co., 2001.
2. Turan Gonen, 'Electric Power Distribution system engineering', CRC Press INC, 2 nd Edition 2007.
3. http://nptel.ac.in/courses/108102047/

BEE603	**MICROPROCESSOR AND MICROCONTROLLER**	**L**	**T**	**P**	**C**
	Total Contact Hours-45	3	0	0	3
	Prerequisite – Digital Electronics				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES	
To gain knowledge in microprocessor architecture, programming and its various applications.	
COURSE OUTCOMES (COs)	
CO1	To expertise the concepts of theory and programming of microprocessors
CO2	To achieve personal and professional success with awareness and commitment towards the social responsibility. To understand and work on 8bit and 16 bit microcontrollers
CO3	To Design microprocessor based systems along with I/O interfacing
CO4	To Understand the impact of microcontrollers in engineering applications
CO5	The student will be able to select an appropriate architecture and to apply to a particular situation
Mapping of Course Outcomes with Program outcomes (POs)	

(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M	H		M				M
	CO2	M	M	M	H	M	M	M	H	H			M
	CO3		M	H	H	H	H		H	M			
	CO4		M	H	H	H	H	M	M	M			
	CO5			L	H		M						M
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences(ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elec-tive(NE)	Open Elective(OE)		Project/ Term Paper Seminar/ Internship (PR)
							X						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I 8085 PROCESSOR 9

Hardware Architecture, pinouts – Functional Building Blocks of Processor – Memory organization –I/O ports and data transfer concepts– Timing Diagram – Interrupts.

UNIT II PROGRAMMING OF 8085 PROCESSOR 9

Instruction -format and addressing modes – Assembly language format – Data transfer, data Manipulation & control instructions – Programming: Loop structure with counting & Indexing – Look up table -Subroutine instructions - stack.

UNIT III 8051 MICRO CONTROLLER 9

Hardware Architecture, pin outs – Functional Building Blocks of Processor – Memory organization –I/O ports and data transfer concepts– Instruction set-Timing Diagram – Interrupts.

UNIT IV INTERFACING 9

Study on need, Architecture, and interfacing, with ICs: (a)8251 –USART; (b) 8256 –Direct memory access controller (c) 8259 programmable interrupt controller; (d) 8279 keyboard – display interface. A/D and D/A converters &Interfacing with 8085& 8051.

UNIT V MICRO CONTROLLER PROGRAMMING & APPLICATIONS 9

Data Transfer, Manipulation, Control Algorithms& I/O instructions – Simple programming exercises, –Key board and Display interface- Stepper Motor control –Washing Machine Control-.Microprocessor vs Microcontroller.

TEXT BOOKS:

1. Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
2. R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013.
3. Soumitra Kumar Mandal, Microprocessor & Microcontroller Architecture, Programming & Interfacing using 8085, 8086, 8051, McGraw Hill Edu, 2013.

REFERENCES:

1. Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
2. N.Senthil Kumar, M.Saravanan, S.Jeevananthan, 'Microprocessors and Microcontrollers', Oxford University Press, 2013.
3. http://nptel.ac.in/courses/108107029/

BEE604	DIGITAL SIGNAL PROCESSING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Transmission and Distribution, Power System Analysis				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

- To classify signals and systems& their mathematical representation.
- To analyse the discrete time systems.
- To study various transformation techniques & their computation.
- To study about filters and their design for digital implementation.
- To study about a programmable digital signal processor & quantization effects.

COURSE OUTCOMES (COs)

CO1	Explain Properties and algorithms for implementation of DFT
CO2	Describe Filters and their structures
CO3	Illustrate the design of FIR and IIR filters
CO4	Describe the quantization effects
CO5	Relate the architectures and instruction set of a Digital Signal Processor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	L	L	M	H	H	H	H	H
	CO2	H	H	H	H	H	L	M	H	H		H	H
	CO3	H	H	H	H	H			H	H	H	H	H
	CO4	M	M	L	H	M			H	H		H	M
	CO5	H	H	H	H	H	M	M	H	H			H

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elec-tive(NE)	Open Elective(OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION 9

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Digital signal representation.

UNIT II DISCRETE TIME SYSTEM ANALYSIS 9

Z-transform and its properties, inverse z-transforms; difference equation – Solution byztransform, application to discrete systems - Stability analysis, frequency response – Convolution – Fourier transform of discrete sequence – Discrete Fourier series.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION 9

DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS 9

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping – Frequency transformation.

UNIT V DIGITAL SIGNAL PROCESSORS 9

Introduction – Architecture – Features – Addressing Formats – Functional modes - Introduction to Commercial Processors

TEXT BOOKS

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithmsand Applications', Pearson Education/ PHI, 4th Edition, New Delhi, 2007.
2. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGrawHill, 3rd Edition, New Delhi, 2008.

REFERENCES

1. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete – Time SignalProcessing', Pearson Education, New Delhi, 2003.
2. Emmanuel C Ifeachor and Barrie W Jervis ,"Digital Signal Processing – A Practical Approach" Pearson Education, Second edition, 2002.
3. Steven W. Smith, "The Scientist and Engineer's Guide to Digital Signal Processing",Second Edition, California Technical Publishing San Diego, California. www.DSPguide.com)
4. B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, 2003

	MEASUREMENT AND INSTRUMENTATION	L	T	P	C
BEE605	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basics of Electrical and Electronic Systems.				

	Course Designed by – Dept. of Electrical & Electronics Engineering

OBJECTIVES

To make the student have a clear knowledge of the basic laws governing the operation of the instruments, relevant circuits and their working, Introduction to general instrument system, error, calibration etc.

COURSE OUTCOMES (COs)

CO1	Gain the knowledge of measuring various electrical and non electrical parameters.
CO2	Know the working and functions of Transducers and advanced sensors.
CO3	Gain the knowledge in digital measurement and data acquisition system.
CO4	Ability to measure frequency, phase with Oscilloscope
CO5	Ability to measure strain, displacement, Velocity, Angular Velocity, temperature, Pressure ,Vacuum, and Flow

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	L	H	M	L	M	L	M	M	L	M
	CO2	H	H	L	H	M	L	M	L	H	M	L	M
	CO3	H	H	M	H	H	M	M	L	H	M	L	M
	CO4	H	H	M	H	H	M	M	L	H	M	L	M
	CO5	H	H	M	H	H	M	M	L	H	M	L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar/ Internship (PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION 9

Functional elements of measurement system – static characteristics – static calibration – accuracy, precision, resolution, linearity, dynamic, characteristics – performance characteristics of zero first, second order system – error in measurement.

UNIT II SENSORS AND TRANSDUCER 9

Basic requirement of sensors – classification of sensors – resistive, inductive and capacitive transducers –LVDT, piezoelectric, thermoelectric, optical and digital transducer – transducers application in force, torque, level, flow, pressure, speed, and temperature measurement – PH electrode – photoelectric transducer..

UNIT III SIGNAL CONDITIONING SYSTEM AND BRIDGE CIRCUIT 9

Bridges – instrumentation amplifier – operational amplifier – buffer amplifier – differential amplifier – active filter, V/F and F/V converters, PLL, sample and hold circuit, A/D and D/A converters, function generators, multiplexing and de-multiplexing system, data acquisition system.

UNIT IV ELECTRICAL AND ELECTRONICS MEASUREMENT AND TELEMETRY 9

Principle of ammeter and voltmeter – digital voltmeter – energy meter – wattmeter – current – voltage and position telemetry system – AC telemetry – wattmeter – current, voltage and position telemetry system – AC system

UNIT V INPUT – OUTPUT DEVICES AND DISPLAYS 9

Seven segment display – LED, LCD, mixie tube, alphanumeric display – CRT, CRO – Magnetic tape recorder – digital printer – X-Y recorder.

TEXT BOOKS

1. Doebeline, E.O., "Measurement Systems – Application and Design", McGraw Hill Publishing compeney, 1990.
2. H.S. Kalsi, "Electronic instrumentation", Tata McGraw Hill Co., 1995.
3. Shawney A.K., "Electronic Instrumentation", Dhanpat Rai & Sons, New Delhi,2008.
4. Moorthy.D.V.S,"Tranducers and Instrumentation", Prentice Hall of India Pvt Ltd 1995.

REFERENCE BOOKS

1. Stout M.B., 'Basic electric Measurement, Prentice Hall of India. 1986
2. Dalley, J.W. Riely, W.F and Meconnel, K.G., "Instrumentation for Engineering Measurement", John Wiley & Sons, 1993 J.B Gupta, Measurements and Instrumentation".
3. http://nptel.iitg.ernet.in/courses/Elec_Engg/IIT%20Bombay/Electrical%20and%20Electronic%20Measurements.htm

BSS601	**VALUE EDUCATION AND PROFESSIONAL ETHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept. of Management Studies				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
- To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)

CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing
CO4	To learn more of Engineer as Responsible Experimenter.

CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To learn more of Responsibilities and Rights as Professional and facing Global Challenges

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE) 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.

UNIT III MIND CULTURE & TENDING PERSONAL HEALTH 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelising the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS'S RESPONSIBILITIES FOR SAFETY 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Chalenger, case study. Assessment of Safety and Risk – Risk Benefit Analysis and Re-

ducing Risk – The Three Mile Island and Chernobyl case studies.

UNIT V ENGINEERS'S RESPONSIBILITIES FOR RIGHTSAND GLOBAL ISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership

TEXT BOOKS:

1. Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata McGraw Hill, Newyork 2005 (Units IV & V)

REFERENCE:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The WorldCommunity Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, SerfojiNagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
2. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006 (for Units IV-V)
3. Charles D Fledderman, Engineering Ethics,Prentice Hall,New Mexico,2004(for Units IV,V)

BEE6L1	**MICROPROCESSOR AND MICROCONTROLLER LABORATORY**										**L**	**T**	**P**	**C**
	Total Contact Hours - 45										0	0	3	2
	Prerequisite – Digital Electronics, Electron Devices													
	Course Designed by – Dept. of Electrical & Electronics Engineering													
OBJECTIVES														
To gain knowledge in programming microprocessor and microcontroller and to learn about various Interfacing concepts.														
COURSE OUTCOMES (COs)														
CO1	Write Assembly Language Programmes for various operations using 8085 microprocessor													
CO2	Able to perform 8051 programming.													
CO3	Execute Interface Programs in 8085 microprocessor													
CO4	Execute Interface Programs in 8051 microcontroller													
CO5	Able to apply the concepts of microprocessor and microcontroller to perform related projects.													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low														
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	

2	CO1	H	M		H	L				M			H
	CO2	H	M		H	L				M			H
	CO3	M	M		H	M				M			H
	CO4	M	M		H	M				H			H
	CO5	M	M		H	M				H			H
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar/ Internship (PR)
							√						
4	Approval			37th Meeting of Academic Council, May 2015									

LIST OF EXPERIMENTS:

8085 Programming

1 (a) 8 bit Addition. (b) 8 bit Subtraction.
2 (a) Multiplication. (b) Division.
3 (a) 16 bit Addition (b) 16 bit Subtraction.
4 (a) Largest Element in an array. (b) Smallest Element in an array.
5 (a) Ascending order. (b) Descending order.

8085 Interfacing

6. Traffic Light control
7. Keyboard Interface.
8. 8251 USART interface

8051 programming

9. Demonstration of basic instructions with 8051 micro controller execution including Conditional jumps, looping and calling subroutines.

8051 Interfacing

10. Stepper motor control.
11. A/D & D/A Interface.

REFERENCE

1. LAB manual prepared by Department of Electrical & Electronics Engineering
2. http://nptel.ac.in/courses/108107029/

BEE6L2	**MEASUREMENT AND INSTRUMENTATION LABAROTARY**	**L**	**T**	**P**	**C**
	Total contact hours 45	0	0	3	2
	Prerequisite-NIL				
	Course Designed by – Dept. of Electrical & Electronics Engineering				
OBJECTIVES					

To acquire skills on using different measuring devices and mathematical modeling of machines and use of control system components													
COURSE OUTCOME													
1.	To Understand the operation of DC and AC bridges												
2.	To Calibrate the different types of meters and special type of instruments												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	L	H	M	M	L	L	L	L	L
	CO2	H	H	L	L	M	M	M	L	L	L	L	L
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
							√						
4	Approval			37th Meeting of Academic Council, May 2015									

LIST OF EXPERIMENT:

1. Study of temperature measurement Transducer (thermocouple).
2. Study of displacement and pressure transducer (LVDT).
3. AC Bridges.
4. DC bridges .
5. Instrumentation amplifiers.
6. Linerization using microprocessors.
7. A/D and D/A converters .
8. Hystersis loss measure using CRO.
9. Torque and angle measurement.
10 .Calibration of single phase energy meter.
11. Calibration of three phase energy meter.
12. Measurement of three phase power and power factor

REFERENCES

1.Department lab Manual

BMA 701	**OPERATIONS RESEARCH FOR ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite - Engineering Mathematics –I and Engineering Mathematics – III				
	Course Designed by – Dept. of Electrical & Electronics Engineering				
OBJECTIVES					

To impart knowledge about various tools in Operations Research to apply and solve real life problems in Engineering.	
COURSE OUTCOMES (COs)	
CO1	Apply linear programming model and assignment model to domain specific situations
CO2	Analyze the various methods under transportation model and apply the model for testing the closeness of their results to optimal results
CO3	Apply the concepts of PERT and CPM for decision making and optimally managing projects
CO4	Analyze the various replacement and sequencing models and apply them for arriving at optimal decisions
CO5	Analyze the inventory and queuing theories and apply them in domain specific situations.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											M
	CO2	L		M		L		M		M	H		
	CO3					H			H				L
	CO4		H	H					H	L	H		
	CO5	M				H				M			H
3	Category	Humanities & Social Studies(HS)		Basic Sciences & Maths (BS)		Engg Sciences(ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective(OE)		Project/ Term Paper Seminar/ Internship (PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT – I LINEAR PROGRAMMING 12

Introduction to phases of Operations Research – Linear programming – formulation of the problem – graphical method – simplex method – two phase method – Assignment problems – Transportation models – Vogel's approximation method – Modi method – unbalanced transportation problem – degeneracy in transportation models.

UNIT – II RESOURCE SCHEDULING AND NETWORKS 12

Resource scheduling – Sequencing n jobs through 2 machines and 3 machines. Networks – PERT and CPM – Network diagrams – shortest route – minimum spanning tree – probability of achieving completion date – crash time – cost analysis – resource smoothing and resource levelling.

UNIT – III INVENTROY AND REPLACEMENT MODELS 12

Inventory models- Types of Inventory and variables in the Inventory problem – deterministic models- Replacement models – Replacement of items that deteriorate with time – equipment

that fails completely and their analysis – factors for evaluation of proposals of capital expenditures and comparison and alternatives – present value average investment – rate of return pay off period – individual and group replacement policy.

UNIT – IV QUEUEING MODELS 12

Queuing theory – queuing system and structure – Kendalls's notation– Poisson arrival and exponential service time – characteristic of queuing models – single channel and multiple models – simulation.

UNIT –V DECISION MODELS 12

Game theory –Saddle point-Maximin-Minimax principle-Two person zero sum games (mixed Strategies)-Graphical method for 2×n or m×2 games-Dominance Property-Oddment method.

TEXT BOOKS:

1. KantiSwarup, Gupta, P.K and Manmohan, "Operations Research", Sultan Chand & Sons 1997

REFERENCES:

1 Handy A. Taha, "Operations Research", 7th Edn. Prentice Hall of India. 2007.
2 Gupta and Hira DS " Operations Research", S. Chand & Co, New Delhi, 2006
2. http://www.nptel.ac.in/syllabus/111107064/

BEE701	POWER SYSTEM ANALYSIS	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Linear Algebra , Partial Differential Equations, Knowledge in circuit theory, Transmission and Distribution				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To model various power system components and carry out load flow, short circuit and stability studies.

COURSE OUTCOMES (COs)

CO1	Create computational models for analysis power systems and able to understand per unit system
CO2	Perform load flow computations and analyze the load flow results
CO3	Analyse a power system network under Symmetrical Conditions
CO4	Understand Positive Sequence, Negative & zero sequence system and fault analysis
CO5	Analyze power system operation and stability control

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	M	M	M	M	L	L	L	M
	CO2	H	H	M	H	H	H	M	M	L	M	L	M

	CO3	H	H	H	H	H	H	M	H	L	M	L	M
	CO4	H	H	H	H	H	M	M	H	L	M	L	M
	CO5	H	H	M	H	H	H	M	M	L	M	L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar/ Internship(PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I POWER SYSTEM COMPONENTS 12

Power System Model: Representation-Single Line Diagram-Per unit Quantities-Per unit impedance diagram-Primitive network and its matrices, Network formulation using bus admittance matrix and bus impedance matrix-Symmetrical Components-Sequence impedance and networks.

UNIT II LOAD FLOW STUDIES 12

Primitive network equation-Incidence Bus Matrix. Power flow studies: Formulation of Power flow equations using Y-bus matrix-power flow analysis-Guass-Seidal and Newton Raphson Methods-Handling of Voltage Controlled Buses Off nominal transformer ratios and phase shifting transformer-Fast Decoupled Method.

UNIT III SYMMETRICAL FAULT ANALYSIS 12

Symmetrical Short Circuit Analysis: Types of faults in power systems-Analysis of Symmetrical faults-short circuit capacity-symmetrical fault analysis through Z-bus.

UNIT IV UNSYMMETRICAL FAULT ANALYSIS 12

Unsymmetrical Short Circuit Analysis: Unsymmetrical faults in Power Systems-Analysis of single line to ground, line to line and double line to ground faults power systems using Z-bus.

UNIT V POWER SYSTEM STABILITY 12

Stability Analysis: Steady state and transient Stability limits-Swing equation for single machine infinite bus system-Equal area criterion- Critical clearing angle and time-Solution of swing equation by modified Euler and Runge-kutta methods Stability analysis of multi machine power system. Techniques for stability Improvement

TEXT BOOKS:

1. J.J Nagrath& D.P Kothari, 'Modem Power System Analysis', Tata McGraw Hill, New Delhi, 1989.
2. John J. Graigner and Stevenson Jr.W.D., 'Power System Analysis'. McGraw Hill International Edition, 1994.

REFERENCE BOOKS:

1. Stevenson WD , 'Elements of Power System Analysis',Tata McGraw Hill, 1952.
2. MA Pai, 'Computer Techniques in Power System Analysis', Tata McGraw Hill.NewDelhi, 1979.

3. http://nptel.ac.in/courses/108105067/

BEE703	ELECTRICAL DRIVES AND CONTROL	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Electrical Machines – I & Electrical Machines – II & Concepts of Power Electronics				
	Course Designed by – Dept of Electrical & Electronics Engineering				

OBJECTIVES

To enable the students to gain a fair knowledge on characteristics and applications of electrical drives and how to control the speed of the AC & DC Motors.

COURSE OUTCOMES (COs)

CO1	To learn the General characteristics of different types of electrical AC & DC Motors with respect to the applications.
CO2	To understand the operation of different types of DC electrical drives
CO3	To understand the operation of Three Phase Induction Motors Drive
CO4	To understand the operation of Three Phase Synchronous Motor Drives
CO5	To learn the operation of control circuits and applications of Digital Control And Drive Application

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M					M	M		M			
	CO2	M					M	M		M			
	CO3	M					M	M		M			
	CO4	M					M	M		M			
	CO5	M					M	H		M			

3	Category	Humanities& Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core(Pc)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CHARACTERISTICS OF ELECTRICAL DRIVES 12

Speed – torque characteristics of various types of loads and drives motors-joint speed – torque characteristics – selection of power rating for drives motors with regard to thermal

over loading and load variation factors – load equalization – starting, breaking and reversing operation.

UNIT II DC DRIVES 12

Speed control of DC motors- Ward Leonard scheme - Closed loop operation - speed regulation and speed loop - current loop , tracing of waveforms , speed reversal , torque reversal , with/ without braking and regeneration.

UNIT III THREE PHASE INDUCTION MOTORS DRIVES 12

Speed control of three phase induction motors- Stator control o stator voltages and frequency control-AC chopper, inverter and cyclo converter fed induction motor drives' Rotor control-Rotor resistance control and slip power frequency recovery schemes- Static control of rotor resistance using DC chopper- Static Kramer and scherbius drives.

UNIT IV THREE PHASE SYNCHRONOUS MOTOR DRIVES 12

Speed control of the phase synchronous motor- Voltage source and current source inverts fed synchronous motor- Commutator less DC motor- closed loop control of drives motors. .Marginal angle control - torque angle control - power factor control of synchronous motor

UNIT V DIGITAL CONTROL AND DRIVE APPLICATION 12

Digital techniques in speed control-advantages and limitations-Microprocessor based control of drives-selection of drives and control schemes for steel rolling mills,paper mills,lifts and cranes.

TEXT BOOKS

1. S.K Pillai'A First Course On Electrical Drives', Wiley eastern Ltd., Bombay 1989.
2. Gopal,K.Dubey,' Power Semiconductor Controlled Drives,'Prentics Hall, Englewood Cliffs, New Jersey 1989.
3. N.K.De, P.K.SEN, "Electrical Drives", PHI, New Delhi.

REFERENCE BOOKS

1. P.C. Sen,'Thyristor DCdrives', John Whey and Sons, New York, 1981.
2. B.K. Bose,'Power electronics and AC drives', Prentice Hall, Englewood cliffs, New Jersey, 1986.
3. Vedhamsubramanyam, Thyristor control of electric drives',Tata McGraw hill publishing company Ltd. New Delhi, 1991.
4. http://www.motioncontrolonline.org/content-detail.cfm/Motion-Control-News/Electric-Drives-Concepts-and-Applications/content_id/1082

	TERM PAPER	L	T	P	C
BEE7P1	Total Contact Hours –60	0	0	4	2
	Prerequisite – Professional Courses				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

1. Application of theory learned so far in Electrical and Electronics Engineering
2. Make use of research tools and material
3. Consolidation of Hardware/Software skills for a real world /research problem
4. Improve problem solving skills

5. Improve report writing, word processing skills and documentation skills													
COURSE OUTCOMES (COs)													
CO1	Trace and Analyse the engineering problems effectively.												
CO2	Use modern engineering tools effectively for the system design, and simulate the problem identified.												
CO3	Function effectively as an individual, and as a member or leader in teams which will enhance the communication and leadership capabilities.												
CO4	Present project findings effectively, produce technical thesis and use software applications to write technical reports and oral presentations.												
	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	M		M		M	M	M	M
	CO2	H	H	M	H	H	M	M		M	M	M	M
	CO3	M	M	L	M	M		M		H	H	H	M
	CO4	M	M	L	H	M		M		M	M	M	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar/ Internship (PR)
													√
4	Approval			38th Meeting of Academic Council, January 2016									

DESCRIPTION

The Term Paper may be a precursor to the project work to be done in the VIII semester of the final year B.Tech, EEE program. This may be a team work.

PURPOSE

This helps to supplement the final year project work of the B.Tech students. It helps to identify their research area/topic and complete the groundwork and preliminary research required for it comfortably. It trains the students to make use of research tools and material available both in print and digital formats.

PROCEDURE

The topic of Term Paper is chosen from the B.Tech EEE curriculum. The students are then required to collect literature and support information from standard reference books, journals, and magazines both printed and online. Each student should refer to a minimum of 5 reference sources outside their prescribed textbooks. The students also present their Term Paper with the help of Power Point slides/ OHP.

The Term Paper contains

1. The Aim and Object of the study
2. The need for Rationale behind the study
3. Identify the work already done in the field
4. Hypothesis and Discussion
5. Conclusion
6. Appendix with support data (Illustrations, Tables, Graphs, etc.,)

BEE7L1	**POWER SYSTEM USING PC LABAROTORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Power system analysis, power system operation and control, Basics of Mat Lab Software				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To provide better understanding of power system analysis through MATLAB simulation

COURSE OUTCOMES (COs)

CO1	Acquire skills of using computer packages MATLAB coding in power system studies
CO2	Model and simulate power system network with stable and unstable situation
CO3	Analyse the performance of Power System Network using MATLAB tools.
CO4	To perform the dynamic analysis of power system
CO5	To have hands on experience on various system studies and different techniques used for system planning.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M		H	H				M			M
	CO2	M	H		H	H				M			M
	CO3	M	H		H	H				M			M
	CO4	H	H		H	H				M			M
	CO5	M	M		H	H				H			H

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Per Unit Computation
2. Formation of Y Bus Matrix by Inspection Method
3. Formation of Z Bus Matrix
4. Gauss Seidal Method
5. Load Flow Solution using Fast Decouple Method
6. Load Flow Solution by Newton Raphson Method
7. Short Circuit Analysis
8. Economic dispatch using MATLAB Software
9. Swing equation
10. Load frequency control
11. Study of Programmable Logic Controller

REFERENCE

1. LAB manual prepared by Department of Electrical & Electronics Engineering
2. http://www.mathworks.com/access/helpdesk/help

BEE7L3	**ELECTRICAL DRIVES & CONTROL LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**0**	**0**	**3**	**2**
	Prerequisite – Concepts of Special Electrical Machines				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To enable the students to design gating circuits,PWM inverters and SMPS

COURSE OUTCOMES (COs)

CO1	To design various types of gate pulse generating circuits.
CO2	To interface motors with DSP for speed control applications
CO3	To simulate various types of converters
CO4	To design PWM Inverters
CO5	To design various types of SMPS – BUCK,BOOST & BUCK-BOOST

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H		H		L			M			
	CO2		H		H		L			M			
	CO3		H		H		L			M			
	CO4		H		H		L			M			
	CO5		H		H		L			M			

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences(ES)	Professional Core(Pc)	Core Elective (CE)	Non-Major Elec-tive(NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS:

1. Gate Pulse Generation using R,RC and UJT.
2. IGBT based single phase PWM inverter.
3. IGBT based three phase PWM inverter.
4. Single Phase AC Voltage controller with R & RL Load.
5. Simulation of 1Φ Semi-converter.
6. Simulation of 1Φ Full-converter.
7. Simulation of dc-dc converters.
8. Simulation of cyclo-converter.
9. Design of Switched Mode Power Supply.
10. DSP based Stepper Motor Controller using 8051 Micro-controller.
11. DSP Based DC Servo motor position control system

REFERENCES:

1. Manual prepared by Dept. of EEE.

BEE7V1	**INPLANT TRAINING (Training to be undergone after VI semester)**	**L**	**T**	**P**	**C**
	(END OF VI SEM-15 DAYS)	0	0	0	1
	Prerequisite – NIL				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

Students have to undergo 15 day practical training in Electrical and Electronics Engineering related project at industry or a company so that they become aware of the practical application of theoretical concepts studied in the class rooms.

COURSE OUTCOMES (COs)

CO1	To have extensive training with practical exposure on real time scenarios.
CO2	Function effectively as an individual, and as a member or leader in teams which will enhance the communication and leadership capabilities.
CO3	To have work experience which enhances the technical and professional skills and employment prospects.
CO4	To learn about the skill set required, demands of the industry and also work ethics.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	H	M		M	M			M
	CO2	H	M	M	M	H			M	H	M	M	M
	CO3	M	M		H	M	M		M	M	M	M	M
	CO4	M	M		M	M			H				M
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar/
													√
4	Approval	37th Meeting of Academic Council, May 2015											

- Students have to undergo three-week practical training in Electrical and Electronics Engineering related project at industry or a company of their choice but with the approval of the department. At the end of the training student will submita report as per the prescribed format to the department.

Assessment process

- This course is mandatory and a student has to pass the course to become eligiblefor the award of degree. The student shall make a presentation before acommittee constituted by the department which will assess the student based onthe report submitted and the presentation made. Marks will be awarded out of 100and appropriate grades assigned as per the regulations.

BEE8C1	**COMPREHENSION II**	**L**	**T**	**P**	**C**
	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses upto eighth semester				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

- To provide a complete review of Electrical &Electronics engineering topics covered up to eighth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to eighth semester.

BEE8P1	**PROJECT WORK**	**L**	**T**	**P**	**C**
	Prerequisite – Professional Courses	**0**	**0**	**18**	**9**

	Course Designed by – Dept. of Electrical & Electronics Engineering

OBJECTIVES

1. Implementation of the problem identified in Term Paper
2. Application of theory learned so far in Electrical and Electronics Engineering
3. Make use of research tools and material
4. Consolidation of Hardware/Software skills for a real world /research problem
5. Improve problem solving skills
6. Improve report writing, word processing skills and documentation skills

COURSE OUTCOMES (COs)

CO1	Use modern engineering tools effectively for the system analysis, design and simulate the problem identified.
CO2	Develop a prototype Model.
CO3	Present project findings effectively, use software applications to write technical thesis and oral presentations.
CO4	Function effectively as an individual, and as a member or leader in teams which will enhance the communication and leadership capabilities.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	H	H	M		M	L	L	M
	CO2	H	M	M	H	H		M		M	L	M	M
	CO3	H	M		H	H	M	M		M	M	M	M
	CO4	H	M		H	H		M		H	M	H	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
									√
4	Approval	37th Meeting of Academic Council, May 2015							

- Project work, in general, means design and development of a system with clearly specified objectives. The project is intended to be a challenge to intellectual and innovative abilities and to give students the opportunity to synthesize and apply the knowledge and analytical skills learned in the different Subjects.
- The project shall be a prototype; backed by analysis and simulation etc. No project can be deemed to be complete without having an assessment of the extent to which the objectives are met. This is to be done through proper test and evaluation, in the case of developmental work, or through proper reviews in the case of experimental investigations.
- Project work is to be done by student groups. Maximum of four students only are permitted in any one group.

- Projects are expected to be proposed by the students. They may also be advised by faculty member. Students are expected to finalize project titles with the assistance of an identified faculty member as project guide during the first week of the eighth semester.
- The progress from concept to final implementation and testing, through problem definition and the selection of alternative solutions is monitored. Students build self confidence, demonstrate independence, and develop professionalism by successfully completing the project.

CORE ELECTIVES-I (CE-I)

BEE015	**ELECTRICAL SPECIAL MACHINES**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –Electrical Machines I&II				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

The student gains detailed skills related to the subject of special type of electrical machines.

COURSE OUTCOMES (COs)

CO1	Construction, principle of operation and performance of synchronous reluctance motors.
CO2	Construction, principle of operation, control and performance of stepping motors.
CO3	Construction, principle of operation, control and performance of switched reluctance motors.
CO4	Construction, principle of operation, control and performance of permanent magnet brushless D.C. motors.
CO5	Construction, principle of operation and performance of permanent magnet synchronous motors.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M				M		M			M	L	M
	CO2			L									L
	CO3	M			L	M		M					
	CO4	H	M								M		
	CO5			M		M					L	M	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar/ Internship (PR)

						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I SYNCHRONOUS RELUCTANCE MOTORS 9

Constructional features – Types – Axial and Radial flux motors – Operating principles – Variable Reluctance and Hybrid Motors – Voltage and Torque Equations - Phasor diagram - Characteristics.

UNIT II STEPPING MOTORS 9

Constructional features – Principle of operation – Variable reluctance motor – Hybrid motor – Single and multi stack configurations – Torque equations – Modes of excitations – Characteristics – Drive circuits – Microprocessor control of stepping motors – Closed loop control.

UNIT III SWITCHED RELUCTANCE MOTORS 9

Constructional features – Rotary and Linear SRMs - Principle of operation – Torque production – Steady state performance prediction- Analytical method -Power Converters and their controllers – Methods of Rotor position sensing – Senseless operation –Closed loop control of SRM - Characteristics.

UNIT IV PERMANENT MAGNET BRUSHLESS D.C. MOTORS 9

Constructional features of PMBLDC Motor - Permanent Magnet materials – Magnetic Characteristics –Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations –Commutation - Power converters – Motor characteristics and control.

UNIT V PERMANENT MAGNET SYNCHRONOUS MOTORS 9

Principle of operation – Ideal PMSM – EMF and Torque equations – Armature reaction MMF – Synchronous Reactance – Sine wave motor with practical windings – Phasor diagram – Torque/speed characteristics - Power controllers - Converter Volt-ampere requirements.

TEXT BOOKS

1.T.J.E. Miller, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 1989.
2. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 1984.
3. Venkataraman,"Special Electrical machines".

REFERENCES

1. R. Krishnan, 'Switched Reluctance Motor Drives – Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2001.
2. P.P. Aearnley, 'Stepping Motors – A Guide to Motor

BEE051	**DISTRIBUTED GENERATION AND MICROGRID**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES													
• To illustrate the concept of distributed generation • To analyze the impact of grid integration. • To study concept of Microgrid and its configuration													
COURSE OUTCOMES (COs)													
CO1	Review the conventional power generation												
CO2	Analyze the concept of distributed generation and installation												
CO3	Design the grid integration system with conventional and non-conventional energy sources												
CO4	Design the dc and ac micro grid												
CO5	Analyze power quality issues and control operation of micro grid												
	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M		M		M			M	L	M
	CO2	H		H		H						M	M
	CO3	M			H	M		M					
	CO4	H	M		H	M					M		
	CO5		M	M		M					L	M	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar/ Internship (PR)
									√				
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION 9

Conventional power generation: advantages and disadvantages, Energy crises, Non - conventional energy (NCE) resources: review of Solar PV, Wind Energy systems, Fuel Cells, microturbines, biomass, and tidal sources.

UNIT II DISTRIBUTED GENERATIONS (DG) 9

Concept of distributed generations, topologies, selection of sources, regulatory standards/ framework, Standards for interconnecting Distributed resources to electric power systems: IEEE 1547. DG installation classes, security issues in DG implementations. Energy storage elements: Batteries, ultra-capacitors, flywheels. Captive power plants

UNIT III IMPACT OF GRID INTEGRATION 9

Requirements for grid interconnection, limits on operational parameters,: voltage, frequency, THD, response to grid abnormal operating conditions, islanding issues. Impact of grid integration with NCE sources on existing power system: reliability, stability and power quality issues.

UNIT IV BASICS OF A MICROGRID 9

Concept and definition of microgrid, microgrid drivers and benefits, review of sources of microgrids, typical structure and configuration of a microgrid, AC and DC microgrids, Power Electronics interfaces in DC and AC microgrids,

UNIT V CONTROL AND OPERATION OF MICROGRID 9

Modes of operation and control of microgrid: grid connected and islanded mode, Active and reactive power control, protection issues, anti-islanding schemes: passive, active and communication based techniques, microgrid communication infrastructure, Power quality issues in microgrids, regulatory standards, Microgrid economics, Introduction to smart microgrids.

REFERENCES

1. AmirnaserYezdani, and Reza Iravani, "Voltage Source Converters in Power Systems: Modeling, Control and Applications", IEEE John Wiley Publications, 2009.
2. DorinNeacsu,"Power Switching Converters: Medium and High Power", CRC Press, Taylor & Francis, 2006.
3. Chetan Singh Solanki,"Solar Photo Voltaics", , PHI learning Pvt. Ltd., New Delhi, 2009
4. J.F. Manwell, J.G "Wind Energy Explained, Theory Design and Applications,". McGowan Wiley publication, 2nd Edition, 2009.
5. D. D. Hall and R. P. Grover,"Biomass Regenerable Energy", , John Wiley, New York, 1987.
6. John Twidell and Tony Weir, "Renewable Energy Resources", Taylor and Francis Publications, Second Edition, 2006.

BEE012	SOLID STATE RELAYS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite-power system protection and switch gear,				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

- To educate the basic concepts and new developments in solid state relays and power system protection
- To educate the theory and applications of the main components used in power system protection for electric machines, transformers, bus bars, overhead and underground feeders.

COURSE OUTCOMES (COs)

CO1	Gain Knowledge On Different Protective Equipment's Or Power Relays, Know About Various Protective Systems- How It Works And Where It Works?
CO2	Different Applications Of The Relays, Circuit Breakers, Grounding For Different Elements Of Power System Is Also Discussed In The Subject.
CO3	Ability To Understand Various Power, Frequency And Impedance Relays
CO4	Ability To Understand Protective Schemes ,Transient Behavior ,Testing And Tripping Schemes
CO5	Ability To Understand Relays Using Microprocessor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	H	H	H	H	H	L	M	L	M	M		H
	CO2	M	M	H	M	H	M	L	H	H	H	H	H
	CO3	M	H	H	L	H	M	M	M	M	L	L	H
	CO4	L	L	H	H	M	L	L	M	M	M	M	M
	CO5	H	H	L	L	M	M	M	M	M	M	M	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elec-tive(NE)	Open Elective(OE)	Project/ Term Paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION OF RELAYS 9

Comparators: phase and amplitude comparators-types-Direct and integrating rectifier bridge, circulating current, opposed voltage coincident type phase comparator-Direct or block spike phase comparator, phase splitting technique, integrating type phase comparator with transistor AND gate, hybrid comparator with transistor AND gate. Hybrid comparator- Hall effect type and magneto resistivity type, vector product type - zener diode phase comparators-Multi input-Three input coincidence comparators

UNIT II RELAY CIRCUIT 9

Static relay circuit (using analog and digital ic's) for over current, inverse time characteristics, differential relay.

UNIT III RELAY CIRCUIT 9

Static relay circuits fort generator loss of field, under frequency, distance relay, impedance, reactance, reverse power relays.

UNIT IV TRANSIENT BEHAVIOR OF RELAYS 9

Static relay circuits for carrier current protection-steady state and transient behavior of static relay-testing and maintenance - tripping circuits using thyristors.

UNIT V MICROPROCESSOR BASED RELAYS 9

Microprocessor based relays: hardware and software for the measurement of voltage, current, frequency, phase angle-microprocessor implementation of over current relays-inverse time characteristics-impedance relay-directional relay-mho relay.

TEXT BOOKS

1. Badri Ram, D. N. Vishwakarma 'power system protection and switchgear',22nd Edition, Tata Mcgraw Hill, 2001.
2. Rao, T.S.M. Power System Protection And Switch Gear, 2nd Edition, Wiley Eastern Ltd,1979.

REFERECE BOOKS:

1. Van. C.Wamngton. 'Protective Relays- their theory and practice', 2nd Edition, Chapman and hall
2. Russel c. Mason, "The art and science of protective relays" 1st Edition. John Wiley and Sons Ltd
3. www.electromagneticrelays.in

BEE053	**POWER SYSTEM PROTECTION AND SWITCH-GEAR**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Transmission and Distribution, Power System Analysis				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To develop an ability and skill to design the feasible protection systems needed for each main part of a power system in students.

COURSE OUTCOMES (COs)

CO1	Understand the basic concepts of power system protection and relays.
CO2	Design the relevant protection systems for the main elements of a power system.
CO3	Understand the theory of arcing phenomenon.
CO4	Analyze the purpose and working principle of different circuit breakers and tests.
CO5	Understand the overvoltage protection methods.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H	H	M	L	M	L	H	M	L	M
	CO2	H	M	H	H	M	L	M	L	H	M	L	M
	CO3	H	M	H	H	M	M	M	L	H	M	L	M
	CO4	H	M	H	H	M	M	M	M	H	M	L	M
	CO5	H	M	H	H	M	M	M	M	H	M	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective(NE)	Open Elective(OE)	Project/ Term Paper Seminar/
						√			

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I PROTECTIVE RELAYS 9

Relay construction and characteristics-over current relays - Directional over current relays Directional relays-Differential relays-COMPARATORS-Under frequency and negative sequence relays-Electromagnetic and solid relay comparison.

UNIT II APPARATUS PROTECTION 9

Protection of generator &-transformer protection-Bus zone protection-Feeder protection carrier current scheme for transmission line-Relay co-ordination for a sample system- Substation layout and arrangement of equipment's.

UNIT III THEORY OF ARC QUENCHING 9

Arcing phenomena- Theory and methods of arc quenching- Circuit interruption in AC circuits- Recovery voltage- Restriking voltage- Resistance switching- Current chopping- Capacitive breaking characteristics of fuses and HRC fuses- DC circuit breaking.

UNIT IV CIRCUIT BREAKERS 9

Fault clearing process- Classification of circuit breakers- Construction and operation of circuit breakers- Oil minimum circuit breakers-air blast circuit breaker- Vacuum circuit breaker- SF_6, circuit breaker- Circuit breaker rating- Circuit breaker testing.

UNIT V OVER VOLTAGE PROTECTION 9

Cause for over voltages- Lighting surges insulation failure and arcing grounds- Method of protection- ground wires, Peteroncoils, surge absorbers and diverters- location of protective apparatus- Insulation co-ordination- neutral earthing.

TEXT BOOK

1. Sunil S. Rao. 'Switchgear and Protection', Khanna publisher,NewDelshi.1986
2. C.L Wadhwa,'Electrical Power System',Witey eastern Ltd, New Delhi 1983.
3. Ravindranath& M. Chandar," Protection & switch gear"New Age International.

REFERENCE BOOK:

1. S L Uppal. 'ELECTRIAL POWER',Khanna publishers. New Delhi. 1981
2. Son Bhatnagar $ Gupta,' A cource in electrical power', Dhanpat Rai & Sons, New Delhi,1976
3. B Ravindranath N chander,'Power system protection and switch gear'. Wiley eastern Ltd, NEW Delhi, 1997
4. http://www.nptel.ac.in/downloads/108101039/

BEE013	HIGH VOLTAGE ENGINEERING	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite-Basic Physics & chemistry, PS Switchgear,				
	Course Designed by – Dept of Electrical & Electronics Engineering				

OBJECTIVES

To get a fair knowledge about the generation, measurements of high voltages and currents, testing of high voltage apparatus

COURSE OUTCOMES (COs)

CO1	To understand the various types of over voltages in power system and protection methods.

CO2	Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
CO3	To understand the concept of solid, liquid and gaseous dielectrics.
CO4	To understand the generation and measurement of high voltages and currents
CO5	To gain knowledge in testing of high voltage equipments.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	H		M	H	L	M	H	H		H
	CO2	L	H			H	M	M	M	H	H		M
	CO3	L	H	H		M	H	M	M	H	H		M
	CO4	L	M			M	H	M	M	H	H		H
	CO5	L	H	M		M	H	M	M	H	H		M

3	Category	Humanities &Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences(ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
		-	-	-	-	X	-	-	-

4	Approv-al	37th Meeting of Academic Council, May 2015

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and their effects on power system – Lightning, switching and temporary over voltages – protection against over voltages - Insulation coordination

UNIT II ELECTRICAL BREAKDOWN IN GASES, SOLIDS AND LIQUIDS 9

Gaseous breakdown in uniform and non-uniform fields – corona discharges – Vacuum breakdown – conduction and breakdown in pure and commercial liquids – breakdown mechanisms in solid and composite dielectrics.

UNIT III GENERATION OF HIGH VOLTAGE AND CURRENTS 9

Generation of high DC voltages - multiplier circuits –Van de Graff generator – high alternating voltage generation using cascade transformers-production of high frequency AC high voltages-standard impulse wave shapes-Marx circuit- generation of switching surges - impulse current generation-tripping and control of impulse generators.

UNIT IV MEASUREMENT OF HIGH VOLTAGES AND CURRENTS 9

HVDC measurement techniques – measurement of power frequency A.C voltages- sphere gap measurement technique-potential divider for impulse voltage measurements – measurement of high D.C, A.C and impulse currents

UNIT V HIGH VOLTAGE TESTING 9

Tests on insulators-testing of bushings-testing of isolators and circuit breakers- cable testing- testing of transformers-surge diverter testing -radio interference measurement-use of I.S for testing.

TEXT BOOKS

1. Naidu.M.S, and Kamaraju, "High Voltage Engineering", Tata McGraw Hill, 2009.
2. Wadhwa.C.L, "High Voltage Engineering", Wiley Eastern Limited, 2007.

REFERENCES

1. Kuffel.E and Abdullah. M, "High Voltage Engineering", Pergamon Press, 2000.
2. Dieter Kind, "An Introduction to High Voltage Experimental Techniqu Eastern Limited, 1978.
3. Ravindra Arora, Wolfgang Mosh, "High Voltage and Electrical Insulation e", Wiley Engineering", Wiley-VCH Publishers, 2011.
4. http://nptel.ac.in/courses/108104048/ui/TOC.htm

CORE ELECTIVES-II(CE-II)

BEE052	**ELECTRICAL MACHINE MODELING AND ANALYSIS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ELECTRICAL MACHINES I AND MACHINES II				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To master the various fundamentals, machine design, machine modeling of various types of electrical machines. This will help you to gain knowledge and to do research in the area of electrical machine modeling.

COURSE OUTCOMES (COs)

CO1	To learn about the basic concepts of AC/ DC machine modeling.
CO2	To study about the dynamic modeling and phase transformation.
CO3	To analyze various methodologies in small signal machine modeling.
CO4	To understand the modeling of synchronous machine modeling.
CO5	To learn the performance and dynamic modeling of synchronous machines

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H	M	M	M	M	M	L	M	M	L	M
	CO2		H		M	H	M	M	L	M	M	L	M
	CO3	H	H							M	M		
	CO4	H		M			H	M			M		H
	CO5	H	H	M	H	H	H	M	M	M	M	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BASIC CONCEPTS OF MODELING 9

Basic Two - pole Machine representation of Commutator machines, 3 phase synchronous machine with and without damper bars and 3 - phase induction machine, Kron's primitive Machine - voltage, current and Torque equations. DC Machine modeling: Mathematical model of separately excited D.C motor –Steady State analysis - Transient State analysis - Sudden application of Inertia Load - Transfer function of Separately excited D.C Motor - Mathematical model of D.C Series motor, Shunt motor - Linearization Techniques for small perturbations

UNIT II REFERENCE FRAME THEORY 9

Reference frame theoryReal time model of a two phase induction machine-Transformation to obtain constant matrices - three phase to two phase transformation - Power equivalence. Dynamic modeling of three phase Induction Machine Generalized model in arbitrary reference frame - Electromagnetic torque - Derivation of commonly used Induction machine models - Stator reference frame model - Rotor reference frame model Synchronously rotating reference frame model -Equations in flux linkages - per unit model

UNIT III SMALL SIGNAL MODELING 9

Small Signal Modeling of Three Phase Induction Machine Small signal equations of Induction machine – derivation - DQ flux linkage model derivation - control principle of Induction machine. Symmetrical and Unsymmetrical 2 phase Induction Machine Analysis of symmetrical 2 phase induction machine - voltage and torque equations for unsymmetrical 2 phase induction machine - voltage and torque equations in stationary reference frame variables for unsymmetrical 2 phase induction machine - analysis of steady state operation of unsymmetrical 2 phase induction machine - single phase induction motor - Cross field theory of single - phase induction machine.

UNIT IV MODELING OF SYNCHRONOUS MACHINE 9

Synchronous machine inductances – voltage equations in the rotor's dq0 reference frame - electromagnetic torque - current in terms of flux linkages - simulation of three phase synchronous machine- modeling of PM Synchronous motor.

UNIT V DYNAMIC ANALYSIS OF SYNCHRONOUS MACHINE 9

Dynamic performance of synchronous machine, three -phase fault, comparison of actual and approximate transient torque characteristics, Equal area criteria

TEXT BOOKS:

1. R. Krishnan, “Electric Motor Drives - Modeling, Analysis& control”, Pearson Publications, First edition, 2002.
2. P.C.Krause, Oleg Wasynczuk, Scott D.Sudhoff, “Analysis of Electrical Machinery and Drive systems”, IEEE Press, Second Edition.

REFERENCE BOOKS:

1. P.S.Bimbra, “Generalized Theory of Electrical Machines” Khanna publications, Fifthedition - 1995
2. Chee Mun Ong –“Dynamic simulation of Electric machinery using MATLAB / Simulink”,Prentice Hall of India Publications
3. Online courses on Modeling of Electrical Machines -http://nptel.ac.in/courses/108106023/

BEE016	FLEXIBLE AC TRANSMISSION SYSTEMS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Power System Analysis Power Conversion techniques				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

This course introduces the application of a variety of high power-electronic controllers for active and reactive power in transmission lines. Students are exposed to the basics, modeling aspects, control and scope for different types of FACTS controllers.

COURSE OUTCOMES (COs)

CO1	Ability to understand and analyze power system operation, stability, control and protection.
CO2	Choose proper controller for the specific application based on system requirements
CO3	Understand various systems thoroughly and their requirements
CO4	Interpret the control circuits of Shunt Controllers SVC & STATCOM for various functions
CO5	To learn the concept of coordination of FACTS controllers.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	M	M	M	M	L	M	M	L	M
	CO2	H	H	M	M	H	M	M	L	M	M	L	M
	CO3	H	H	M	M	H	H	M	L	M	M	L	M
	CO4	H	H	M	H	H	H	M	M	M	M	L	M
	CO5	H	H	M	H	H	H	M	M	M	M	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/
						√			

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION 9

Reactive power control in electrical power transmission lines -Uncompensated transmission line - series compensation – Basic concepts of Static Var Compensator (SVC) – Thyristor Controlled Series capacitor (TCSC) – Unified power flow controller (UPFC).

UNIT II STATIC VAR COMPENSATOR (SVC) AND APPLICATIONS 9

Voltage control by SVC – Advantages of slope in dynamic characteristics – Influence of SVC on system voltage – Design of SVC voltage regulator –Modelling of SVC for power flow and fast transient stability – Applications: Enhancement of transient stability – Steady state power transfer – Enhancement of power system damping.

UNIT III THYRISTOR CONTROLLED SERIES CAPACITOR (TCSC) AND APPLICATIONS 9

Operation of the TCSC – Different modes of operation – Modelling of TCSC – Variable reactance model – Modelling for Power Flow and stability studies. Applications: Improvement of the system stability limit – Enhancement of system damping.

UNIT IV VOLTAGE SOURCE CONVERTER BASED FACTS CONTROLLERS9

Static Synchronous Compensator (STATCOM) – Principle of operation – V-I Characteristics. Applications: Steady state power transfer-enhancement of transient stability - prevention of voltage instability. SSSC-operation of SSSC and the control of power flow–modelling of SSSC in load flow and transient stability studies.

UNIT V CO-ORDINATION OF FACTS CONTROLLERS 9

Controller interactions – SVC – SVC interaction – Co-ordination of multiple controllers using linear control techniques – Control coordination using genetic algorithms.

TEXT BOOKS

1. R.MohanMathur, Rajiv K.Varma, “Thyristor – Based Facts Controllers for Electrical TransmissionSystems”, IEEE press and John Wiley & Sons, Inc, 2002.
2. Narain G. Hingorani, “Understanding FACTS -Concepts and Technology of Flexible ACTransmission Systems”, Standard Publishers Distributors, Delhi- 110 006, 2011.
3. K.R.Padiyar,” FACTS Controllers in Power Transmission and Distribution”, New Age International (P) Limited, Publishers, New Delhi, 2008.

REFERENCES

1. A.T.John, “Flexible A.C. Transmission Systems”, Institution of Electrical and Electronic Engineers (IEEE), 1999.
2. V.K.Sood,HVDC and FACTS controllers – Applications of Static Converters in Power System, APRIL 2004 , Kluwer Academic Publishers, 2004.
3. Xiao – Ping Zang, Christian Rehtanz and Bikash Pal, “Flexible AC Transmission System:Modelling and Control” Springer, 2012.
4. http://nptel.ac.in/courses/108104052/26

	RENEWABLE ENERGY SOURCES	L	T	P	C
BEE048	Total Contact Hours-45	3	0	0	3
	Prerequisite - Nil				

	Course Designed by – Dept. of Electrical & Electronics Engineering

OBJECTIVES

To create awareness among the students about the different types of non-conventional energy resources and emphasize its importance

COURSE OUTCOMES (COs)

CO1	Able to gain a good knowledge of renewable energy sources.
CO2	Able to understand how renewable energy can be used to help reduce greenhouse gases.
CO3	To educate scientifically the new developments in non-conventional and renewable energy studies.
CO4	To emphasize the significance of Green Energy Technologies.
CO5	Able to understand various energy generation technologies.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H	M		M	M	H	H	M	H	H	M
	CO2		M	M		H	H	M	M			L	M
	CO3		H	H		H	H	H	H	M	M	H	M
	CO4		M	H		H	H	H	H		M	H	M
	CO5		M	M		L	M	M	M	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective(NE)	Open Elective(OE)	Project/ Term Paper Seminar/ Internship (PR)
						X			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION ABOUT ENERGY RESOURCES 9

General primary and commercial energy resources- study of availability-energy consumption pattern and growth rath in India- non –commercial energy sources –availability, economics and efficiency

UNIT II SOLAR ENERGY AND APPLICATIONS OF SOLAR ENERGY 9

Solar energy and application; solar radiation-principles of solar energy collections- types of collectors-characteristics and principles of different types of collectors- their efficiencies-solar energy applications water heaters, air heaters, solar cooking, solar drying and power generation-tower concept (solar plant)-solar pump

UNIT III WIND ENERGY 9

Wind energy: energy from wind-general theory of wind mills - types of wind mills-performance of wind machines-wind power - efficiency

UNIT IV TIDAL AND GEOTHERMAL ENERGY 9

Tidal Energy from tides and waves- working principles of tidal plants-tidal power generations –geothermal energy-principle of working of geothermal power plants

UNIT V BIOMASS ENERGY 9

Bio energy: energy from bio mass-biogas plants-various types-industrial wastes-municipal wastes-burning plants-energy from the agricultural wastes- applications

TEXT BOOKS:

1. Rai.G.D, "Non-conventional resources of energy", Khanna publishers, Fourthedition, 2010.
2. Khan.B.H,"Non-Conventional Energy Resources", The McGraw Hills, Second edition, 2009.

REFERENCE BOOKS :

1. S.P.Sukhatme,' Solar Energy,(principles of thermal collection and storage), Tata McGraw-Hill Publishers, Fourth print-February 1989
2. Ronald Shaw,'Wave Energy – (A Design Challenge)',Ellis Horwood Limited publishers, first edition- 1982
3. http://nptel.ac.in/courses/113104058/mme_pdf/Lecture1.pdf

BEE003	ADVANCED CONTROL SYSTEM	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Control System				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To provide knowledge on design in state variable form and in phase plane analysis.

COURSE OUTCOMES (COs)

CO1	To develop mathematical models and understand the mathematical relationships between the sensitivity functions and how they govern the fundamentals in control systems.
CO2	To understand the phase plane analysis.
CO3	To give basic knowledge in describing function analysis.
CO4	To study the design of optimal controller.
CO5	To design of optimal estimator including Kalman Filter

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	H		L		H	L	L	M

	CO2	H	M	M	H	H		L		H	L	L	M
	CO3	H	M		H	H		L		H	L	L	M
	CO4	H	M		H	H		L		H	L	L	M
	CO5	H	M	M	H	H		L		H	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences(ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I STATE VARIABLE DESIGN 9

Introduction to state Model- effect of state Feedback- Necessary and Sufficient Condition for Arbitrary Pole-placement- pole placement Design- design of state Observers- separation principle- servo design: -State Feedback with integral control.

UNIT II PHASE PLANE ANALYSIS 9

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearization Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

UNIT III DESCRIBING FUNCTION ANALYSIS 9

Basic concepts, derivation of describing functions for common non-linearities –Describing function analysis of non-linear systems – limit cycles – Stability of oscillations.

UNIT IV OPTIMAL CONTROL 9

Introduction - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti's equation – Application examples.

UNIT V OPTIMAL ESTIMATION 9

Optimal estimation – Kalman Bucy Filter-Solution by duality principle-Discrete systems-Kalman Filter- Application examples..

TEXT BOOKS

1. K. P. Mohandas, "Modern Control Engineering", Sanguine Technical Publishers, 2006.
2. G. J. Thaler, " Automatic Control Systems", Jaico Publishing House, 1993.
3. M.Gopal, "Modern Control System Theory", New Age International Publishers, 2002.

REFERENCES

1. William S Levine, "Control System Fundamentals," The Control Handbook, CRC Press, Tayler and Francies Group, 2nd edition, 2011.
2. Ashish Tewari, 'Modern Control Design with Matlab and Simulink', John Wiley, New Delhi, 2002.
3. K. Ogata, 'Modern Control Engineering', 4th edition, PHI, New Delhi, 2002.
4. T. Glad and L. Ljung,"Control Theory –Multivariable and Non-Linear Methods", Taylor&

Francis, 2002.
5. D.S.Naidu, "Optimal Control Systems" First Indian Reprint, CRC Press, 2009.
6. http://nptel.ac.in/courses/101108047/

BEE011	HIGH VOLTAGE DC TRANSMISSION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite-Transmission and Distribution, Power System Protection				
	Course designed by Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To master the various fundamentals, converter design, protection schemes of HVDC transmission systems. This will help you to gain knowledge and to do research in the area of HVDC transmission systems.

COURSE OUTCOMES (COs)

CO1	To learn about the historical development and emergence of HVDC transmission.
CO2	To study about the various thyristor converters used in HVDC transmission.
CO3	To analyze various control methodologies and characteristics of converters.
CO4	To understand the principle of protection schemes used in HVDC transmission.
CO5	To learn the fundamentals of ground return, filters and harmonics.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M	M	M	H		H	L	M
	CO2	H	M	M	H	H		M	H	H	H	L	M
	CO3	L	H		H	H	M	L	H	H	H	L	H
	CO4	L	H	M	H	H	M	L	M	H	L	H	H
	CO5	H	M	M	H	H		M			L	L	L

3	Category	Humanities & Social Studies(HS)	Basic Sciences &Maths(BS)	Engg Sciences(ES)	Professional Core(Pc)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I GENERAL ASPECTS 9

Historical development HVDC and HVDC link – Comparison of AC and DC Transmission – Application of DC Transmission – Types of DC link – Converter Station - HVDC projects in India and abroad – Advantages and disadvantages of HVDC transmission Principal applica-

tion of dc transmission – Economical factor – Development of power devices for HVDC transmission – Thyristors - switching and steady state characteristics.

UNIT II INTRODUCTION TO CONVERTERS 9

Line Commutated Converter – Analysis of Graetz Bridge Neglecting Overlap – Choice of Converter Configurations for any Pulse Number – Analysis of a 12 Pulse Converter – Voltage Source Converter – Basic Two level Converter (Graetz Bridge) – A Three Level Voltage Source Converter – Converter Using Pulse Width Modulation – capacitor Commutated Converter.

UNIT III CONTROL OF CONVERTERS 9

Principles of DC Link Control – Converter Control Characteristics – Firing Angle Control – Current and Extinction Angle Control – Starting and Stopping of DC Link - Power Control - Higher Level Controllers – SVC and STATCOM.

UNIT IV FAULTS AND PROTECTION 9

Converter Faults – commutation failure – Arc through – Misfire – Current extinction – Short Circuit in a Bridge – Protection against Over currents – Over voltages in a converter station – Disturbance on the DC side – Surge Arrestors – Protection Against Overvoltage – Protection against faults in a voltage Source Converter – DC Breakers.

UNIT V HARMONICS AND FILTERS 9

Generation of Harmonics - Characteristics and Non-Characteristic Harmonics - Troubles caused by harmonics – Means of Reducing Harmonics - .Design of AC Filters – Passive AC Filters – DC Filters – Active Filters – Carrier Frequency and RI Noise.

Total periods: 45

TEXT BOOKS

1. K.R. Padiyar ,"HVDC Power Transmission System Technology and System Interaction"- Willey Eastern Ltd. 1991.
2. E.W Kimbark, "DirectCurrent Transmission", Vol. Willey Inter Science. New York 1971.

REFERENCES

1. Colin Adamson and N.G. Hingorani. "High Voltage Direct Current Power Transmission", Garraway limited. England 1960.
2. B.J Kor(ed), "High Voltage Direct Current Converters and Systems", Macdonald and Co, London 1965.
3. B.M Wedy Bectric "Power Systems", John Wiley and Sons, London 1979.
4. Arrillaga, J., "High Voltage Direct Current Transmission", Peter Pregrinus, London, 1983.
5. Online courses on HVDC Transmission systems-http://nptel.ac.in/courses/108104013/

CORE ELECTIVES-III (CE-III)

BEE047	**POWER SYSTEM OPERATION AND CONTROL**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Optimization Techniques Advanced Power System Analysis				
	Course Designed by – Dept. of Electrical & Electronics Engineering				
OBJECTIVES					
To understand the economics of power system operation with thermal and hydro units, To realize the requirements and methods of real and reactive power control in power system					

and to be familiar with the power system security issues and contingency													
COURSE OUTCOMES (COs)													
CO1	An overview of power system operation and control.												
CO2	Basics of speed governing mechanism, modelling and speed-load characteristics												
CO3	Generation and absorption of reactive power.												
CO4	Formulation of economic dispatch problem and incremental cost curve coordination equations without and with loss (No derivation of loss coefficients)												
CO5	Know the concept of energy control centre												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M	M	M	L	M	L	M	L	L	M
	CO2	H	H	M	M	H	M	M	L	H	M	L	M
	CO3	H	H	M	H	H	H	M	M	M	M	L	M
	CO4	H	H	H	H	H	H	M	M	L	M	L	M
	CO5	H	H	H	H	M	M	M	M	L	M	L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar/ Internship (PR)
											√		
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION 9

An overview of power system operation and control - system load variation - load characteristics load curves and load-duration curve - load factor - diversity factor - Importance of load forecasting and quadratic and exponential curve fitting techniques of forecasting – plant level and system level controls.

UNIT II REAL POWER - FREQUENCY CONTROL 9

Basics of speed governing mechanism and modelling - speed-load characteristics – load sharing between two synchronous machines in parallel - control area concept - LFC control of a singlearea system - static and dynamic analysis of uncontrolled and controlled cases - two-area system modelling - static analysis of uncontrolled case - tie line with frequency bias control - state variable model - integration of economic dispatch control with LFC.

UNIT III REACTIVE POWER–VOLTAGE CONTROL 9

Generation and absorption of reactive power - basics of reactive power control - excitation systems – modelling - static and dynamic analysis - stability compensation - methods of voltage control: tap changing transformer, SVC (TCR + TSC) and STATCOM – secondary voltage control.

UNIT IV UNIT COMMITMENT AND ECONOMIC DISPATCH 9

Formulation of economic dispatch problem – I/O cost characterization – incremental cost curve – coordination equations without and with loss (No derivation of loss coefficients) - solution by direct method and λ-iteration method - statement of unit commitment problem – priority-list method – forward dynamic programming.

UNIT V COMPUTER CONTROL OF POWER SYSTEMS 9

Need for computer control of power systems - concept of energy control centre - functions – system monitoring - data acquisition and control - system hardware configuration – SCADA and EMS functions - network topology - state estimation – WLSE - Contingency Analysis - state transition diagram showing various state transitions and control strategies.

TEXT BOOKS

1. Olle.I.Elgerd, 'Electric Energy Systems theory - An introduction', Tata McGraw Hill Education Pvt.Ltd., New Delhi, 34th reprint, 2010.
2. Allen. J. Wood and Bruce F. Wollenberg, 'Power Generation, Operation and Control', John Wiley & Sons, Inc., 2003.
3. Abhijit Chakrabarti, SunitaHalder, 'Power System Analysis Operation and Control', PHI learning Pvt. Ltd., New Delhi, Third Edition, 2010.

REFERENCES

1. Nagrath I.J. and Kothari D.P., 'Modern Power System Analysis', Tata McGraw-Hill, Fourth Edition,2011.
2. Kundur P., 'Power System Stability and Control, Tata McGraw Hill Education Pvt. Ltd., New Delhi,10th reprint, 2010.
3. HadiSaadat, 'Power System Analysis', Tata McGraw Hill Education Pvt. Ltd., New Delhi, 21streprint, 2010.
4. http://nptel.ac.in/courses/108104052/

BEE044	**POWER QUALITY MANAGEMENT**	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Power Systems, Signals and Systems.				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To study the various issues affecting Power Quality, their production, monitoring and Suppression**.**

COURSE OUTCOMES (COs)

CO1	To study various methods of power quality monitoring.
CO2	To Study the production of voltages sags, interruptions and harmonics and methods of control.
CO3	Investigate different power quality phenomena causes and effects.
CO4	Understand different techniques for power quality problems mitigation.
CO5	Understand power quality monitoring and classification techniques.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	M	H	M	H	M	L	M	L	M	M	L	M
	CO2	M	H	H	H	H	H	M	L	M	M	L	M
	CO3	M	H	H	H	H	H	M	L	M	M	L	M
	CO4	M	H	H	H	H	H	M	L	M	M	L	M
	CO5	M	H	M	M	H	M	M	L	M	M	L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION TO POWER QUALITY 9

Power Quality phenomenon-Terms and definitions-Various Power events in power quality - causes for reduction in power quality

UNIT II VOLTAGE SAGS 9

Sources of sags – Magnitude & duration of sag-effect of sag on computer and consumer Electronics- Monitoring and mitigation of voltage sag.

UNIT III INTERRUPTIONS 9

Origin of Long & Short interruption –influence on various equipments-Basic reliability indices -monitoring and mitigation of interruption

UNIT IV HARMONICS 9

Harmonic distortion: Voltage and current distortion- harmonic indices- harmonic sources from commercial and industrial loads- Effects of harmonics on various equipments- harmonic distortion evaluation- Devices for controlling harmonic distortion

UNIT V POWER QUALITY MONITORING 9

Monitoring considerations: Power line disturbance analyzer, power quality measurement equipment, harmonic spectrum analyzer, flicker meters, disturbance analyzer.

TEXT BOOKS

1. Arindam Ghosh,"Power Quality Enhancement Using Custom Power Devices Power Quality Enhancement Using Custom Power Devices", Springer, 2002.
2. Roger.C.Dugan, Mark.F.McGranagham, Surya Santoso, H.Wayne Beaty, "Electrical Power Systems Quality" McGraw Hill, 2003.

REFERENCES

1. Math H.J.Bollen, "Understanding Power Quality Problems-Voltage sag &Interruptions", IEEE Press, 2000.
2. http://nptel.ac.in/courses/108106025/

BEE019	SMART GRID	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite-HVDC, Power Quality, Power Systems, Computer Knowledge.				
	Course Designed by – Dept of Electrical & Electronics Engineering				

OBJECTIVES

To enable the students acquire knowledge on smart grid, different options of architectural design and communication technology for various aspects of smart grid , System analysis and stability analysis in smart grid, renewable energy sources and storage integration with smart grid.

COURSE OUTCOMES (COs)

CO1	To understand the concepts and design of Smart grid
CO2	To understand the various communication and measurement technologies in smart grid.
CO3	To understand the analysis and stability of smart grid.
CO4	To learn the renewable energy resources and storages integrated with smart grid
CO5	To familiarize the high performance computing for Smart Grid applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/ POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	L	M	H	L	L	H	M	L	M	M	L	M
	CO2	M	H	M	H	L	M	M	L	M	M	L	L
	CO3	M	L	H	M	M	M	L	L	M	M	M	M
	CO4	H	H	H	L	H	M	H	L	H	M	H	H
	CO5	H	H	M	M	M	M	H	L	H	M	H	H

3	Category	Humanities & Social Studies	Basic Sciences & Maths (BS)	Engg Sciences(ES)	Professional Core (PC)	Core Elective (CE)	Major Elective	Open Elective (OE)	Paper Seminar/ Intern-
		-	-	-	-	X	-	-	-
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO SMART GRID 9

Evolution of Electric Grid, Concept, Definitions and Need for Smart Grid, Smart grid drivers, functions, opportunities, challenges and benefits, Difference between conventional & Smart Grid, Concept of Resilient &Self Healing Grid, Present development & International policies in Smart Grid, Diverse perspectives from experts and global Smart Grid initiatives.

UNIT II SMART GRID TECHNOLOGIES 9

Technology Drivers, Smart energy resources, Smart substations, Substation Automation, Feeder Automation ,Transmission systems: EMS, FACTS and HVDC, Wide area monitoring,

Protection and control, Distribution systems: DMS, Volt/VAr control, Fault Detection, Isolation and service restoration, Outage management, High-Efficiency Distribution Transformers, Phase Shifting Transformers, Plug in Hybrid Electric Vehicles (PHEV).

UNIT III SMART METERS 9

Introduction to Smart Meters, Advanced Metering infrastructure (AMI) drivers and benefits, AMI protocols, standards and initiatives, AMI needs in the smart grid, Phasor Measurement Unit(PMU), Intelligent Electronic Devices(IED) & their application for monitoring & protection.

UNIT IV POWER QUALITY MANAGEMENT IN SMART GRID 9

Power Quality & EMC in Smart Grid, Power Quality issues of Grid connected Renewable Energy Sources, Power Quality Conditioners for Smart Grid, Web based Power Quality monitoring, Power Quality Audit.

UNIT V HIGH PERFORMANCE COMPUTING 9

Local Area Network (LAN), House Area Network (HAN), Wide Area Network (WAN),Broadband over Power line (BPL), IP based Protocols, Basics of Web Service and CLOUD Computing to make Smart Grids smarter, Cyber Security for Smart Grid.

TEXT BOOK:

1. Vehbi C. Güngör, DilanSahin, TaskinKocak, SalihErgüt, ConcettinaBuccella, Carlo Cecati, and Gerhard P. Hancke, Smart Grid Technologies: Communication Technologies and Standards IEEE Transactions On Industrial Informatics, Vol. 7, No. 4, November 2011.

REFERENCES:

1. Xi Fang, SatyajayantMisra, GuoliangXue, and Dejun Yang "Smart Grid – The New and Improved Power Grid: A Survey" , IEEE Transaction on Smart Grids, 2011.
2. Stuart Borlase "Smart Grid :Infrastructure, Technology and Solutions",CRC Press 2012.
3. https://www.youtube.com/watch?v=JwRTpWZReJk&list=PLzcxA4YJjE1s6NOlhCA34vrsFCeokjs9_
4. https://iit.edu/news/iittoday/?tag=smart-grid

BEE043	SOLAR ENERGY UTILIZATION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Renewable Energy Sources				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To enable the students to acquire knowledge of solar energy fundamentals and various applications.

COURSE OUTCOMES (COs)

CO1	Analyze Solar radiation data and its measurement
CO2	Understand Operation of solar thermal energy systems
CO3	Understand the working of solar concentrators and their applications to produce energy
CO4	Understand the photovoltaic theory and implementation process.

CO5	Understand the design of Solar conscious buildings												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	H	H	H			M	M	H		
	CO2			M	M	M					M		
	CO3	M		M	M					M			
	CO4		M	M				M	M				
	CO5			M		M	M	M					

3	Category	Humanities& Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar / Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I SOLAR RADIATION 9

Sun and earth geometry, solar radiation-beam and diffuse radiations, measurement of solar radiation – pyranometer, pyrheliometer, sunshine recorder. Solar collectors and applications.

UNIT II SOLAR THERMAL SYSTEMS 9

Flat plate and evacuated tube collectors, domestic hot water and process heat systems, solar cooker, solar dryer, solar desalination and solar pond.

UNIT III SOLAR POWER PLANT 9

Principles of solar parabolic concentrators-trough and dish types, compound parabolic concentrators, Fresnel lens collectors, central receiver plant, direct steam generation systems, solar furnaces.

UNIT IV SOLAR PHOTOVOLTAICS 9

Solar photo voltaic theory, mono and polycrystalline silicon technologies, PV modules and integrated systems, implementation and maintenance.

UNIT V SOLAR-CONSCIOUS BUILDINGS 9

Orientation and design of buildings, passive solar heat- thermal capacity, insulation, solar cooling-refrigeration and air-conditioning, space heating, sensible and latent heat energy storages in buildings.

TEXT BOOKS:

1. Sukhatme.K, Suhas P. Sukhatme, "Solar energy: Principles of thermal collection and storage", Tata McGraw Hill publishing Co. Ltd, 8th edition,2008.
2. Soteris A. Kalogiru, "Solar Energy Engineering: Processes and systems", 1st edition, Academic press, 2009.

REFERENCES:

1. Duffie.J.A, & Beckman.W.A, "*Solar Engineering of Thermal Processes"*, 3rd edition, John Wiley & Sons, Inc., 2006.
2. Martin A. Green, "*Third generation Photovoltaics: Advanced energy conversion"*, 1st edition, 2005.
3. Garg.H.P, Prakash.J, "*Solar energy fundamentals and applications"*, Tata McGraw Hill publishing Co. Ltd, 2006.
4. http://nptel.ac.in/courses/112105051/22

BEE033	ELECTRIC AND HYBRID VEHICLES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Power Systems, Signals and Systems.				
	Course Designed by – Dept of Electrical & Electronics Engineering				

OBJECTIVES

This course introduces the fundamental concepts, principles, analysis and design of hybrid, electric and fuel cell vehicles.

COURSE OUTCOMES (COs)

CO1	Understand working of different configurations of electric vehicles,
CO2	Understand hybrid vehicle configurationand its components, performance analysis.
CO3	Understand the properties of batteries and its types
CO4	Understand of electric vehicle drive systems.
CO5	Understand of hybrid electric vehicles.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M	L	M	L	H	M	L	M
	CO2	H	H	H	H	H	L	M	L	H	M	L	M
	CO3	H	H	H	H	H	L	M	M	H	M	L	M
	CO4	M	M	H	H	H	L	M	M	H	M	L	M
	CO5	H	H	H	H	H	L	M	M	H	M	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ELECTRIC VEHICLES 9

Introduction, Components, vehicle mechanics – Roadway fundamentals, vehicle kinetics, Dynamics of vehicle motion - Propulsion System Design.

UNIT II BATTERY 9

Basics – Types, Parameters – Capacity, Discharge rate, State of charge, state of Discharge, Depth of Discharge, Technical characteristics, Battery pack Design, Properties of Batteries.

UNIT III DC & AC ELECTRICAL MACHINES 9

Motor and Engine rating, Requirements, DC machines, Three phase A/c machines, Induction machines, permanent magnet machines, switched reluctance machines.

UNIT IV ELECTRIC VEHICLE DRIVE TRAIN 9

Transmission configuration, Components – gears, differential, clutch, brakes regenerative braking, motor sizing.

UNIT V HYBRID ELECTRIC VEHICLES 9

Types – series, parallel and series, parallel configuration – Design – Drive train, sizing of components.

TEXT BOOK:

1. Iqbal Hussain, "Electric & Hybrid Vehicles – Design Fundamentals", Second Edition, CRC Press, 2011.
2. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003.

REFERENCES

1. Mehrdad Ehsani, Yimin Gao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.
2. Sandeep Dhameja, "Electric Vehicle Battery Systems", Newnes, 2000
3.http://nptel.ac.in/courses/108103009/

NON MAJOR ELECTIVES-I (NE-I)

BEE045	**INSTRUMENTATION AND CONTROL IN POWER PLANT INDUSTRIES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite-Measurement, Control System				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

We can know about the various methods of power generation and its control methods.

COURSE OUTCOMES (COs)

CO1	Familiarize about different power generation process
CO2	To be familiar about the important parameters that has to be monitored and controlled
CO3	To be familiar about the various parameters that has to be analyzed and measured analytically.
CO4	To understand about the boilers.
CO5	To get an detailed knowledge about Nuclear Power Plant Instrumentation

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H	H		H	H	H	H	M	M
	CO2	M			M	M	M	L	L				H
	CO3	L	L	H									H
	CO4		H	H	H								H
	CO5	H	M	H					H		H		H
3	Category	Humanities & Social Studies(HS)	Basic Sciences & Maths (BS)	Engg Sciences(ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)				
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I OVERVIEW OF POWER GENERATION 9

Brief survey of methods of power generation-Wind, Solar, Tidal, Geothermal, MHD, Fuel cells, Biomass-Conventional energy resources-Hydro, Nuclear, Gas, Thermal-Comparison of various conventional power plants-Importance of Instrumentation and control in power generation-P&I diagrams-P&I diagram of boiler-co-generation

.

UNIT II TURBINE MONITORING AND CONTROL 9

Electrical parameters-Current, Voltage, Power, Energy, Frequency, Power factor etc-Non-electrical parameters-Flow of feed water, fuel, air and steam with correction factor for temperature and pressure-Speed, vibration, shell temperature monitoring and control-Steam pressure control-Lubricant oil temperature control- cooling system.

UNIT III ANALYTICAL MEASUREMENT 9

Oxygen measurement in flue gas-CO2 in flue gas-Combustibles analyzers-Infrared flue gas analyzers-Smoke detector-Dust monitor-Closed Circuit Television-Fuel analyzers-Pollution monitoring instruments

UNIT IV CONTROL LOOPS IN BOILERS 9

Combustion control-air-fuel ratio control-furnace draft control-drum level control- main steam and reheat steam temperature control-super heater control- attemperator- deaerator control-Distributed Control System in power plant interlocks in boiler operation. 188 IC-2013 SRM(E&T)

UNIT V NUCLEAR POWER PLANT INSTRUMENTATION 9

Introduction-Nuclear physics-Classification of nuclear reactors-Basic reactor systems-P&I diagram of Nuclear power plant-Radiation detection instruments- nuclear reactor control systems and allied instrumentation

TEXT BOOKS

1. P. K. Nag, "Power Plant Engineering" 2nd Edition, Tata McGraw-Hill Education, 2002
2. Sam G. Dukelow, "The control of boilers" 2nd Edition, Research Triangle Park, 1991.

REFERENCES

1. R.K.Jain, "Mechanical and Industrial Measurements", 10th Edition, Khanna Publishers, New Delhi,1995.
2. Bela G Liptak, "Instrumentation in the processing industries"1st edition, Chilton Book Co, Chilton Book Co; 1973.
3. https://app.knovel.com/web/toc.v/cid:kpPCITCBH4

	DESIGN OF EMBEDDED SYSTEMS	L	T	P	C
BEE049	Total Contact Hours - 45	3	0	0	3
	Prerequisite-NIL				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To introduce students to the design issues of embedded systems.

COURSE OUTCOMES (COs)

CO1	Design simple embedded systems.
CO2	Choose effective communication Protocols for embedded systems.
CO3	Analyze real-time scheduling algorithms.
CO4	Analyzing different case studies of PIC microcontroller.
CO5	To be familiar about different operating system concepts.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	L	L	H	H	H	L	L	L	H	H	M	H
	CO2	L	H	M	H	H	H	H	H	L	M	H	M
	CO3	H	H	M	H	M	H	M	M	H	H	H	H
	CO4	H	M				H						
	CO5	L	L	H	H	H	H	M	H	H			M

3	Category	Humanities& Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core(Pc)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
							√		

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I OVERVIEW OF EMBEDDED SYSTEMS 9

Basics of Developing for Embedded Systems – Embedded System Initialization- I/O Devices – Types and Examples – Synchronous, Iso-synchronous and Asynchronous Communication – Serial Communication Devices – Parallel Device Ports- Reset Circuitry – Serial Communication Protocols : I2C, CAN,USB – Parallel Bus device Protocols: ISA, PCI, ARM bus

UNIT II CPU ARCHITECTURE OF PIC MICROCONTROLLER 9

PIC Microcontroller – Architecture of PIC 16F8xx – FSR – Reset action – Oscillatory Circuit – Program Memory Consideration- Register File Structure and Addressing Modes – Instruction Set- Simple Assembly Language Programming

UNIT III PIC PROGRAMMING 9

Interrupts – Constraints – Interrupt Servicing – Interrupt Programming – External Interrupts – Timers – Programming - I/O ports – LCD Interfacing– ADC – MPLAB IDE – Hex file format – Programming Tools

UNIT IV CASE STUDIES OF PIC MICROCONTROLLER 9

Driving a Multiplexed LED and LCD Display –Washing Machine control: actuators and sensor interfacing-Closed loop control of servo motor .

UNIT V REAL-TIME OPERATING SYSTEM CONCEPTS 9

Architecture of the Kernel – Task and Task Scheduler – Interrupt Service Routines – Semaphore – Mutex – Mailbox – Message Queue – Other Kernel Objects – Memory Management – Priority Inversion Problem

TEXT BOOKS:

1. Raj Kamal, "Embedded Systems Architecture Programming and Design", 2 nd Edition, Tata McGraw Hill, 2008, New Delhi.
2. Dr. K.V.K Prasad, "Embedded /Real-Time Systems: Concepts, Design and Programming", 1st Edition, Dream tech Press, 2009.

REFERENCES:

1. Ajay V Deshmukh, "Microcontroller Theory and Applications", 1st Edition, Tata McGraw Hill, 2007, New Delhi.
2. Daniel .W Lewis, "Fundamentals of Embedded Software", 1st Ed., Pearson Education, 2005.
4. John B Peatman, "Designing with PIC Micro Controller", 1st Ed., Pearson,1998.
5. C. M. Krishna, Kang. G. Shin, "Real-time systems", 1st Ed., Tata McGraw Hill, 2009.
6. Steve yeath, "Embedded system design", 2 nd Edition, Elsevier, 2008.
7. http://hdl.handle.net/123456789/520

BEE009	**ROBOTICS AND AUTOMATION**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite-Basic Electronics, Control Systems				
	Course Designed by – Dept. of Electrical & Electronics Engineering				
OBJECTIVES					

To provide comprehensive knowledge of robotics in the design, analysis and control point of view.	
COURSE OUTCOMES (COs)	
CO1	To study the various parts of robots and fields of robotics.
CO2	To study the various kinematics and inverse kinematics of robots.
CO3	To study the Euler, Lagrangian formulation of Robot dynamics
CO4	To study the trajectory planning for robot.
CO5	To study the control of robots for some specific applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	H		H	M	H	M	H	M	H	H
	CO2	M	M	M									H
	CO3	M	H	M		M	M	H	M		M		H
	CO4	M	H	M						H		H	H
	CO5	M	H	M			M	H	M		H		H

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
		-	-	-	-	-	X	-	-
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BASICCONCEPTS 9

Robotics – basic components – classification - performance characteristics- drives and control systems – electric , hydraulic and pneumatic actuators – control loops using current amplifiers and voltage amplifiers**.**

UNIT II SENSORS AND TRANSDUCERS 9

Sensors and vision systems; Transducers and sensors – tactile sensors –Proximity and range sensors –Acoustics sensors- visition systems – image Processing and analysis – image data reduction – segmentation feature

UNIT III ROBOTIC PROGRAMMING AND GRIPPER 9

End effectors –type –mechanical gripper –vacuum cup- magnetic grippers – robot to end effectors interface –software for industrial robots – positive stop program-Point to point program and continuous path program.

UNIT IV KINEMATICSANDPATHPLANNING 9

Robot motion analysis and control manipulation kinematics – homogeneous Transformation and robot dynamics configuration of a robot controller

UNIT V INDUSTRIALROBOT 9

Industrial robots –Robots for welding ,painting and assembling –remote Controlled robots for nuclear ,thermal and chemical plants –industrial Automation – typical examples of automated industries .

TEXT BOOKS

1.MikellPGroover, ”Industrial robotics : technology, programming, and applications” McGraw Hill New Delhi, 1996.
2. Ghosh, ”Control in Robotics and Automation: Sensor Based Integration”, Allied Publishers, Chennai, 1998.

REFERENCES

1. Deb.S.R, ”Robotics technology and flexible Automation”, John Wiley1992.
2. Asfahl. C.R, “Robots and manufacturing Automation”, John Wiley, USA ,1992.
3. https://www.youtube.com/watch?v=DaWMvEY3Qgc&list=PLED9EB384E656C007
4. http://www.nptel.ac.in/downloads/112101098/

BEC612	**PRINCIPLE OF COMMUNICATION ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours-45	3	0	0	3
	Prerequisite - Nil				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

To create awareness among the students about the different types of non-conventional energy resources and emphasize its importance

COURSE OUTCOMES (COs)

CO1	To introduce different methods of analog communication and their significance
CO2	To introduce the concepts of source and line coding techniques for enhancing rating oftransmission of minimizing the errors in transmission.
CO3	To introduce MAC used in communication systems for enhancing the number of users.
CO4	Ability to understand and analyze analog and digital communication
CO5	To introduce various media for digital communication.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		M	M		M		M			M		M
	CO2			L		H	M				L	L	
	CO3		M			H		M				L	
	CO4		M			M	M	M			M	L	M
	CO5			M		H					L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
							X		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT 1 RADIO COMMUNICATION SYSTEM 9

Frequency spectrum-Principle of AM and FM-AM and transmitters and receivers-Introduction to microwave communication systems-Principle Of satellite communication.

UNIT II PULSE COMMUNICATION SYSTEM 9

PAM, PPM, PDM, PCM-Delta Modulation-Differential PCM-Merit and demerits-Comparison Of pulse modulation schemes.

UNIT III DATA TRANSMISSION 9

Base band signal receiver-Error probability-Optimum and matched filter techniques coherent reception-Digital modulation system, FS, PSK-Comparison Of data transmission systems.

UNIT IV TRANSMISSION MEDIUM 9

Characteristics Of cables-Optical fibers-Effects Of EM radiation – Bandwidth and noise restrictions-Statistical and measurement of random noise-Concept of multiplexing-FDM and TDM.

UNIT V TELEVISION 9

Scanning methods-B/W and Color Systems-Camera and picture tubes-Synchronization-Transmitters and receivers.

TEXT BOOKS:

1. 'Kennedy, G , 'Electronic Communication Systems', McGraw Hill, 4th Edition, 1987
2. Simon Haykins, 'Communication systems', 3rd Edition, John Wiley, Inc., 1995.

REFERENCES:

1. Taub and Schilling, 'Principle of Communication system', 2nd Edition, McGraw Hill, 1987.
2. Bruce Carlson, A., 'Communication Systems', 3rd Edition, Tata McGraw Hill, 1986.
3. Roddy and Coolen ,'Electronic communication', 4th Edition Prentice Hall of India.1999.
4. http://www.mathworks.com/access/helpdesk/help/toolbox/signal & systems/

BEE042	ELECTRONIC INTEGRATED CIRCUITS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite- Circuit theory, Electron Devices				

	Course designed by Dept of Electrical & Electronics Engineering

OBJECTIVES

To master the various biasing techniques, small and large signal analysis and design, wave shaping, regulating and rectification using electronics devices. This will help you to gain knowledge in the electronic integrated circuits

COURSE OUTCOMES (COs)

CO1	To understand the biasing techniques of various electronics devices.
CO2	To learn the small signal low frequency analysis and design of various electronic devices.
CO3	To analyze various large signal amplifier and to study their design.
CO4	To understand the principle of various wave shaping, triggering and oscillating circuits
CO5	To learn the fundamentals of rectification, filter design and regulating power supplies

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M	M	M	H		H	L	M
	CO2	H	M	M	H	H		M	H	H	H	L	M
	CO3	L	H		H	H	M	L	H	H	H	L	H
	CO4	L	H	M	H	H	M	L	M	H	L	H	H
	CO5	H	M	M	H	H		M			L	L	L

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective(NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BASIC STABILITY AND DEVICES STABILIZATION 9

Biasing Circuits for BJT, DC and AC load lines-Stability factor analysis-Temperature compensation methods-Biasing circuits for FET's and MOSFETs

UNIT II SMALL SIGNAL LOW FREQUENCY ANALYSIS AND DESIGN 9

Transistor, FET and MOSFET Amplifier, Equivalent circuit, input and output characteristics, calculation of Mid band gain input and output impedance of various amplifier, cascade amplifier, Darlington bootstrapping, differential amplifier, CMRR measurement, use of current source in emitter.

UNIT III LARGE SIGNAL AMPLIFIER 9

Class A, AB, B, C and D type of Operation, Efficiency of class A amplifier with resistive and transformer coupled load, Efficiency of class B amplifier, Complementary symmetry amplifiers, MOSFET power amplifier, Thermal stability of power amplifiers heat sink design.

UNIT IV PULSE CIRCUITS 9

RC wave shaping circuits – Diode clampers and clippers – multi vibrators – Schmitt trigger – UJT triggering circuits – Saw tooth oscillators.

UNIT V RECTIFIERS AND POWER SUPPLIES 9

Half and full wave rectifiers ripples factor calculation for C, L, L-C and "Pi" symbol filters-Switch mode power supplies- Linear electronic voltage regulators - Power control using SCR.

TEXT BOOKS:

1. Albert Paul Malvino, "Electronic Principles", Sixth Edition, Tata McGraw Hill Edition, 1998
2. R.S Sedha, "Applied Electronics", Third edition, S Chand Publishing, 2008

REFERENCE BOOKS:

1. David A. Bell, "Electronic Devices and Circuits", Prentice Hall of India, 1998
2. Donald L. Schilling ChartesBeloue, "Electronic Circuits", Third Edition, 1989
3. Online courses on electronic circuits-http://electronicsforu.com/newelectronics/default.asp

NON MAJOR ELECTIVES-II(NE-II)

BEE007	BIO-MEDICAL INSTRUMENTATION	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite -NIL				
	Course Designed by – Dept of Electrical & Electronics Engineering				

OBJECTIVES

Discuss the internal circuitry of medical instruments and its maintenance.

COURSE OUTCOMES (COs)

CO1	Describe the physiology and anatomy of human system.
CO2	Recognize the technical concepts and operation of medical instrumentation.
CO3	With widespread use and requirements of medical instruments, this course gives knowledge of the principle of operation and design of biomedical instruments.
CO4	It attempts to render a broad and modern account of biomedical instruments.
CO5	It gives the introductory idea about human physiology system which is very important with respect to design consideration

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M		M		M			M	L	M
	CO2	H		H		H						M	M
	CO3	M			H	M		M					

	CO4	H	M		H	M					M		
	CO5		M	M		M					L	M	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
										√			
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I PHYSIOLOGY AND TRANSDUCERS 9

Electrophysiology: cell and its functions- Neuron-Axon-Synapse-Action Potential - Propagation of electrical impulses along the axon-Sodium sump-Salutatory condition- Electrophysiology and Cardiopulmonary systems- Respiration and nervous system and peripheral nervous system

UNIT II ELECTRO – PHYSIOLOGICAL MEASUREMENTS 9

Sensors and recorders: psychological transducer-general consideration for electronic recording systems- basic recording systems-pre amplifiers-direct writing recorders- UV recorders-electrostatic recorders-instrumentation tape recorders

UNIT III NON-ELECTRICAL PARAMETER MEASUREMENTS 9

Modem imaging systems: X- ray machines and computed Tomography-magnetic resonance imaging systems--ultrasonic imaging systems-medical thermography-electron microscope

UNIT IV MEDICAL IMAGING AND PMS 9

Diagnostic equipments: electrocardiograph-electroencephalograph-electromyograph-blood flow meters-blood gas analyzers-computer applications in medical field- ultrasonic equipments-bio telemetry-transmission of physiological data

UNIT V ASSISTING AND THERAPEUTIC EQUIPMENTS 9

Therapeutic equipments: pace makers- defibrillators-dialysers-surgical diathermy machines-later applications-physiotherapy and electrotherapy equipments

TEXT BOOKS

1. Arumugam M. 'BioMedical Instrumentation ', Anumdhaa Agencies ,1992
2. Gedders L.A. and Baker L.E. ' principles of Applied Bio- Medical instrumentation', john Wiley, 1989.

REFERENCES

1. Bertill Jacobson and john G. Webster 'Medicaland clinical Engineering' Prentice HallIndia , 1977
2. Gedders L.A and Baker L.E 'principles of applied Bio- medical instrumentation', John Wiley-Interscience, 3rd Edition, 1989.

BEE014	FUZZY LOGIC AND NEURAL NETWORK	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite- Engineering Mathematics, Fundamentals of Computing and Programming				
	Course designed by -Dept of Electrical & Electronics Engineering				

OBJECTIVES

To master the various fundamental concepts of fuzzy logic and artificial neural networks. This will help you to get sufficient knowledge to analyze and design the various intelligent control systems

COURSE OUTCOMES (COs)

CO1	To understand the basic concepts of fuzzy sets, fuzzy logic and defuzzification
CO2	To learn the basics of Artificial Neural Networks and its algorithms
CO3	To analyze various techniques in feedback and feed forward neural networks.
CO4	To understand the principle of competitive neural networks and adaptive resonance theory
CO5	To learn the architecture and algorithm of Cognitron, Neo cognitron and the concepts of fuzzy associative memory and fuzzy systems.

Mapping of Course Outcomes (COs) with Program Outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	M	M	H	M	M	M	H		H	L	M
	CO2		M	M	H	H		M	H	H	H	L	M
	CO3		H			H	M	L	H	H		L	H
	CO4		H	M		H	M	L	M	H	L	H	H
	CO5	H	M	M	H	H		M				L	L

3	Category	Humanities & Social Studies(HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective(OE)	Project/ Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I FUNDAMENTALS OF FUZZY LOGIC 9

Basic concepts: fuzzy set theory- basic concept of crisp sets and fuzzy sets- complements-union- intersection- combination of operation- general aggregation operations- fuzzy relations-compatibility relations-orderings- morphisms- fuzzy relational equations-fuzzy set and systems

UNIT II ARCHITECTURE OF NEURAL NETWORKS 9

Architectures: motivation for the development of natural networks-artificial neural networks-biological neural networks-area of applications-typical Architecture-setting weights-common activations functions- Basic learning rules- McGulloch-Pitts neuron- Architecture, algorithm, applications-single layer net for pattern classification- Biases and thresholds, linear separability - Hebb'srule- algorithm -perceptron - Convergence theorem-Delta rule

UNIT III BASIC NEURAL NETWORK TECHNIQUES 9

Back propagation neural net:standard back propagation-architecture algorithm- derivation of learning rules-number of hidden layers--associative and other neural networks- hetro associative memory neural net, auto associative net- Bidirectional associative memory-applications-Hopfield nets-Boltzman machine

UNIT IV COMPETITIVE NEURAL NETWORKS 9

Neural network based on competition: fixed weight competitive nets- Kohonen self organizing maps and applications-learning vector quantization-counter propagation nets and applications adaptive resonance theory: basic architecture and operation-architecture, algorithm, application and analysis of ART1 & ART2

UNIT V SPECIAL NEURAL NETWORKS 9

Cognitron and Neocognitron- Architecture, training algorithm and application-fuzzy associate memories, fuzzy system architecture- comparison of fuzzy and neural systems

TEXT BOOKS

1. Kliryvan- Fuzzy System & Fuzzy logic Prentice Hall of India, First Edition.
2. Lawrence Fussett- fundamental of Neural network Prentice Hall , First Edition.

REFERENCES

1. Bart Kosko, "Neural network and Fuzzy System" - Prentice Hall-1994
2. J.Klin and T.A.Folger, "Fuzzy sets" University and information- Prentice Hall -1996
3. J.M.Zurada, "Introduction to artificial neural systems"-Jaico Publication house,Delhi 1994
4. Vallusu Rao and Hayagvna Rao , "C++ Neural network and fuzzy logic"-BPB and Publication, New Delhi,1996
5. Intelligent Systems and Control-http://nptel.ac.in/courses/108104049/16

BEE027	**MICROCONTROLLER BASED SYSTEM DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Microprocessor and Microcontroller, Digital electronics				
	Course Designed by – Dept. of Electronics & communication Engineering				

OBJECTIVES	
To expose the students to the fundamentals of microcontroller based system design	
COURSE OUTCOMES (COs)	
CO1	Understand the basics of embedded system
CO2	Understand about Hardware/software co-design aspects and analyse the requirements for interfacing
CO3	Understand concepts of ARM Processor and programming them.

CO4	Understand concepts of PIC controller and programming them.
CO5	Analyse and implement various interfacing circuits necessary for various applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		M	M	M	M			M		M	M
	CO2	M		M	M	M	M			M		M	H
	CO3	M		M		M	H			M		M	M
	CO4	M		M		M	M			H		M	M
	CO5	M		H	M	H	M			H		H	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences(ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I EMBEDDED SYSTEMS 9

Introduction to embedded systems – hardware and software components –types- examples-characteristics –system on chip-challenges in embedded computing system design – embedded system design process.

UNIT II EMBEDDED SYSTEM INTERFACING 9

Serial and parallel communication devices-wireless devices – timer & counting devices-Watch dog timer – Serial communication using I2C- CAN USB buses –Parallel Communication using ISA- PCI- PCI/X buses-wireless and mobile system protocol.

UNIT III ARM PROCESSOR-7 9

MSP430 architecture-addressing modes-constant generator and emulsion instructions-instruction set, functions- interrupts low power modes.

UNIT IV PIC CONTROLLER 9

PIC microcontrollers: History and features –Architecture – memory organization – addressing modes – instruction set – PIC progrmming –I/O port, Data Conversion, RAM & ROM Allocation.

UNITV INTERFACING – CASE STUDY 9

Interfacing PIC to LCD – Keyboard– parallel and serial ADC, DAC– Stepper motor interfacing.

TEXT BOOKS:

1. Sriram. V.Iyer & Pankaj Gupta, “Embedded real time systems Programming”, Tata McGraw- Hill, 2007.
2. Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey ‘ PIC Microcontroller and Embedded Systems using Assembly and C for PIC18’, Pearson Education 2008 .
3. John Iovine, ‘PIC Microcontroller Project Book ’, McGraw Hill 2000

REFERENCES:

1. Rajkamal, “Embedded system-Architecture, Programming and Design”, 2nd edition Tata McGraw-Hill, 2003.
2. John H. Davies, "MSP430 Microcontroller Basics”, Newnes publishers, First edition, 2008.
3. Rafiquzzaman**.M,** “Microcontroller Theory and Applications with the PIC18F”, Wiley 2011.
4. http://nptel.ac.in/courses/Webcourse-contents/IIT-KANPUR/microcontrollers/micro/ui/Course_home1_1.htm

BBM405	**BIOSENSORS AND TRANSDUCERS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Biology for Engineers.				
	Course Designed by – Dept. of Bio Medical Engineering.				

OBJECTIVES

- Understand the purpose of measurement, the methods of measurements, errors associated with measurements.
- Know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications.

COURSE OUTCOMES (COs)

CO1	Describe the purpose and methods of measurements.
CO2	Explain different display and recording devices for various applications.
CO3	Know the principle of transduction, classifications and the characteristics of different transducers and study its biomedical applications
CO4	Remember and understand the concepts, types, working and practical applications of important biosensors.
CO5	Know some of the commonly used biomedical transducers.
CO6	Know the different display and recording devices.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M	H	H	M	H			L	M	
	CO2	M	H	M	H	H	M	H			L	M	
	CO3	M	H	M	H	H	M	H			L	M	
	CO4	M	H	M	H	H	M	H			L	M	
	CO5	M	H	M	H	H	M	H			L	M	
	CO6	M	H	M	H	H	M	H			L	M	

3	Category	Humanities &Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (H)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I SCIENCE OF MEASUREMENT 9

Units and Standards - calibration methods - statics calibration - classification of errors, error analysis - statistical methods - odds and uncertainity.

UNIT – II CHARACTERISTICS OF TRANSDUCERS 9

Static characteristics - accuracy, precision, sensitivity, linearity etc - mathematical model of transducers - zero first - order and second - order transducers - response to impulse step, ramp and sinsoidal inputs.

UNIT – III VARIABLE RESISTANCE TRANSDUCERS 9

Principle of operation, construction details, characteristics and applications of resistance potentiometers, strain gauges, resistance thermometers, thermistors, hot-wire aneometer, piezo-resistive sensors and humidity sensors.

UNIT - IV BIOSENSORS - PHYSIOLOGICAL RECEPTORS - J RECEPTORS 9

Chemoreceptors, Baroreceptors, Touch receptors, Biosensors - Working Principle and Types, Applications.

UNIT - V OTHER TRANSDUCERS 9

Piezoelectric tranducers, magnetostrictive transducer, IC sensor digital transducers - smart sensor - fibre optic transducers.

TEXT BOOKS

1. Doeblin. E. O, Measurment Systems, McGraw Hill Book Co. 1998
2. Renganathan S, Transducer Engineering, Allied Publishers, Chennai,2000.
3.https://www1.ethz.ch/lbb/Education/Biosensors/Lecture_1_overview.pdf

BEC013	**AUTOMOTIVE ELECTRONICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – basic Electrical & Electronics Engg				
	Course Designed by – Dept. of Electronics & Communication Engineering				

OBJECTIVES

- To facilitate the acquisition of the foundation skills in the process, tools and techniques in the Integrated Product Development area of the Engineering Services industry.

• To provide the requisite understanding towards application of academic topics from engineering disciplines into real world engineering projects.													
COURSE OUTCOMES (COs)													
CO1	Analyze various global trends and decide on the scope of a new product												
CO2	Outline the product development methodologies and management.												
CO3	Develop product management plan for a new product based on the type of the new product and development methodology.												
CO4	Summarize requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification.												
CO5	Conceptualize new product integrating the hardware, software, controls, electronics and mechanical systems.												
CO6	Understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					M				M		
	CO2	M	L	H					L				
	CO3	M			M					H			H
	CO4	L				H		M				M	
	CO5		L										
	CO6						H						
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
											√		
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I AUTOMOBILEELECTRICALSANDELECTRONICS 8

BasicElectricalComponentsandtheiroperationinanautomobile- Startingsystems,Charging systems–ignitionsystems- Electronicfuelcontrol-Environmentallegislationforpollution- Overviewof vehicle electronic systems-Power trainsubsystem-chassissubsystem-comfortand safetysubsystems.

UNIT II INTRODUCTIONTOEMBEDDEDSYSTEMS 8

Embedded Systemsdefinition- Components ofEmbeddedsystems–Microprocessor- ClassificationofMicroprocessors-Microcontrollers-Memory -Peripherals.Introductiontoan embeddedboard(TMS470based/ARM9based)forhandsonlabsessions(RISCprocessor based with standard peripherals /interfacesandI/Os)

UNIT III OPERATINGSYSTEMINEMBEDDEDENVIRONMENT 7

IntroductiontoOS- General Purpose OS,RTOS-,Kernel- Pre-emptive&Non pre-emptive, Scheduler,Interrupt-Interruptlatency andContextSwitchLatency-BoardSupportpackage,

Task- Multi-tasking,Tasksynchronization,Inter-task communication,Featuresof a typical embedded RTOS(µC/OS-II)

UNIT III INTEGRATEDDEVELOPMENTENVIRONMENT 8

IntegratedDevelopmentEnvironment(IDE)- Getting Started,Hardware/Software Configuration (Boot Service, Host– TargetInteraction),Booting, Reconfiguration, Managing IDE,TargetServers,Agents,Cross–Development,debugging-IntroductiontoanIDEforthe lab board– RTOS, PC based debugger.

UNIT IV EMBEDDEDSYSTEMINAUTOMOTIVEAPPLICATIONS 10

Engine Managementsystems- Diesel/Gasoline systems,Varioussensors used insystem- Vehiclesafety systems-electroniccontrolofbrakingandtraction-Introductiontocontrol elementsandcontrolmethodology-Electronictransmissioncontrol-Body electronics- Infotainmentsystems– Navigationsystems- system leveltests–Softwarecalibration using engine and vehicle dynamometers-Environmental tests for electroniccontrol units.

UNIT V EMBEDDEDSYSTEMCOMMUNICATIONPROTOCOLS 4

Introduction toControl networking- Communication protocols inembedded systems-SPI,I^2C, USB, -Vehiclecommunication protocols – Introduction to CAN, LIN, FLEXRAY, MOST, KWP2000-Details of CAN

REFERENCES:

1. R.K. Jurgen,"Automotive electronics handbook,McGrawHillInc, New Delhi,Second Edition,1999.
2. Paul Pop, Petru Eles, Zebo Peng, "Analysis and Synthesis of Distributed Real-Time Embedded Systems",Springer-Verlag US,2004.
3. B.KantaRao, "Embedded Systems", PHILearning Pvt.Ltd, 2nd Edition, 2011

NON MAJOR ELECTIVES-III(NE-III)

	VIRTUAL INSTRUMENTATION	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
BEI704	Prerequisite –. This includes interfacing a computer or microcontroller, such as the Arduino microcontroller, to various instruments for data acquisition and instrument control.				
	Course Designed by – Dept. of Electronics & Instrumentation Engineering				

OBJECTIVES

- To know about virtual versus traditional instruments, programming techniques
- To know about A/D and D/A converter and data acquisition.
- To know about PC buses, Instrumentation buses and network protocols.
- To design using VI software of controllers
- To know about PC operating system and instrumentation.

COURSE OUTCOMES (COs)

CO1	Define virtual instrumentation concepts.
CO2	Describe acquisition methodologies.
CO3	Compare traditional and virtual instrumentation.

CO4	Discuss operating systems required for virtual instrumentation.
CO5	Illustrate implementation methods for instrumentation.
CO6	Familiarize the basics and interfacing of VI

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H				H	M				M		
	CO2	M	L	H				M	L				
	CO3	M			H					H			H
	CO4	M										M	
	CO5		L										
	CO6						H						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT- I INTRODUCTION 9

Virtual Instrumentation - Definition and Flexibility - Block diagram and Architecture for Virtual Instruments versus Traditional Instruments Instrumentation -VI Programming techniques - VI, sub VI, Loop and Charts, Arrays, Clusters and Graphs, Case and Sequence Structures, Formula nodes, String and File Input / Output

UNIT- II DATA ACQUISTITION IN VI 9

A/D and D/A converters, Plug-in Analog Input / Output cards – Digital Input and Output Cards, Organization of the DAQ VI system – Opto-isolation – Performing analog input and analog output – Scanning multiple analog channels – Issues involved in selection of Data acquisition cards – Data acquisition modules with serial communication – Design of digital voltmeter with transducer input –Timers and Counters.

UNIT –III COMMUNICATION NETWORKED MODULES 9

Introduction to PC Buses – Local busses:- ISA, PCI, RS232, RS422 and RS485 – Interface Buses:- USB, PCMCIA, VXI, SCXI and PXI –Instrumentation Buses :- Modbus and GPIB – Networked busses – ISO/OSI Reference model, Ethernet and TCP/ IP Protocols.

UNIT- IV REAL TIME CONTROL IN VI 9

Designs using VI Software - ON/OFF controller – Proportional controller – Modeling and

basic control of level and reactor processes – Case studies on development of HMI, SCADA in VI

UNIT- V OPERATING SYSTEM AND HARDWARE OVERVIEW 9

PC architecture, current trends, operating system requirements, PC based instrumentation, analog and digital interfaces, PXI and SCXI main frame - modular instruments – Transducers – power, speed and timing considerations.

TEXT BOOKS:

1. LabVIEW Graphical Programming, Gary W. Johnson, Richard Jennings 3rd edition , McGraw-Hill Professional Publishing
2. Lisa K Wells, Lab view for Everyone‖, Prentice Hall of India.

REFERENCES:

1. Barry Paton, ―Sensor, transducers and Lab view‖, Prentice Hall of India 2000.
2. Buchanan, W. ―Computer buses‖, CRC Press 2000
3. https://www.ni.com/

BEE026	**MICRO ELECTRO MECHANICAL SYSTEMS**									**L**	**T**	**P**	**C**
	Total no of hours: 45									3	0	0	3
	Prerequisite-Study of electronic devices and circuits												
	Course Designed by – Dept. of Electrical & Electronics Engineering												
PURPOSE													
The objective of this course is to present the state of the art in the areas of semiconductor device physics and materials technology to enable the Nano electronics.													
COURSE OBJECTIVES													
CO1.	To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.												
CO2.	To educate on the rudiments of Micro fabrication techniques												
CO3.	To introduce various sensors and actuators												
CO4.	To introduce different materials used for MEMS												
CO5.	To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	L	H	M	M	L	L	L	L	L
	CO2	H	H	L	L	M	M	M	L	L	L	L	L
	CO3	H	H	L	L	H	M	M	L	L	L	L	L
	CO4	H	H	L	L	H	M	M	L	L	L	L	L
	CO5	H	H	L	L	H	M	M	L	L	L	L	L

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
							✓		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication – Silicon based MEMS processes – New Materials – Review of Electrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis – Flexural beam bending- Torsional deflection.

UNIT II SENSORS AND ACTUATORS-I 9

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers – Micro Motors – Thermal Sensing and Actuation – Thermal expansion – Thermal couples – Thermal resistors – Thermal Bimorph – Applications – Magnetic Actuators – Micromagnetic components – Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys.

UNIT III SENSORS AND ACTUATORS-II 9

Piezo resistive sensors – Piezo resistive sensor materials – Stress analysis of mechanical elements – Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors.

UNIT IV MICROMACHINING 9

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies – Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods – LIGA Process – Assembly of 3D MEMS – Foundry process.

UNIT V POLYMER AND OPTICAL MEMS 9

Polymers in MEMS– Polimide – SU-8 – Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon – Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TEXT BOOKS:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2000.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

REFERENCES:

1. Nadim Maluf," An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application," Springer, 2010.

BEE050	PROCESS CONTROL ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engg Mathematics-I, Control system, Measurement & Instrumentation.				
	Course Designed by – Dept. of Electronics & Instrumentation				

OBJECTIVES

To enable the students to learn the basic concepts of process control and to develop sufficient knowledge of the various control actions and design of controllers used to control any process.

COURSE OUTCOMES (COs)

CO1	Learn the basic control actions and. Compute the Mathematical Model for different process.
CO2	Analyse the characteristics of different types of Controllers and selection of controller.
CO3	Select ,design and tune a controller to suit a particular process
CO4	Identify the basic components of a final control element and distinguish the different Characteristics of control valve.
CO5	Understand and analyze the concept of multi loop control techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/ POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L		L				H			M
	CO2	M	H	M		L				M			M
	CO3	M	H	H		M				H			M
	CO4	H	M	M		L				M			M
	CO5	M	M	L		M				M			M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences(ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I MATHEMATICAL MODELLING OF PROCESS 9

Process control introduction – Need for process control –Hardware elements of a process control system – Need of Mathematical modelling –Mathematical model of level, pressure ,thermal processes and interacting and non-interacting systems– Servo and Regulator Operation – Batch & Continuous Process – Concept of self regulation– Dead time–Degrees of freedom –Linearization.

UNIT II VARIOUS CONTROLLERS AND ITS CHARACTERSTICS 9

Characteristics of ON- OFF, Single speed floating and PID controllers – Response of P,PI and PID controllers to various type of error signals – Analysis of Servo and Regulatory response of P and PI and PID controllers for first order and second order process – Reset Windup and prevention – Derivative and Proportional kick –Bumpless transfer – Selection of a controller for a particular process

UNIT III CONTROLLER DESIGN 9

Need for controller tuning –Evaluation criteria - Quarter Decay Ratio, IAE, ISE and ITAE– Optimum controller tuning using Evaluation criteria–Tuning of PID controllers using Process reaction curve method, Damped oscillation method and Z-N tuning method.

UNIT IV FINAL CONTROL ELEMENTS 9

I/P, P/I converters – Final control elements - Pneumatic and electric actuators -Types of control valves - Valve positioner and its importance - Inherent and Installed characteristics of control valve - Control valve sizing - Cavitation and flashing.

UNIT V MULTILOOP CONTROL 9

Feed-forward control – Ratio control – Cascade control – Inferential control – Split-range and introduction to multivariable control – Examples from distillation column and boiler systems – IMC– Model Predictive Control – Adaptive control – P&ID diagram.

TEXT BOOKS:

1. Stephanopoulos. G, “Chemical Process Control - An Introduction to Theory and Practice”, Prentice Hall of India, 2005.
2. Johnson .C.D, “Process Control Instrument Technology”, Prentice Hall Inc., 2004.

REFERENCES:

1. Bequette. B.W, “Process Control Modeling, Design and Simulation”, Prentice Hall of India, 2004.
2. Seborg. D.E, Edgar. T.F and Mellichamp. D.A, “Process Dynamics and Control”, Wiley

John and Sons, 2nd Edition, 2003.
3. Coughanowr, D.R, "Process Systems Analysis and Control", McGraw –Hill International Edition, 2004.
4. Harriott .P, "Process Control", Tata McGraw Hill, 2005.
5. http://nptel.ac.in/courses/103103037/

BEE022	**FIBER OPTICS AND LASER INSTRUMENTATION**	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite :Measurement and Instruments				
	Course Designed by – Dept of Electrical & Electronics Engineering				

OBJECTIVES

To contribute to the knowledge of Fiber optics and Laser Instrumentation and its Industrial and Medical Application.

COURSE OUTCOMES (COs)

CO1	To expose the students to the basic concepts of optical fibers and their properties
CO2	To provide adequate knowledge about the Industrial applications of optical fibers.
CO3	To expose the students to the Laser fundamentals.
CO4	To provide adequate knowledge about Industrial application of lasers.
CO5	To provide adequate knowledge about holography and Medical applications of Lasers.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M	H	M		M		H	L	L	M
	CO2	H	M	M	H	H		M		H	L	L	M
	CO3	H	M		H	H		M		H	L	L	M
	CO4	H	M		H	H		M		H	L	L	M
	CO5	H	M	M	H	H		M		H	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
							√		

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I OPTICAL FIBRES AND THEIR PROPERTIES 9

Principles of light propagation through a fiber - Different types of fibers and their properties, fiber Characteristics – Absorption losses – Scattering losses – Dispersion – Connectors and splices –Fiber termination – Optical sources – Optical detectors.

UNIT II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fiber optic sensors – Fiber optic instrumentation system – Different types of modulators – Interferometric method of measurement of length – Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – Three level and four level lasers – Properties of laser –Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers, semiconductor lasers.

UNIT IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, length, velocity, acceleration, current, voltage and Atmospheric effect – Material processing – Laser heating, welding, melting and trimming of material – Removal and vaporization.

UNIT V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography – Basic principle - Methods – Holographic interferometry and application, Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser and tissue interactive – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynecology and oncology.

TEXT BOOKS:

1. J.M. Senior, "Optical Fiber Communication – Principles and Practice", Prentice Hall of India,1 st edition,1985.
2. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2nd Edition,2001.

REFERENCES:

1. G. Keiser, 'Optical Fibre Communication', McGraw Hill,3rd edition, 1995.
2. John F. Read, 'Industrial Applications of Lasers', Academic Press, 1st edition,1978.
3. Monte Ross, 'Laser Applications', McGraw Hill, 1968

BBA005	**ENERGY ENGINEERING AND MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Management				
	Course Designed by – Department of Management studies				

OBJECTIVES	
To enlight the student in the field of energy engineering concern with energy efficiency, energy service and facility management	
COURSE OUTCOMES	
CO1	Understanding the different energy resources and their uses.
CO2	Understanding the different energy conservation techniques.
CO3	Understanding the impact of energy on environment
CO4	Understanding the energy Management
CO5	Understanding the Engineering Economics

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H				M	M					M
	CO2	H							M			M	
	CO3				H				M				
	CO4			M				H		H			M
	CO5		M			M						H	
	CO6			H									H
3	Category	Humanities & Sciences (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar/ Internship (PR)
										√			
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION TO ENERGY AND ENVIRONMENT 9

Definition – Fossil fuel reserves – Energy consumption – Green house effect, global warming – Renewable energy resources – Environmental aspects, utilization – energy prizes – Energy policies.

UNIT II ENERGY CONSERVATION 9

Need – different types of energy conservation schemes – industrial energy use – energy surveying and auditing – energy index – cost of energy – cost index-energy conservation in engineering and process industry in thermal systems, in buildings and non conventional energy resources schemes.

UNIT III ENERGY GENERATION BY TECHNOLOGY 9

Fuels and consumption – Boilers – Furnaces – Waste heat recovery systems – Heat pumps and refrigerators – Storage systems – Insulated pipe work systems – heat exchangers.

UNIT IV ENERGY MANAGEMENT 9

Energy management principles – energy resource management – energy management information systems – Instrumentation and measurement – Computerized energy management.

UNIT V ENGINEERING ECONOMICS 9

Costing techniques – Optimization cost – Optimal target investment schedules – Finance appraisal – Profitability – Project management.

REFERENCES:

1. W.R. Murphy and G. Mckay, Energy Management, Butterworths, London, 1982.
2. Callaghan P.W. Design and Management for Energy Conservation, Pergamon Press, Oxford,1993.

OPEN ELECTIVES-I(OE-I)

BBA004	**ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Management				
	Course Designed by – Department of Management studies				

OBJECTIVES

To know about engineering economics and cost analysis

COURSE OUTCOMES

CO1	To learn about introduction to economics
CO2	To learn about value engineering
CO3	To learn about cash flow.
CO4	To learn about economics of sampling and Replacement and Maintenance
CO5	To learn about depreciation and Evaluation of public alternatives.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H				M				M	
	CO2					H			M				H
	CO3		H				M			M			
	CO4							H					M
	CO5	M								H			

3	Category	Humanities & Sciences(HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Introduction –Economics Theories And Scope –Demand And Supply Analysis – Determinants of Demand –Law Of Demand – Elasticity Of Demand – Demand Forecasting – Demand Sensitivity –Price ,Income ,Gross ,Advertisement –Law Of Supply –Elasticity Of Supply –Cost Concepts –Types –Cost Curves –Short Run And Long Run –Break Even Analysis –Pricing Concepts –Types ,Price –Determinations.

UNIT II DEMAND & SUPPLY ANALYSIS 9

Concepts–Firm, Industry, Market, Market power, Market Conduct, Market Performance.

Market Structure- Types-Perfect Monopoly, Monopolistic and Oligopoly Competition. Manufacturing Practices-Diversification, Vertical and Horizontal Integration, Merger.

UNIT III PRODUCTION AND COST ANALYSIS 9

National Income: Concepts and Measurements –GNP, NNP- Methods of Measuring National Income-Inflation and Deflation, Unemployment.

Money and Banking: Value of Money-Banking-Commercial Banks and Its Function. New Economic Environment: Economic Systems –Economic Liberalization, Privatization and Globalization

UNIT IV PRICING 9

Introduction, Scope, Objectives, Basic Financial Concepts – Time Value Of Money And Method Of Appraising Project Profitability – Rate of Return –Pay Back Period – Percent Value, NPV Comparison – Cost – Benefit Analysis. Source of Finance – Internal And External –Long Term And Short Term – Securities, Debentures/ Bonds, Shares, Financial Institutions.

UNIT V FINANCIAL ACCOUNTING 9

Accounting System-Financial Statement – Types- Ledger, Cash Flow Statement Profit And Loss Account, Balance Sheet, Ratios/ Financial Analysis- Liquidity Leverage Activity, Profitability, Trends Analysis.

REFERENCES

1. Maheshwari S N "Management Accounting and Financial Accounting", S.Chand and-Company. 1993.
2. D N Drivedi, "Managerial Economics ", Vikas Publishing House.1980
3. R R Barthwal, Industrial Economics ",Wiley Eastern Ltd1996
4. G S Guptha, "Management Economics ",Tata McGraw Hill Ltd

BBA 008	**TOTAL QUALITY MANAGEMENT**										**L**	**T**	**P**	**C**
	Total Contact Hours - 45										3	0	0	3
	Prerequisite –Professional Courses													
	Course Designed by – Dept. of Masters of Business Administration													
	COURSE OUTCOMES (COs)													
CO1	Understand quality concepts and philosophies of TQM													
CO2	Apply TQM principles and concepts of continuous improvement													
CO3	Apply and analyze the quality tools, management tools and statistical fundamentals to improve quality													
CO4	Understand the TQM tools as a means to improve quality													
CO5	Remember and understand the quality systems and procedures adopted													
CO6	know prerequisites of evolution of total quality management and significance of quality gurus' works to the management of modern organizations.													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low														
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	

2	CO1	H					M				M		
	CO2	M	L	H					L				
	CO3	M			H					H			H
	CO4	M				L		M				L	
	CO5		L										
	CO6						H						
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Term Paper Seminar/ Internship (PR)
											√		
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT- I INTRODUCTION 9

Definition of Quality, Dimensions of Quality, Quality costs, Top Management Commitment, Quality Council, Quality Statements, Barriers to TQM Implementation, Contributions of Deming, Juran and Crosby, Team Balancing

UNIT- II TQM PRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Continuous Process Improvement,5S, Kaizen, Just-In-Time and TPS

UNIT –III STATISTICAL PROCESS CONTROL 9

The seven tools of quality, New seven Management tools, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Concept of six sigma.

UNIT- IV TQM TOOLS 9

Quality Policy Deployment (QPD), Quality Function Deployment (QFD), Benchmarking, Taguchi Quality Loss Function, Total Productive Maintenance (TPM), FMEA

UNIT- V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9001:2008 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, ISO 14001:2004

TEXT BOOKS:

1. Dale H.Besterfiled, "Total Quality Management", 3rd edition 2011 Pearson Education
2. James R.Evans & William M.Lidsay, ―"The Management and Control of Quality", 9th Edition South-Western (Thomson Learning),

REFERENCES:

1. Feigenbaum.A.V. ―Total Quality Management; 4 edition (August 1, ǁ, McGraw-Hill Professional

2. Oakland.J.S. ―Total Quality Management‖,, 3rd Edition, 2003. Butterworth – Hcinemann ltdOxford
3. https://open.library.ubc.ca/cIRcle/collections

BBA001	PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management Studies				

OBJECTIVES

- Familiarize the students with the fundamental concepts of Management and to highlight the approaches in organization behavior

COURSE OUTCOMES (COs)

CO1	Understanding the concepts of Management
CO2	Knowledge on Management Functions
CO3	Understanding the Organization Theory & Approach.
CO4	Knowledge on the Concepts of Motivation
CO5	Clear insight on the factors contributing to discipline
CO6	In-depth Understanding about the concepts of Group Behavior

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					H					H	
	CO2		H		M					H			
	CO3	M							M		H		
	CO4			M	H							H	
	CO5							M					
	CO6				H								L

3	Category	Humanities & Sci-ences(HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT –I NATURE OF MANAGEMENT 9

Definition – theory and practice – effective management – Management : Science of Art – Management in India. Development of Management thoughts – Taylor's – Henry Fayol – Hawthrone experiment – Barnard & Social system – Herbert Simon – Peter Drucker – Various approaches – Management thoughts.

UNIT- IIMANAGEMENT PROCESS 9

Co-ordination – Functions of management – Managers and environment – External and internal Business Ethics – Planning – Fundamentals – Definitions & Features – Steps in planning – types of planning – Objectives – Concepts and features – Hierarchy of objectives – role – Process of MBO – Policy & Strategy – Decision making process – Individual Vs Group Decisions.

UNIT- III ORGANIZATION STRUCTURE 9

Organizing – Theory & Approach –Authority & Responsibility – Delegation – Centralization & Decentralization – Line & Staff Relationship – Staffing – Fundamentals – System approach – Manpower Planning – Recruitment & Selection – Training and development – Performance appraisal – Direction – Fundamentals Motivation – Theories of Motivation-Maslow's Hersberg's MaClelland's theory X,Y & Z leadership – Theories and Styles – Communication – Type – Controlling – System and Process.

UNIT- IV ORGANIZATIONAL BEHAVIOUR 9

Definition – Organization – Managerial Role and Functions – Organizational Approaches, Individual behaviour – Causes – Environmental effect – Behaviour and performance, perception – Organizational implications, Personality – Contributing factors – Dimension, Motivation – Need Theories – Process Theories – Job satisfaction, Learning and Behaviour – Learning Curves, Work Design and Approaches.

UNIT –VGROUPBEHAVIOUR 9

Groups – Contributing factors –Group Norms, types – Causes – Intergroup relations – Conflict and Resolution – Change Process –Resistance to change.

TEXT BOOKS:

1. Herald Knootz and Heinz weihrich, 'Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition, 2004.
2. Ties AF, Stoner and R. Edward Freeman, "Management" Prentice Hall of India Pvt. Ltd., New Delhi -110011, 1995.

REFERENCE BOOKS :

1. Joseph I. Massie 'Essentials of Management', Prentice Hall of India Pvt. Ltd,New Delhi - 110011, 2004.
2. L.M. Prasad "Principles and Practice of Management", Sultan Chand & Sons.2001
3. Uma Sekaran, "Organizational Behaviour", Tata McGraw Hill, 2007.
4. https://www.extension.harvard.edu

BEE031	**WEB DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – fundamentals of C & C++				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

- The purpose of the course is to provide the knowledge and skills to build creative, interactive, and well-designed Web sites.
- To balance the technical skills with artistic skills to create web pages that are conceptually interesting, easily navigable, visually pleasing, and functional with web publishing tools and Graphics programs including Dreamweaver, Photoshop and Flash.

COURSE OUTCOMES (COs)	
CO1	To understand the principles of creating an effective web page, including an in-depth consideration of information architecture.
CO2	To design, create, and maintain of web pages and websites with various multi-media elements.
CO3	To develop skills in developing web site with Dream weaver
CO4	To draw and create symbols in Flash for providing interactivity with the user
CO5	To understand basics of Photoshop and incorporate the artistic skills by applying various brushes and filters

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M				L				M			
	CO2	M								M			
	CO3												
	CO4												
	CO5									M			

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I WEB DESIGN INTRODUCTION 9

Environment and Tools –Web Publishing Fundamentals –Planning a Website

UNIT II WEB DESIGN – CONCEPTS 9

Typography and Images –Multimedia Elements –Promoting and maintaining a Website

UNIT III DREAM WEAVER 9

Getting Started –Developing a web page –Working with Text and CSS –Adding Images – Working with Links and Navigation –Managing a Web Server and files

UNIT IV FLASH 9

Getting Started –Drawing objects –Working with Symbols – Creating Animations

UNIT V PHOTOSHOP 9

Photoshop Basics –Working with Layers –Making Selections –Incorporating Color Techniques – Brushes –Filters –Placing Type in an Image

TEXT BOOKS

1. Gary B.Shelly, H.Albert Napier, Ollie N. Rivers, “Web Design: Introductory Concepts and Techniques”, Course Technology, Cengage Learning, Third Edition, 2009.
2. Sherry Bishop , James E. Shuman , Elizabeth Eisner Reding, “The Web Collection Revealed Premium Edition: Adobe Dreamweaver CS5, Flash CS5 and Photoshop CS5”, DELMAR,Cengage Learning, 2010.

REFERENCES

1. Tom Negrino, Dori Smith, “Dreamweaver CS5 for Windows and Macintosh: Visual QuickStart”, Peachpit Press, 2010.
2. Elaine Weinmann, Peter Lourekas, “Photoshop CS5 for Windows and Macintosh: Visual QuickStart”, Peachpit Press, 2010.
3. Katherine Ulrich, “Flash CS5 Professional for Windows and Macintosh: Visual QuickStart”, Peachpit Press, 2011.
4. https://teamtreehouse.com/tracks/web-design

BEE046	**JAVA PROGRAMMING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Fundamentals of Computing				
	Course Designed by – Dept of Electrical & Electronics Engineering				

OBJECTIVES

To enable the students to becomes as java professional and able to work in real time environment.

COURSE OUTCOMES (COs)

CO1	Understand fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
CO2	Have the ability to write a computer program to solve specified problems.
CO3	Understand fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
CO4	Understand the basics of event handling, swing components and exception handling.
CO5	Understand the basics of Multi-threaded programming

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1									M			L
	CO2									M			L
	CO3									M			L
	CO4									M			L
	CO5									M			L

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO OBJECT ORIENTED PROGRAMMING 9

Object oriented programming concepts – objects – classes – methods and messages – abstraction and encapsulation – inheritance – abstract classes – polymorphism.- Objects and classes in Java – defining classes – methods - access specifiers – static members – constructors – finalize method

UNIT II INHERITANCE 9

Arrays – Strings - Packages – Java-Doc comments –- Inheritance – class hierarchy – polymorphism – dynamic binding – final keyword – abstract classes

UNIT III GRAPHICS PROGRAMMING 9

The Object class – Reflection – interfaces – object cloning – inner classes – proxies - I/O Streams - Graphics programming – Frame – Components – working with 2D shapes.

UNIT IV JAVA SWING 9

Basics of event handling – event handlers – adapter classes – actions – mouse events – AWT event hierarchy – introduction to Swing – Model-View-Controller design pattern – buttons – layout management – Swing Components – exception handling – exception hierarchy – throwing and catching exceptions.

UNIT V GENERIC PROGRAMMING&MULTITHREADING 9

Motivation for generic programming – generic classes – generic methods – generic code and virtual machine – inheritance and generics – reflection and generics - Multi-threaded programming – interrupting threads – thread states – thread properties – thread synchronization – Executors – synchronizers.

TEXT BOOKS

1. Cay S. Horstmann and Gary Cornell, "Core Java: Volume I – Fundamentals", Eighth Edition, Sun Microsystems Press, 2008.
2. K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education, 2000.

REFERENCES:

1. Timothy Budd, "Understanding Object-oriented programming with Java", Updated Edition, Pearson Education, 2000.
2. C. Thomas Wu, "An introduction to Object-oriented programming with Java", Fourth Edition, Tata McGraw-Hill Publishing company Ltd., 2006.
3. http://www.tutorialspoint.com/java/java_overview.htm

OPEN ELECTIVE-II(OE-II)

BBA007	ENGINEERING ECONOMICS AND COST ANALYSIS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Management, Engineering				
	Course Designed by – Department of Management studies				

OBJECTIVES	
To know aboutengineering economics and cost analysis.	
COURSE OUTCOMES (COs)	
CO1	To learn about theintroduction to economics
CO2	To learn about the value engineering
CO3	To learn about the cash flow.
CO4	To learn about the Replacement and Maintenance analysis.
CO5	To learn about the depreciation and Evaluation of public alternatives.
CO6	To learn about the Break-even analysis

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H				M				M	
	CO2					H			M				H
	CO3		H				M			M			
	CO4							H					M
	CO5	M								H			
	CO6				M				M			H	

3	Category	Humanities & Sci-ences(HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO ECONOMICS 8

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT II VALUE ENGINEERING 10

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recov-

ery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW 9

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION 9

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TEXT BOOKS

1. Panneer Selvam, R, Engineering Economics, Prentice Hall of India Ltd, New Delhi, 2001.

REFERENCES

1. Chan S.Park, Contemporary Engineering Economics, Prentice Hall of India, 2002.
2. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2002
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, Engineering Economy, Macmillan, NewYork, 1984.
4. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, Principles of Engineering Economy, Ronald Press, New York,1976.
5. Smith, G.W., Engineering Economy, Lowa State Press, Iowa, 1973.

BBA002	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management Studies				

OBJECTIVES

- To learn about types of entrepreneurship.
- To study about major motivation methods.
- To study about government policies for small scale industries.

COURSE OUTCOMES (COs)

CO1	To learn the difference between entrepreneur and intrepreneur.
CO2	To learn about entrepreneurship development programs.

CO3	To study about economic feasibility methods
CO4	To learn about taxation.
CO5	To study about corrective measures methods.
CO6	To know about the Factors Affecting Entrepreneurial Growth

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		M			H		M				
	CO2				M			H			M		
	CO3												H
	CO4					H						M	
	CO5		H							M			
	CO6				M		H				H		M

3	Category	Humanities & Sciences (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I ENTREPRENEURSHIP 8

Entrepreneur- Types of Entrepreneurs - Difference Between Entrepreneur and Interpreneur- Role of Entrepreneurship in Economic Growth- Women and Rural Entrepreneurship - Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION 8

Major Motives Influencing Entrepreneur – Achievement Motivation Training, Self Rating – Business Game – Thematic Apperception Test – Stress Management – Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9

Small Enterprise – Definition, Classification – Characteristics- Ownership Structure – Project Formulation – Steps Involved in Setting up a Business – Identifying, Selecting a Good Business Opportunity- Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports- Project Appraisal- Sources of Information- Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 10

Need – Sources of Finance- Terms Loans, Capital Structure- Financial Institutions, Management of Working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/ CPM –Taxation – Income Tax – Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 10

Sickness in Small Business- Concept, Magnitude, Causes and Consequences, Corrective Measures- Government Policy for Small Scale Enterprises- Growth Strategies in Small Industry – Expansion- Diversification, Joint Venture, Merger, Sub Contracting.

TEXT BOOKS

1. S.S.Khanka, "Entrepreneurial Development", S. Chand & Co. Ltd., Ram Nagar, New Delhi, 1999.
2. Hisrich RD and Peters MP, "Entrepreneurship", 5th Edition, Tata McGraw Hill, 2002.

REFERENCES

1. Rabindra Kanungo, "Entrepreneurship and Innovation" , Sage Publications, New Delhi
2. ED II. Faculty & External Experts-A Hand book for New Entrepreneurs Publishers: Entrepreneurial Development, Institute of India, and Ahmedabad, 1986.

	MARKETING MANAGEMENT	L	T	P	C
BBA003	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management				

OBJECTIVES

- To learn about consumer marketing.
- To study about demographic factors.
- To study about retailing process

COURSE OUTCOMES (COs)

CO1	To learn marketing concepts of industry and consumer.
CO2	To learn about demographic factors.
CO3	To study about pricing methods.
CO4	To learn about portfolio analysis.
CO5	To study about advertising and sales methods.
CO6	To understand Buyer Behavior and Market Segmentation

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		H								M		
	CO2			M					H				
	CO3				H			M					
	CO4						H			M			
	CO5					M					H		
	CO6	H										H	M

3	Category	Humanities & Sci-ences (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Definition- Marketing Process- Dynamics- Needs- Wants and demands-Marketing Concepts- Environment- Mix- Types- Philosophies- Selling Vs Marketing- Organizational- Industrial Vs Consumer Marketing- Consumer Goods- Industrial Goods- Product Hierarchy.

UNIT II BUYING BEHAVIOUR &MARKET SEGMENTATION 9

Cultural- Demographic Factors- Motives- Types- Buying Decisions- Segmentation factors- Demographic- Psychographic & Geographic Segmentation- Process- Patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives- Pricing- Decisions & Pricing Methods- Pricing Management- Introduction- Uses- Process of Marketing Research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan- Strategy formulation and marketing process- Implementation- Portfolio analysis- BCG- GEC grids.

UNIT V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics- Impact- Goals- Types- Sales promotion- Point of Purchase- Unique selling proposition- Characteristics- Whole selling- Retailing- Channel Design- Logistics- Modern trends in retailing.

TEXT BOOKS:

1. Ramasamy and Nama Kumari, "Marketing Environment: Planning, implementation and control the Indian context",2002
2. Govindarajan.M, "Industrial marketing management:", Vikas Publishing Pvt. Ltd, 2003

REFERENCES:

1. Philip Kotler, Marketing Management, Analysis, Planning, Implementation and control, 1998.
2. Khanna O.P. – Industrial Engineering and Management, Khanna Publishers, New Delhi, 2000.
3. Green Paul.E and Donald Tull, "Research for marketing decisions", Prentice Hall of India. 1995
4. Donald S. Tull and Hawkins, "Marketing Research", Prentice Hall of India- 1997

BEE029	CLOUD COMPUTING	L	T	P	C
	Total Contact hours : 45	3	0	0	3

	Prerequisite- Fundamentals of Computing
	Course Designed by – Dept. of Electrical & Electronics Engineering

OBJECTIVE

This course gives an introduction to cloud computing and its techniques, issues, and its services that will lead to design and development of a simple cloud service.

COURSE OUTCOME

1.	To analyze the components of cloud computing and its business perspective.
2.	To evaluate the various cloud development tools
3.	To collaborate with real time cloud services.
4.	To analyze the case studies to derive the best practice model to apply when developing and deploying cloud based applications.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	L	H	M	M	L	L	L	L	L
	CO2	H	H	L	L	M	M	M	L	L	L	L	L
	CO3	H	H	L	L	H	M	M	L	L	L	L	L
	CO4	H	H	L	L	H	M	M	L	L	L	L	L

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CLOUD INTRODUCTION 9

Cloud Computing Fundamentals: Cloud Computing definition, Types of cloud, Cloud services: Benefits and challenges of cloud computing, Evolution of Cloud Computing , usage scenarios and Applications , Business models around Cloud –Major Players in Cloud Computing - Issues in Cloud - Eucalyptus - Nimbus – OpenNebula, CloudSim.

UNIT II CLOUD SERVICES AND FILE SYSTEM 9

Types of Cloud services: Software as a Service - Platform as a Service –Infrastructure as a Service - Database as a Service - Monitoring as a Service –Communication as services. Service providers- Google App Engine, Amazon EC2,Microsoft Azure, Sales force. Introduction to Map Reduce, GFS, HDFS, Hadoop Framework.

UNIT III COLLABORATING WITH CLOUD 9

Collaborating on Calendars, Schedules and Task Management – Collaborating onEvent Management, Contact Management, Project Management – Collaborating on Word Processing,

Databases – Storing and Sharing Files- Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Collaborating via Social Networks – Collaborating via Blogs and Wikis.

UNIT IV VIRTUALIZATION FOR CLOUD 9

Need for Virtualization – Pros and cons of Virtualization – Types of Virtualization –System Vm, Process VM, Virtual Machine monitor – Virtual machine properties -Interpretation and binary translation, HLL VM - Hypervisors – Xen, KVM ,VMWare, Virtual Box, Hyper-V.

UNIT V SECURITY, STANDARDS, AND APPLICATIONS 9

Security in Clouds: Cloud security challenges – Software as a Service Security, Common Standards: The Open Cloud Consortium – The Distributed management Task Force – Standards for application Developers – Standards for Messaging –Standards for Security,

TEXT BOOKS

1. Bloor R., Kanfman M., Halper F. Judith Hurwitz "Cloud Computing for Dummies" (Wiley India Edition),2010
2. John Rittinghouse & James Ransome, "Cloud Computing Implementation Management and Strategy", CRC Press, 2010.
3. Antohy T Velte ,Cloud Computing : "A Practical Approach", McGraw Hill,2009.
4. Michael Miller, Cloud Computing: "Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, August 2008.
5. James E Smith, Ravi Nair, "Virtual Machines", Morgan Kaufmann Publishers, 2006.
6. http://cloud-standards.org/wiki/index.php?title=Main_Page

REFERENCES

1. Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing", Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008
2. webpages.iust.ac.ir/hsalimi/.../89.../Cloud%20Common%20standards.pptopennebula.org,
3. www.cloudbus.org/cloudsim/, http://www.eucalyptus.com/
4. http://hadoop.apache.org/docs/stable/hdfs_design.html
5. http://static.googleusercontent.com/external_content/untrusted_dlcp/research. google.com/en//archive/mapreduce-osdi04.pdf

BEE030	**CYBER SECURITY**	**L**	**T**	**P**	**C**
	Total Contact Hours-45	3	0	0	3
	Prerequisite – Fundamentals of Computing				
	Course Designed by – Dept. of Electrical & Electronics Engineering				

OBJECTIVES

The proliferation of Internet has impacted the lives of people in all professions. Equally, they are also prone to get attacked by hackers and intruders and eventually lose their privacy. Naïve users of Internet, without proper awareness and implications carry out communication in the cyber world. Therefore, it becomes indispensable for every individual to gain knowledge in the fundamentals of cyber security, best practices related to cyber security and legal implications of intruding in the privacy of others. This necessitates the need for this course on Cyber Security.

COURSE OUTCOMES (COs)

CO1	Understand the need for Cyber security and its related threats and attacks.
CO2	Learn methods to become secure in the cyber world and securely communicate in the cyber world.
CO3	Become knowledgeable about the best practices related to cyber security, regulations and laws associated with the same.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		M	M		M	M	M			H	L	M
	CO2		M	M		H	M	M		M	M	M	M
	CO3		M			H	H	M			M	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
								X	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I NEED FOR CYBER SECURITY 9

Introduction to security- CIA triad-Case studies- security attacks-issues related to social networking - Guidelines

UNIT II METHODS TO SECUREYOURSELF IN THE CYBER WORLD 9

Why and What of Reversible and Irreversible Cryptographic mechanisms? - Applications of Digital Signature - Good password practices

UNIT III E-COMMERCE: SECURE TRANSACTIONS 9

What is E-commerce? – Online banking security- Online shopping fraud-Guidelines and Recommendations

UNIT IV EVERYDAY SECURITY 9

Connecting your laptop, mobile devices, PDAs to Internet-Managing your browser-Facebook Security-E-mail security – Safe guarding from Viruses: Antiviruses– Best practices and guidelines

UNIT V CYBER SECURITY LAWS AND COMPETENT AUTHORITIES 9

Indian IT Act, 2008 - What is Cyber Forensics? – Functions of cybercrime cell – Responding to a cyber attack

REFERENCES

1. "Information Security Awareness Handbook, ISEA, Department of Electronics and Information Technology", Government of India, 2010
2. deity.gov.in/sites/upload_files/dit/.../itact2000/it_amendment_act2008.pdf
3. www.schneier.com/blog/archives/2013/03/browser_securit.html
4. www.dhses.ny.gov/ocs/awareness-training-events/news/2010-03.cfm

5. https://www.watsonhall.com/e-commerce-security/

B.TECH – AUTOMOBILE ENGINEERING

CURRICULUM AND SYLLABUS

CHOICE BASED CREDIT SYSTEM

I – VIII SEMESTERS

I-SEMESTER						
THEORY						
Sub Code	**Category**	**Subject**	**L**	**T**	**P**	**C**
BEN101	HS	English – I	3	1	0	3
BMA101	BS	Mathematics – I	3	1	0	3
BPH101	BS	Engineering Physics – I	3	0	0	3
BCH101	BS	Engineering Chemistry – I	3	0	0	3
BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
BBA101	HS	Personality Development (Civil, Mechanical and Bio branches)	1	2	0	2
BBT 102	BS	Biology for Engineers (Civil & Mechanical branches)	2	0	0	2
BCE101	ES	Basic Civil Engineering (Mechanical & Bio Engineering Branches)	2	0	0	2
BME102	ES	Engineering Graphics – E (Civil, Mechanical & Aeronautical Engineering)	2	4	0	4
PRACTICAL						
BCM1L1	ES	Basic Civil and Mechanical Engineering Practices Laboratory (Civil, Mechanical and Bio Branches)	0	0	3	1
BSS1L4/1L5/1L6	HS	NCC/NSS/NSO to be conducted during weekends				1
Total No. of Contact Hours: 33		**Total No. of Credits: 27**				

II-SEMESTER						
THEORY						
Sub Code	**Category**	**Subject**	**L**	**T**	**P**	**C**
BEN201	HS	English – II	3	1	0	3
BMA201	BS	Mathematics – II	3	1	0	3
BPH201	BS	Engineering physics – II	3	0	0	3
BCH201	BS	Engineering Chemistry – II	3	0	0	3
BFI201#	HS	Foreign/Indian Language	3	0	0	3
BME202	ES	Engineering Mechanics (Civil & Mechanical Branches)	3	1	0	3
BEE201*	ES	Basics Electrical and Electronics Engineering (Civil, Mechanical & Bio Engineering Branches)	2	0	0	2
PRACTICAL						
BCS2L2	ES	Computer Practices Lab (Civil, Mech & Bio)	0	0	3	1
BEE2L1	ES	Basic Electrical and Electronics Engineering Practices	0	0	3	1
BPC2L1	BS	Physics and Chemistry Laboratory	0	0	3/3	1
BSS2L7	HS	Yoga to be conducted during weekends				1
Total No. of Contact Hours: 32		**Total No. of Credits: 24**				

Any one of the following courses: BFR201 – French, BGM201 – German, BJP201- Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 - Tamil

*Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)

III SEMESTER						
THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BMA301	BS	Mathematics – III	3	2	0	4
BAM301	PC	Solid Mechanics	4	0	0	4
BAM302	PC	Automotive Petrol engines	3	0	0	3
BAM303	PC	Engineering Thermodynamics	4	0	0	4
BAM304	PC	Engineering Fluid Mechanics	3	0	0	3
BAM305	PC	Production Technology	3	0	0	3
PRACTICAL						
BAM 3L1	PC	Automotive Parts and Assembly Drawing	0	0	3	2
BCE3L2	PC	Fluid Mechanics and Strength of Materials Lab	0	0	3	2
Total No. of Contact Hours: 28			**Total No. of Credits: 25**			

IV SEMESTER						
THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BMA402	BS	Numerical Methods	3	2	0	4
BAM401	PC	Theory of Machines	4	0	0	4
BAM402	PC	Automotive Chassis	3	0	0	3
BAM403	PC	Automotive Diesel Engines	3	0	0	3
BAM404	PC	Automotive Electrical Systems	3	0	0	3
BCE406	HS	Environmental Studies	3	0	0	3
PRACTICAL						
BAM4L1	PC	Automotive Engine Components Laboratory	0	0	3	2
BAM4L2	PC	Engine Testing and Emission Measurement Lab	0	0	3	2
BAM4L3	PC	Automotive Electrical Lab	0	0	3	2
BAM4S1	PR	Technical Seminar- I	0	0	2	1
Total No. of Contact Hours: 32			**Total No. of Credits: 27**			

V SEMESTER						
THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BAM501	PC	Computer Control of Vehicle Systems	3	0	0	3
BAM503	PC	Automotive Transmission	4	0	0	4
BAM504	PC	Electronics & Instrumentation	3	0	0	3
BAM505	PC	Engineering Design for Automobile Engineers	4	0	0	4
BBA501	HS	Value Education and Professional Ethics	3	0	0	3
	CE	Core Elective-I	3	0	0	3
PRACTICAL						
BAM5L1	PC	Automotive Chassis Components Laboratory	0	0	3	2
BME5L1	PC	Machine Shop Practice	0	0	3	2
BEC5L1	PC	Automotive Electronics and Microprocessor Lab	0	0	3	2
BAM5C1	PR	Comprehension I	0	0	0	1
Total No. of Contact Hours: 29		**Total No. of Credits: 27**				

VI SEMESTER						
THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BAM601	PC	Vehicle Dynamics	4	0	0	4
BAM602	PC	Electronic Engine Management System	3	0	0	3
BAM603	PC	Instrumentation and Experimental Techniques	3	0	0	3
BAM604	PC	Automotive Aerodynamics	4	0	0	4
	CE	Core Elective-II	3	0	0	3
	NE	Non Major Elective-I	3	0	0	3
PRACTICAL						
BAM6L1	PC	Autotronics Lab	0	0	3	2
BAM6L2	PC	Vehicle Dynamics Lab	0	0	3	2
BAM6S1	PR	Technical Seminar II	0	0	2	1
Total No. of Contact Hours: 28		**Total No. of Credits: 25**				

VII SEMESTER						
THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BAM701	PC	Vehicle Maintenance	3	0	0	3
BAM702	PC	Vehicle Body Engineering	3	0	0	3
BAM703	PC	Vehicle Design	4	0	0	4
	CE	Core Elective-III	3	0	0	3
	NE	Non Major Elective-II	3	0	0	3
	OE	Open Elective-I	3	0	0	3
PRACTICAL						
BAM7L1	PC	Vehicle Maintenance Lab	0	0	3	2
BME7L2	PC	CAD/CAM Lab	0	0	3	2
BAM7P1	PR	Term Paper	0	0	4	2
BAM7V1	PR	Inplant Training [End of 6th Semester 15 Days]	0	0	0	1
Total No. of Contact Hours: 29		**Total No. of Credits: 26**				

VIII SEMESTER						
THEORY						
Sub. Code	**Category**	**Subject Name**	**L**	**T**	**P**	**C**
BAM8E1	NE	Non Major Elective-III	3	0	0	3
BAM8E2	OE	Open Elective-II	3	0	0	3
PRACTICAL						
BAM8C1	PR	Comprehension II	0	0	0	1
BAM8P1	PR	Project Work	0	0	18	9
Total No. of Contact Hours: 24		**Total No. of Credits: 16**				

OVERALL CREDITS: 197

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	6	7	-	3	3	-		-	19	9.64
2	Basic Sciences (BS)	11	10	4	4	-	-	-	-	29	14.72
3	Engineering Sciences (ES)	10	7	-		-	-	-	-	17	8.63
4	Professional Core (PC)	-	-	21	19	20	18	14		92	46.70
5	Core Electives (CE)	-	-	-	-	3	3	3		9	4.57
6	Non major Electives (NE)	-	-	-	-	-	3	3	3	9	4.57
7	Open Electives (OE)	-	-	-	-	-	-	3	3	6	3.05
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-		1	1	1	3	10	16	8.12
	Total Credit	27	24	25	27	27	25	26	16	197	100%
	Total Contact Hour	33	32	28	32	29	28	29	24	235 Hrs	

LIST OF ELECTIVES

Code No.	Course Title	L	T	P	C
Core Elective (CE)-I					
BAM014	Advanced Theory of IC Engines	3	0	0	3
BAM002	Finite Element Methods	3	0	0	3
BAM017	Special Type of Vehicles	3	0	0	3
Core Elective (CE)-II					**C**
BAM001	Computer Simulation of IC Engine Processes	3	0	0	3
BAM010	Product Design	3	0	0	3
BAM003	Two and Three Wheelers	3	0	0	3
Core Elective (CE)-III					
BAM004	Simulation of Vehicle Systems	3	0	0	3
BAM019	Computer Aided Design and Drafting	3	0	0	3
BAM018	Hybrid Electric and Fuel cell vehicles	3	0	0	3
Non Major Elective (NE)-I					
BAM008	Modern Manufacturing Process	3	0	0	3
BAM006	Noise Vibration and Harshness	3	0	0	3
BAM021	Industrial Engineering	3	0	0	3
BAM016	Vehicle Air Conditioning Systems	3	0	0	3
Non Major Elective (NE)-II					
BAM007	Computer Integrated Manufacturing Systems	3	0	0	3
BAM015	Automotive Safety	3	0	0	3
BAM013	Quality Control and Reliability Engineering	3	0	0	3
BAM020	Measurements & Metrology	3	0	0	3
Non Major Elective (NE)-III					
BAM009	Robotics for Automobile Engineers	3	0	0	3
BAM005	Tyre Technology	3	0	0	3
BAM011	Operation Research for Automobile Engineers	3	0	0	3
BAM012	Transport management and Motor Industry	3	0	0	3
Open Elective (OE)-I					
BBA001	Principles of Management and Organizational Behaviour	3	0	0	3
BBA002	Entrepreneurship Development	3	0	0	3
BBA003	Marketing Management	3	0	0	3
Open Elective (OE)- II					
BBA004	Engineering Economics and Financial Accounting	3	0	0	3
BBA005	Total Quality Management and Reliability Engineering	3	0	0	3
BBA006	Indian Constitution and Society	3	0	0	3

BEN101	ENGLISH - I	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Dept of English				

OBJECTIVES

To make the students learn the basic modes of communication for fluency and attainment of confidence in speech, reading and writing.

COURSE OUTCOMES (COs)

CO1	Understand the importance of being responsible, logical, and thorough.
CO2	Respond to the situations where short reports and instructions are required.
CO3	Explain "how things work", and what to suggest when "things don't work
CO4	Develop our confidence and authority in the practical use of language.
CO5	Understand the importance of being responsible, logical, and thorough.
CO6	e to Face interviews and competitive examinations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H	H	M	L	L	H	H	H	H
	CO2							L					
	CO3	H						H		H			H
	CO4	H	M				M	L	H	H			H
	CO5							L					
	CO6	H		H	H	H	H	L		H	H	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I STRUCTURES 12

Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT IITRANSCODING 12

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT IIIREPORTING 12

Degrees of comparison – Positive, Comparative, Superlative - questions- SI units -Lab reports - Physics chemistry, workshop and Survey report for introducing new product in the market.

UNIT IVFORMAL DOCUMENTATION **12**

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT VMETHODOLOGY **12**

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives , prepositional relatives.

TEXT BOOK

1. Department Of Humanities and Social Sciences Division, Anna University, Oxford University Press, 2013.

REFERENCES:

1. S.P.Danavel, English and Communication for Students of Science and Engineering, Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007.
3. Murali Krishna and Sunitha Moishra, Communication Skills for Engineers . Pearson, New Delhi, 2011.

BMA101	**MATHEMATICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – + 2 Level Mathematics				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To make the students learn Mathematics in order to formulate and solve problems effectively in t respective fields of engineering.

COURSE OUTCOMES (COs)

CO1	Study the fundamentals of mathematics
CO2	Students learn multiple integral techniques
CO3	Students gain knowledge in application of variables
CO4	Find area and volume based on a function with one or more variables.
CO5	Apply matrix operations to solve relevant real life problems in engineering.
CO6	Formulate a mathematical model for three dimensional objects and solve

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2			M		H							
	CO3		H				M						
	CO4								L				
	CO5							H			L		

	CO6											L	
3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)				
			√										
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT-1 MATRICES

Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes- Envelopes- Applications of Evolutes and Envelopes.

UNIT 1V FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives- Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobians- Taylor's expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates- Area as double integral- Volume as triple integral.

TEXT BOOK:

1. Ravish R.Singh and Mukkul Bhatt, "Engineering Mathematics-I" First Reprint, Tata McGraw Hill Pub Co., New Delhi. 2011.
2. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi. 2007.

REFERENCES:

1. Ramana.B.V. "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, "Advanced Engineering Mathematics", 7thEdition, Pearson Education, 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons, New York, 2003.

4. Murray R.Spiegel, "Advanced Calculus", Schaum's Outline Series, First Edn, McGraw Hill Intl Book Co.,New Delhi, 1981.

PH101	ENGINEERING PHYSICS I	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES:
To enhance the fundamental knowledge in Physics and its applications relevant to various stream Engineering and Technology

COURSE OUTCOMES (COs)

CO1	Understand the Principles and Laws of Physics
CO2	To understand the impact of Crystal Physics
CO3	Learn the Properties of Elasticity and Heat transfer.
CO4	Acquire Knowledge on Quantum Physics.
CO5	Understand the concepts on Laser & Ultrasonic's and its Applications
CO6	Understand the Principle of Laser and its Applications in Engineering and Medicine.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	A	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M			H		
	CO2		L	H		M				M		L	H
	CO3												
	CO4	H		M	L						L		M
	CO5		L	L								L	L
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity-Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress - strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion –Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO2, Semiconductor lasers (homo junction & hetero junction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TEXT BOOKS:

1. Jayaraman D Engineering Physics I. Global Publishing House, 2014.
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai Publishers, 2009.
4. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
4. http://ocw.mit.edu/courses/find-by-topic
5. http://nptel.ac.in/course.php?disciplineId=122
6. https://en.wikipedia.org/wiki/Engineering_physics

BCH101	ENGINEERING CHEMISTRY - I	L	T	P	C
		3	0	0	3
	Prerequisite – +2 Level Chemistry				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving the different

application oriented topics required for all engineering branches.	
COURSE OUTCOMES (COs)	
CO1	Understand the principles of water characterization and treatment for portable and industrial purposes.
CO2	To impart knowledge on the essential aspects of Principles of polymer chemistry and engineering applications of polymers
CO3	Having a sound knowledge in the Field of the Conventional and non-Conventional energy
CO4	To impart knowledge on the essential aspects of electrochemical cells, emf and applications of EMF measurements
CO5	To make the students understand the Principles of corrosion and corrosion control .
CO6	To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I WATER TECHNOLOGY 9

Introduction-Characteristics : Hardness of water – types - temporary and permanent hardness - estimation by EDTA method Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –Domestic water treatment – disinfection methods (Chlorination, Ozonation , UV treatment) Boiler feed water – requirements – disadvantages of using hard water in boilers Internal conditioning (Calgon Conditioning method) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

UNIT II POLYMERS 9

Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization– Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting

plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III ELECTRO CHEMISTRY 9

Introduction CELLS: types of Electrochemical cells , Electrolytic cells – Reversible and irreversible cells EMF – measurement of EMF– Single electrode potential – Nernst equation Reference electrodes : Standard Hydrogen electrode -Calomel electrode Ion selective electrode :Glass electrode and measurement of pH using Glass electrode Electrochemical series – significance Titrations :Potentiometer titrations (redox - Fe^{2+}vs dichromate titrations) Conduct metric titrations (acid-base – HCI vs, NaOH titrations)

UNIT IV CORROSION AND CORROSION CONTROL 9

Introduction: Chemical corrosion Definition - Chemical Corrosion - Electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion control – sacrificial anode and impressed cathodic current methods – Protective coatings :Paints– constituents of the paint and their functions Metallic coatings – electroplating of Gold and electro less plating of Nickel.

UNIT V NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Introduction : Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor Solar energy conversion – solar cells – wind energy Fuel cells – hydrogen – oxygen fuel cell Batteries :Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries :Lead–acid storage battery –working –uses Nickel–cadmium battery - working –uses Solid – state battery : Lithium battery

TEXT BOOKS:

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara “A text book of engineering chemistry” S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).

REFERENCES :

1. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Electrochemistry

BCS101	FUNDAMENTALS OF COMPUTING AND PROGRAMMING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES

Students will understand the basics of computers and solve computer oriented problems using various computing tools.

COURSE OUTCOMES (COs)	
CO1	Learn the fundamental principles in computing.
CO2	Learn to write simple programs using computer language
CO3	To enable the student to learn the major components of a computer system.
CO4	Computing problems
CO5	To learn to use office automation tools.
CO6	To interpret and relate programs

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO COMPUTER 9

Introduction- Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers- Basic Computer Organization-Number system. Computer Software: Types of Software—System software-Application software-Software Development Steps

UNIT II PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program – Purpose – Algorithm – Flowcharts– Pseudo code Introduction to Office Packages: MS Word, Spread Sheet, Power Point, MS Access, Outlook.

UNIT III INTRODUCTION TO C 9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions. Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV ARRAYS AND STRUCTURES 9

Overview of C-Constants, Variables and Data types-Operators and Expressions -Managing Input and Output operators-Decision making-Branching and Looping.

UNIT V INTRODUCTION TO C++ 9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TEXT BOOKS:

1. Ashok, N.Kamthane,"Computer Programming", Pearson Education (2012).
2. Anita Goel and Ajay Mittal,"Computer Fundamentals and Programming in C", Dorling V Kindersley (India Pvt Ltd).,Pearson Education in South Asia,(2011).
3. Yashavant P. Kanetkar, "Let us C",13th Edition,BPB Publications(2013).
4. Yashavant P. Kanetkar,"Let us C++"10th Edition, BPB Publications (2013**).**

REFERENCES:

1. Pradeep K.Sinha, Priti Sinha "Foundations of Computing", BPB Publications (2013).
2. Byron Gottfried, "Programming with C", 2nd edition, (Indian Adapted Edition), TMH Publication.
3. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in 'C' First Edition, Oxford University Press(2009).
4. The C++ Programming Language , 4th Edition, Bjarne Stroustrop, Addison-Wesley Publishing Company (2013).

BSS101	**PERSONALITY DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	1	1	0	2
	Prerequisite – +2 Level Knowledge				
	Course Designed by – Department of Management Studies				

OBJECTIVES

To make students groom their personality and prove themselves as good Samaritans of the society.

COURSE OUTCOMES (COs)

CO1	Individual or in-group class presentations pertaining to the applications of conce theories or issues in human development..
CO2	Scores obtained from essay and or objective tests.
CO3	Attendance, classroom participation, small group interactions.
CO4	Research and write about relevant topics.
CO5	Design and complete a research project that can take the form of a developme interview, an observation or assessment through service learning.
CO6	Develop and maintain a Reflection

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	L		H				M					
	CO2		H	H				M					
	CO3							M	H				
	CO4									H	H		
	CO5							M			H	H	
	CO6							M					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 9

The concept personality- Dimensions of theories of Freud & Erickson- personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analyses.

UNIT II ATTITUDE & MOTIVATION 6

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III SELF-ESTEEM 9

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV OTHER ASPECTS OF PERSONALITY DEVELOPMENT 9

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics –Good manners and etiquette.

UNIT V EMPLOYABILITY QUOTIENT 9

Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TEXT BOOKS:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition, Prentice Hall.

REFERENCE BOOKS:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).

6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

BBT102	**BIOLOGY FOR ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – Basic Science				
	Course Designed by – Department of Industrial Bio Technology				

OBJECTIVES
Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system**.**

COURSE OUTCOMES (COs)

CO1	Graduates within the first five years will be able to grasp and apply biological engineering principles, procedures needed to solve real-world problems.
CO2	To understand the fundamentals of living things, their classification, cell structure and biochemical constituents
CO3	To apply the concept of plant, animal and microbial systems and growth in real life situations
CO4	To comprehend genetics and the immune system
CO5	To know the cause, symptoms, diagnosis and treatment of common diseases
CO6	To give a basic knowledge of the applications of biological systems in relevant industries

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M					
	CO2		H							H			
	CO3			H							M		
	CO4										H		
	CO5												
	CO6						H						M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO LIFE 6

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell-Introduction to biomolecules: definition-general classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome.

UNIT II BIODIVERSITY 6

Plant System: basic concepts of plant growth-nutrition-photosynthesis and nitrogen fixation-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions-Microbial System: history-types of microbes-economic importance and control of microbes.

UNIT III GENETICS AND IMMUNE SYSTEM 6

Evolution: theories of evolution-**Mendel's** cell division–mitosis and meiosis-evidence of e **laws of inheritance**-variation and speciation- nucleic acids as a genetic material-central dogma immunity-antigens-antibody-immune response.

UNIT IV HUMAN DISEASES 6

Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis

UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION 6

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines-cloning-drug discovery-biological neural networks-bioremediation-biofertilizer-biocontrol-biofilters-biosensors-biopolymers-bioenergy-biomaterials-biochips-basic biomedical instrumentation.

TEXT BOOKS:

1. A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

REFERENCE BOOKS

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
3. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

BCE 101	**BASIC CIVIL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Civil Engineering				
OBJECTIVES: Understand the basic concepts of civil engineering.					
COURSE OUTCOMES (COs)					
CO1	Will gain knowledge in Design, concept preparation				
CO2	Loading calculation				
CO3	Structural component design				
CO4	Drawing and chart preparation				

CO5	Will understand the components of buildings.
CO6	Will learn the engineering aspects to dams , water supply and sewage disposal.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			H		L					
	CO2					H	H						
	CO3							H	L				
	CO4									L			
	CO5										H	L	
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CIVIL ENGINEERING MATERIALS 8

Introduction – Civil Engineering – Materials – Stones – Bricks – Sand – Cement – Plain Concrete – Reinforced Cement Concrete – Steel Sections – Timber – Plywood – Paints – Varnishes (simple examples only)

UNIT II SURVEYING 5

Surveying – objectives – classification – principles of survey-Measurement of distances – Chain survey – Determination of areas – Use of compass – Use of leveling Instrument – (simple examples only)

UNIT III FOUNDATION FOR BUILDING 5

Bearing Capacity of Soil – Foundation – Functions – Requirement of good foundations – Types of foundations – Merits & Demerits.

UNIT IV SUPERSTRUCTURE 7

Stone Masonry – Brick Masonry – Columns – Lintels – Beams – Roofing – Flooring – Plastering– White Washing (Simple examples only)

UNIT V MISCELLANEOUS TOPICS 5

Types of Bridges –Dam- purpose – selection of site - Types of Dams – Water Treatment & Supply sources – standards of drinking- distribution system. – Sewage Treatment (simple examples only)

TEXT BOOKS:

1. Raju.K.V.B, Ravichandran .P.T, "Basics of Civil Engineering", Ayyappa Publications,

Chennai, 2012.
2. SeetharamanS., "Basic Civil Engineering", Anuradha Agencies, (1st ed. 2005).
3. Dr.M.SPalanisamy, "Basic Civil Engineering" (3rded. 2000), TUG Publishers, New Delhi/Tata McGrawHill Publication Co., New Delhi

REFERENCE BOOKS:

1. Rangwala.S.C, "Engineering Materials", Charotar Publishing House, Anand, 41st Edition: 2014.
2. National Building Code of India, Part V, "Building Materials", 2005
3. Ramesh Babu"A Textbook on Basic Civil Engineering" (1998). Anuradha Agencies, Kumbakonam.
4. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. (1999).

BME 101	**ENGINEERING GRAPHICS- E**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	2	0	3	4
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES
To understand techniques of drawings in various fields of engineering

COURSE OUTCOMES (COs)

CO1	To know about different types of lines & use of different types of pencils in an Engineering Drawing
CO2	To know how to represents letters & numbers in drawing sheet
CO3	To know about different types of projection
CO4	To know projection of points ,straight lines, solids etc.
CO5	To know development of different types of surfaces.
CO6	To know about isometric projection.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H											H
	CO2	M	H										M
	CO3			L									M
	CO4						L		H	H			L
	CO5			L						H			L
	CO6			L							H		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BASIC CURVES, PROJECTION OF POINTS AND STRAIGHT LINES 6+6

Conics-construction of ellipse, parabola and hyperbola by eccentricity method-construction of cycloids- construction of involutes of square and circle-Drawing of tangent and normal to the above curves-Scales-Basic drawing conventions and standards-Orthographic projection principles- Principal planes-First angle projection- Projection of points. Projection of straight lines (only first angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces.

UNIT II PROJECTIONS OF PLANES AND SOLIDS 6+6

Projection of planes (Polygonal and circular surfaces) inclined to both the principal planes. Projection of simple solids like prisms, pyramids, cylinder, cone, tetrahedron and truncated solids when the axis is inclined to one of the principal planes/ both principal planes by rotating object method and auxiliary plane method.

UNITIII ORTHOGRAPHIC PROJECTIONS, ISOMETRIC PROJECTIONS & FREEHANDSKETCHING 6+6

Orthographic projection of Simple parts from 3D diagram-Principles of isometric projection and isometric view-isometric scale- Isometric projections of simple solids and truncated solids-Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems Free hand sketching of orthographic & Isometric projection

UNIT IVPROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+6

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other-obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids- Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

.

UNIT VPERSPECTIVEPROJECTION,BUILDINGDRAWINGAND COMPUTERAIDEDDRAFTING 6+6

Perspective projection of simple solids-Prisms, Pyramids and cylinders by visual ray method. Introduction- components of simple residential or office building-specifications-plan and elevation of different types of Residential buildings and office buildings. Introduction to drafting packages and basic commands used in AUTO CAD. Demonstration of drafting packages.

TEXT BOOKS:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. K.V.Natarajan "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.

REFERENCES:

1. K.R.Gopalakrishna, "Engineering drawing",(Vol-I & II combined) Subhas stores, Bangalore,2007.
2. K.Venugopal and V. Prabhu Raja, "Engineering Graphics", New Age International Private limited,2008.
3. Luzzader, Warren.J., and Duff, John.M.,, "Fundamentals of Engineering Drawing with an introduction to Interactive computer graphics for design and production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi,2005.

Special points applicable to University Examinations on Engineering Graphics

1) There will be five questions, each of either or type covering all units of the syllabus.
2) All questions will carry equal marks of 20 each making a total of 100.

BCM1L1	BASIC CIVIL & MECHANICALENGINEERING PRACTICES LABORATORY	L	T	P	C
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Department of Mechanical Engineering& Civil Engineering				

OBJECTIVES

To provide exposure to the students with hands on experience on various basic Civil & Mechanical Engineering practices.

COURSE OUTCOMES (COs)

CO1	Learn Basic concepts
CO2	Students will get exposure regarding pipe connection for pumps & turbines and to study the joint used in roofs, doors, windows and furniture's.
CO3	Students will get exposure regarding smithy, foundry operations and in latest welding operations such as TIG, MIG, CO2, spot welding etc.,
CO4	Students will get hands on experience on basic welding techniques, machining and sheet metal works.
CO5	Students will get hands on experience on basic machining techniques
CO6	Students will get hands on experience on basic sheet metal techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H	L										
	CO2				H								
	CO3					H	L	L					
	CO4		H				M		L			H	
	CO5		H				M		L			H	
	CO6		H				M		L			H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
				√					
4	Approval		37th Meeting of Academic Council, May 2015						

LIST OF EXPERIMENTS

I. CIVIL ENGINEERING PRACTICE

Buildings:

a) Study of plumbing and carpentry components of residential and industrial buildings. Safety aspects.

Plumbing Works:

a) Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, elbows in household fittings.
b) Study of pipe connections requirements for pumps and turbines.
c) Preparation of plumbing line sketches for water supply and sewage works.
d) Hands-on-exercise: Basic pipe connection of PVC pipes & G.I. Pipes – Mixed pipe material connection – Pipe connections with different joining components.
e) Demonstration of plumbing requirements of high-rise buildings.

Carpentry using Hand tools and Power tools:

a) Study of the joints in roofs, doors, windows and furniture.
b) Hands-on-exercise: Wood work, joints by sawing, planning and cutting.
c) Preparation of half joints, Mortise and Tenon joints.

II MECHANICAL ENGINEERING PRACTICE

Welding:

a) Preparation of butt joints, lap joints and tee joints by arc welding

Basic Machining:

a) Simple Turning and Taper turning

b) Drilling Practice

Sheet Metal Work:

a) Forming & Bending:
b) Model making – Trays, funnels, etc.
c) Different type of joints
d) Preparation of air-conditioning ducts
e) Preparation of butt joints, lap joints and tee joints by arc welding

Machine assembly practice:

a) Assembling, dismantling and Study of centrifugal pump
b) Assembling, dismantling and Study of air conditioner
c) Assembling, dismantling and Study of lathe

Moulding:

a) Moulding operations like mould preparation for gear and step cone pulley etc

Fitting:

a) Fitting Exercises – Preparation of square fitting and vee – fitting models.

Demonstration:

a) Smithy operations, upsetting, swaging, setting down and bending. Example–Exercise – Production of hexagonal headed bolt.
b) Gas welding.

REFERENCES:

1. K. Jeyachandran, S. Nararajan& S, Balasubramanian, "A Primer on Engineering Practices Laboratory" ,Anuradha Publications, (2007).
2. T.Jeyapoovan, M. Saravanapandian& S. Pranitha, "Engineering Practices Lab Manual",Vikas Publishing House Pvt. Ltd. (2006)
3. H. S. Bawa, "Workshop Practice", Tata McGraw–Hill Publishing Company Limited, (2007).
4. A. Rajendra Prasad & P. M. M. S Sarma, "Workshop Practice", Sree Sai Publication, (2002).
5. P. Kannaiah& K.L. Narayana, "Manual on Workshop Practice", Sci tech Publication, (1999).

BEN 201	ENGLISH II	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – English I				
	Course Designed by – Department of English				

OBJECTIVES

Students will be able to actively participate in group discussions. Students will have Teleph Skills, Giving Directions and Information Transfer

COURSE OUTCOMES (COs)

CO1	To make the students aware to different kinds of Learner-friendly modes of language variety of self- instructional learning (Computer based)
CO2	To make students comprehend the habit of intelligent Reading as well as Computer- ba competitive exams glob
CO3	To achieve a reasonably good level of competency in Report Writing.
CO4	To make the students aware to different kinds of Learner-friendly modes of language variety of self- instructional learning (Computer based)
CO5	To achieve a reasonably good level of competency in group discussions
CO6	To achieve a reasonably good level of competency in public speaking

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	M	L	H	L	M			H		M	L	
	CO2			H	L				H		M	L	
	CO3			H	L	M			H		H	L	
	CO4			H	L	M			H		M	L	
	CO5			H	L	M			H		M	L	
	CO6			H	L	M			H		M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ORIENTATION 12

Numerical adjectives - Meanings in context - Same words used as different parts of speech - Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II ORAL SKILL 12

Listening to audio cassettes - C.Ds , News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - and Giving Instructions - Reading Comprehension answering questions. Inferring meaning.

UNIT III THINKING SKILL 12

Self- introduction describing –Group Discussion – Debate –Role play- Telephone- Things-etiquette- Recommendation and Sequencing jumbled sentences to make a suggestions-paragraph-advertisement and notice, Designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV WRITING SKILL 12

Definitions - Compound nouns - Abbreviations and acronyms – (a) business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) Letters to the editor (giving suggestions on an issue) .

UNIT V FORMAL INFORMATION 12

Editing **–** Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

TEXT BOOK:

1. Meenakshi Raman, Sangeetha Sharma , Technical English for Communication: Principle and Practice, OUP, 2009.

REFERENCE BOOKS:

1. Sumanth , English for Engineers, Vijay Nicole , Imprints pvt ltd.2013.
2. Meenakshi Raman and SangeethaSharma , Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binodmishra , Communication skills for engineers and scientists , PHI Learning Pvt Ltd, New Delhi, 2010.

BMA 201	**MATHEMATICS – II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – Mathematics I				
	Course Designed by – Department of Mathematics				

OBJECTIVES

Ability to apply these principles of mathematics in projects and research works.

COURSE OUTCOMES (COs)

CO1	Student shall be able to Solve differential equations, simultaneous linear equations, and s special types of linear equations related to engineering.
CO2	Relate the use of mathematics in applications of various fields namely fluid flow, heat fl solid mechanics, electrostatics, etc.
CO3	Ability to test hypothesis
CO4	Find intensity of degree of relationship between two variables and also bring out regres equations.
CO5	Understand to solve matrix problems related to real life problems.
CO6	Formulate mathematical models

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		L									

	CO2		H				H		L	L		M	
	CO3		H				H		L	L		M	
	CO4					M						M	
	CO5										M	M	
	CO6										M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ORDINARY DIFFERENTIAL EQUATION 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – **Cauchy's** and L**egendre's linear equations** - simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient, divergence and curl –Directional derivatives –Irrotational and solenoidal vector fields – vector integration– **Green's theorem in a plane , Gauss divergence theorem and** S**toke's theorem (**without proofs) – simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) – Harmonic and orthogonal properties of analytic functions – Harmonic conjugate – construction of analytic functions – conformal mapping: W= Z+C, CZ, 1/Z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration – **Statement and application of Cauchy's integral theorem and Cauchy's integral formula** –Taylor and Laurent expansions – Singular points – Residues – Residue theorem –Application of Residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V STATISTICS 12

Mean, Median, Mode – Moments –Skewness and Kurtosis – Correlation – Rank Correlation – Regression –Chi square test for contingency tables.

TEXT BOOK:

1. R.M.Kannan and B.Vijayakumar" Engineering Mathematics–II "2nd Edition, SRB Publication, Chennai 2007.
2. Bali.N.P and Manish Goyal , "Engineering Mathematics", 3rd Edition, Laxmi Publications (P) Lltd, 2008 .
3. Grewal .B/S "Higher Engineering Mathematics", 40th Editon, Khanna Publications, Delhi, 2007

REFERENCES :

1. Ramana.B.V, "Higher Engineering Mathematic", Tata McGraw Hill Publishing Company,

New Delhi, 2007.
2. Gupta SC, and VK.Kapoor, "Fundamentals Mathematical Statistics", 11th edition, Sultan Chand Sons, New Delhi, 2014.

BPH201	ENGINEERING PHYSICS -II	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING PHYSICS -I				
	Course Designed by – Department of Physics				

OBJECTIVES

- To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications
- To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

COURSE OUTCOMES (COs)

CO1	Understand about properties and advancements of conducting materials.
CO2	Understand the principle and properties semiconducting materials.
CO3	Acquire Knowledge on Magnetic and dielectric Materials.
CO4	To Know about the creation of new materials with novel properties
CO5	To Understand the impact of modern materials in technical uses.
CO6	Learn new engineering materials and its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L								
	CO5		L	L									
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum

theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials – Birefringence- optical Kerr effect – Classification of Biomaterials and its applications.

TEXT BOOKS:

1. Jayaraman D Engineering Physics II. Global Publishing House, 2014.
2. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
3. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

REFERENCES:

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4 http://ocw.mit.edu/courses/find-by-topic
5 http://nptel.ac.in/course.php?disciplineId=122
6 https://en.wikipedia.org/wiki/Engineering_physics

BCH 201	**ENGINEERING CHEMISTRY-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING CHEMISTRY –I				
	Course Designed by – Department of Chemistry				
OBJECTIVES To impart a sound knowledge on the principles of chemistry involving application orie					

topics required for all engineering branches.													
COURSE OUTCOMES (COs)													
CO1	Students will understand the concepts and further industrial applications of surface chemis												
CO2	To impart knowledge about the Industrial importance of Phase rule and alloys												
CO3	To make the students to be conversant with Analytical techniques of chemistry and t importance												
CO4	To have an idea and knowledge about the Chemistry of Fuels and												
CO5	Understanding of engineering materials												
CO6	All about bonding and molecular structures												
	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L		H		H				M	
	CO2		H			H		H					
	CO3	H		L		H		H				M	
	CO4			L		H		H					
	CO5			L		H		H					
	CO6			L		H		H		H		M	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
				√										
4	Approval	37th Meeting of Academic Council, May 2015												

UNIT I SURFACE CHEMISTRY 9

Introduction **:** Adsorption , absorption , desorption , adsorbent , adsorbate and sorption – (definition only) Differences between adsorption and absorption Adsorption of gases on solids – factors affecting adsorption of gases on solids – Adsorption isotherms –Frendlich adsorption isotherm and Langmuir adsorption isotherm Role of adsorbents in catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II PHASE RULE AND ALLOYS 9

Introduction **:**Statement of Phase Rule and explanation of terms involved – one component system – water system – Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) – eutectic temperature – eutectic composition – Pattinsons Process of desilverisation of Lead Alloys: Importance, ferrous alloys –nichrome and stainless steel – 18/8 stainless steel -heat treatment of steel – annealing – hardening – tempering normalizing – carburizing - nit riding . Non-ferrous alloys: Brass and Bronze

UNIT III ANALYTICAL TECHNIQUES 9

Introduction: Type of Spectroscopy - Atomic spectroscopy – molecular spectroscopy - Explanation IR spectroscopy – principles – instrumentation (block diagram only) – applications - finger print region UV-visible spectroscopy –– principle – instrumentation (block diagram only) – Beer-**Lambert's law**- – estimation of iron by colorimetry– Atomic absorption spectroscopy-

principle - instrumentation (block diagram only) - estimation of Nickel by Atomic absorption spectroscopy Flame photometry– principles – instrumentation (block diagram only) - estimation of sodium ion by Flame photometry

UNIT IV FUELS 9

Introduction **:** Calorific value – types of Calorific value - gross calorific value – net calorific value Analysis of Coal –- Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only) Flue gas analysis – importance - Orsat apparatus

UNIT V ENGINEERING MATERIALS 9

Introduction: Refractory's – classification – acidic, basic and neutral refractory's – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Manufacture of Refractory's: alumina bricks and Magnesite bricks, Abrasives – natural and synthetic abrasives Natural type : Siliceous - quartz ; Non –siliceous – diamond Synthetic Abrasives : silicon carbide and boron carbide. Lubricants: Liquid lubricants - Properties – viscosity index, flash and fire points, cloud and pour points, oiliness) Solid lubricants – graphite and molybdenum sulphide

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand &Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub. Co.Ltd, New Delhi,(2008)
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Spectroscopy

BFR 201	**FRENCH**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

Language gives access and insights into another culture. It is a fundamental truth that cultures define themselves through languages.

COURSE OUTCOMES (COs)

CO1	Introduce the basics of the language to beginners
CO2	Understand a dialogue and dialogue presentation
CO3	To develop their knowledge as well as their communicative skills so as to be able to respond in simple everyday contexts.

CO4	Synchronies I includes documents which initiate the learners to another world, another culture and which acclimatize them to the authentic use of the French language through the exploitation of written and iconographic documents. The Indian context has been used.
CO5	Grammatical and lexical notions as well as activities required for communication are learnt by the students.
CO6	Interpreting skills and confidence in the language.
CO6	Interpreting skills and confidence in the language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION **8**

At the airport: Savoir– faire: exchanging greetings, self introduction, introducing another, welcoming someone, identifying someone - Grammar: verbs 'to be', 'to call oneself', subject pronouns, interrogation

UNIT II GRAMMAR **8**

At the University: Savoir-faire: enquiring after one's welfare, taking leave, expressing appreciation -Grammar: definite & indefinite articles, gender of nouns, adjectives, present tense of regular 'er' verbs, 'to have', 'to learn', negation, irregular verbs

UNIT III CONVERSATION **8**

At the café: Savoir –faire: speaking about one's likes, giving information, expressing admiration, asking information about someone - Grammar: Interrogative adjectives, irregular verbs, possessive and interrogative adjectives

UNIT IV PROPOSAL WRITING **7**

At the beach: Savoir faire: proposing an outing, accepting/ refusing the proposal - Grammar: singular & plural, indefinite pronoun, demonstrative adjectives, negation, irregular verbs

UNIT V FORMAL LETTERS **7**

A concert: Savoir –faire: inviting, accepting, expressing one's inability to accept an invitation

UNIT VI REGULAR & IRREGULAR VERBS 7

Grammar: Present tense of more irregular verbs, contracted articles, future tense, interrogative adverbs, **At Nalli's** Savoir- faire: asking the price of an article, protesting against the price, Grammar: possessive adjectives, Exclamative adjectives, imperative tense

REFERENCES:

1. Course Material: Synchronie I –Méthode de Français
2. Madanagobalane -Samita Publications, Chennai, 2007

BGM 201	**GERMAN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

At the end of this course, students shall be able to obtain good knowledge of the language, to r write and speak German, whereby the emphasis is laid on speech.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand German lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

Course structure:

A. German Language (speaking, reading, writing, grammar and test)
B. Life in Germany (shopping, restaurant, doctor, government, bank, post)
C. The German Way (introduction, doing business, conversation, meetings, dining)
D. Germany (Culture, Climate)

UNIT IPRONOUNCIATION **9**

Welcome: Introduction to the Language, Spelling and Pronunciation (The alphabets and numbers) Greetings, ordering, requesting, saying thank you - Grammar **– the article "the", conjugation** of verbs

UNIT IISELF INTRODUCTION **9**

Shopping - Grammar **–** adjectives, endings before nouns, practice. Self introduction

UNIT IIITRAINING **9**

Addresses, Occupations, Studies - Grammar - **'to be', the definite/indefinite** articles, individual Training

UNIT IVORAL **9**

Leisure Time, Sports, Hobbies - Grammar **–** position of a verb in a main clause , oral practice

UNIT VNARRATION **9**

At a Restaurant, Food and Drink - Grammar **–** the personal pronoun in the Nominative and Accusative, Narrating an event

RESOURCES:

1. Sprachkurs Deutsch 1 (Verlag Diesterweg), New Delhi Learning Centre

BJP 201	**JAPANESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Japanese language, Japanese culture and heritage
To impart knowledge Japanese lifestyle.
To give sufficient exposure to develop basic conversational skills.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Japanese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L

	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT ICULTURAL HERITAGE **9**

Introduction-history and origin of Japanese language-Japan and its cultural heritage-Self introduction-counting numbers (1-100)-time-conversation with the use of audio devices, grammar– usage of particles wa, no, mo and ka

UNIT IIUSAGE **9**

Greetings, seasons, days of the week and months of the year-numbers (up to 99,999)-grammar– usage of kore, sore, are, kono, sono, ano, koko and kochira, arimasu and imasu-i-ending and na-ending adjectives-use of audio and drills for practice

UNIT IIIORAL **9**

Asking the price–associated vocabulary-usage of particles ni, ga and ne- use of audio and drills for practice-Introduction to basic Kanji characters- use of audio and drills for practice

UNIT IVART AND CULTURE **9**

Family relationships- colours-Kanji (numbers) and festivals of Japan-religion-Japanese art and culture-ikebana, origami-introduction to hiragana- use of audio and drills for practice

UNIT VDRILLS AND PRACTICE **9**

Vocobulary associated with directions-asking way-particles – e, de, mo, koko, soko, asoko, doko, nani, mae, ushiro, ue, shita- use of audio and drills for practice-introduction to katakana

TEXT BOOKS

1. Japanese Hiragana and Katakana for beginners, Timothy G. Stout, 2011
2. Genki I: An integrated course in elementary Japanese, Eri Banno and Yuko Ikeda, 2011

REFERENCE BOOKS

1. Japanese Reader collection Volume I, Yumi Boutwell and Clay Boutwell, Kotoba books, 2013
2. Living Language Japanese Complete Edition beginners through advanced course, Living Language, 2012

BKR 201	**KOREAN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	1	0	3

	Prerequisite – +2 Level English
	Course Designed by – Department of English

OBJECTIVES

To have a basic knowledge of Korean language, Korean culture and heritage
To impart knowledge on Korean lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Korean lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT IPLANNING **9**

Asking/giving reasons for studying Korean, making plans for the holiday, writing letters, describing past travel experiences and future travel plans, shopping in a grocery store, shopping in electronics store, storytelling Grammar: would like to (do), want to (do), construct future tense.

UNIT IIMODIFIERS **9**

Asking about feelings, asking about problems and giving advice, brief introductions - Grammar: Noun modifier, please try doing (something), irregular adjective/verb

UNIT IIIPLACING ORDERS **9**

Asking about hobbies, asking about abilities (sports), job requirements, Ordering things for delivery, ordering a meal at a restaurant - Grammar: Sentence ending for the honorific form, please do something for me, have tried (something),

UNIT IVDESCRIPTIONS **9**

Asking about evening plans, making plans with others, making preparations - Asking about rooms, describing your room to your classmates, describing your house. Grammar: to know/not know how to do something, must (do), have to (do), should,

UNIT VGRAMMAR **9**

Describing your plans and giving reasons, cancelling appointments. Grammar: Shall we~? / Should we~?, with, and, irregular verbs/adjective, so, because, cannot, intend to, plan to, or hope to, (more) than, the most, tag question/is n't it? ,will (do)

COURSE MATERIAL:

Korean for Non-Native Speakers (Student Book 1B) Korean Language Education Center, Sogang University

BCN 201	**CHINESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Chinese language, Chinese culture and heritage

To impart knowledge on Chinese lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Chinese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT 1RISE OF DIALECTS **9**

History, Origins, Old and middle Chinese, Rise of northern dialects

UNIT IIVARIETIES **9**

Influences 3 Varieties of Chinese. 1.Classification 2.Standard Chinese and 3.Nomenclature

UNIT III CHARACTERS **9**

Chinese characters, Homophones, Phonology

UNIT IV TRANSCRIPTIONS **9**

Tones, Phonetic transcriptions, Romanization, Other phonetic transcriptions

UNIT VGRAMMAR **9**

Grammar and morphology, Vocabulary, Loanwords, Modern borrowings and loanwords

REFERENCES:

1. Hannas, William C. (1997), Asia's Orthographic Dilemma, University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-1892-0" 978-0-8248- 1892-0.
2. Qiu, Xigui (2000), Chinese Writing, trans. Gilbert Louis Mattos and Jerry Norman, Society for the Study of Early China and Institute of East Asian Studies, University of California, Berkeley, ISBN HYPERLINK http://en.wikipedia.org/wiki/Special:BookSources/978-1-55729 071-7,978-1-55729-071-7.
3. Ramsey, S. Robert (1987), The Languages of China, Princeton University Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-691-01468-5" 978-0-691-01468-5.
4. Schuessler, Axel (2007), ABC Etymological Dictionary of Old Chinese, Honolulu: University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248 2975-9"978-0-8248-2975-9.
5. R. L. G. " Language borrowing Why so little Chinese in English?" The Economist. June 6, 201

BME 202	**ENGINEERING MECHANICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – Engineering Mathematics I , II, Engg. Physics				
	Course Designed by – Department of Mechanical Engineering				
OBJECTIVES: To understand the concept of basic engineering mechanism					
COURSE OUTCOMES (COs)					
CO1	Students will understand the concepts of engineering mechanics				
CO2	Students will understand the vectorial representation of forces and moments				
CO3	Students will gain knowledge regarding center of gravity and moment of inertia and apply them for practical problems.				
CO4	Students will gain knowledge regarding various types of forces and reactions and tom draw free body diagram to quicker solutions for complicated problems.				

CO5	Student will gain knowledge in solving problems involving work and energy
CO6	Student will gain knowledge on friction on equilibrium and its application.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

		a	b	c	d	e	f	g	h	i	j	k	l
1	COs/POs												
2	CO1	H	H	L	H		H		L		H	H	
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BASICS AND STATICS OF PARTICLES 12

Introduction - Units and Dimensions - Laws of Mechanics – **Lame's theorem, Parallelogram and triangular Law** of forces – Vectors –Vectorial representation of forces and moments – Vector operations on forces - Coplanar Forces – Resolution and Composition of forces – Resultant of several concurrent forces - Equilibrium of a forces – Forces in space - Equilibrium of particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples– Scalar components of a moment – **Varignon's theorem** - Equilibrium of Rigid bodies in two dimensions -Equilibrium of Rigid bodies in three dimensions.

UNITIII PROPERTIES OF SURFACES AND SOLIDS 12

Determination of areas – First moment of area and the Centroid of standard sections – T section, I section, Composite figures, Hollow section – second moments of plane area – Rectangle, triangle, circle - T section, I section, Hollow section – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Basic concept of Mass moment of inertia.

UNITIV FRICTION 12

Frictional force – Laws of Coloumb friction – Cone of friction – Angle of repose – Simple contact friction – Sliding of blocks – Wedge friction - Ladder friction – Screw Jack – Belt friction - Rolling resistance.

UNIT V DYNAMICS OF PARTICLES 12

Displacements, Velocity and acceleration, their relationship – Relative motion – Relative acceleration – Curvilinear motion of particles – **Newton's law** – work energy equation – impulse and Momentum – Impact of
elastic bodies.

TEXT BOOK:

1. Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers: Vol. 1 Statics and vol. 2 Dynamics**"**, McGraw-Hill International Edition, 2013.
2. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2011.

REFERENCES :

1. Kumar, K. L Kumar, V., Engineering Mechanics, Tata McGraw – Hill, New Delhi, 2010
2. Palanichamy, M.S., Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw - Hill, 2013.
3. Timoshenko, and Young, Engineering Mechanics, Tata McGraw-Hill, New Delhi, 2013.
4. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition – Pearson Education Asia Pvt., Ltd., 2006.

BEE 201	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Engineering Mathematics, Engineering Physics-I & II				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To understand the laws of electrical engineering.

COURSE OUTCOMES (COs)

CO1	Students will gain knowledge regarding the various laws and principles associated electrical systems.
CO2	Students will gain knowledge regarding electrical machines and apply them for pract problems.
CO3	Students will gain knowledge regarding various types semiconductors.
CO4	Student will gain knowledge digital electronics.
CO5	Student will gain knowledge on electronic systems.
CO6	Students will acquire knowledge in using the concepts in the field of electrical engg. proj and research.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/Pos	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L			
	CO2		H	M			L		L	L			
	CO3		H	M			L		L				
	CO4	M	H	M			L		L	L			
	CO5	M	H	M			L		L				
	CO6		H				L		L	H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ELECTRIC CIRCUITS 6

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem –Thevenin's and Norton's Theorem - Problems.

UNIT II ELECTRICAL MACHINES 6

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT III BASIC MEASUREMENT SYSTEMS 6

Introduction to Measurement Systems, Construction and Operating principles of PMMC, Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method – and Energy meter.

UNIT IV SEMICONDUCTOR DEVICES 6

Basic Concepts of semiconductor devices **–** PN Junction Diode Characteristics and its Applications **–** HWR, FWR **–**Zener Diode **–** BJT (CB, CE, CC) configuration & Characteristics.

UNIT V DIGITAL ELECTRONICS 6

Number system **–** Logic Gates **–** Boolean Algebra**–** De-**Morgan's Theorem –** Half Adder & Full Adder **–** Flip Flops.

TEXT BOOKS:

1. N.Mittal "Basic Electrical Engineering". Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
3. Jacob Millman and Christos C-Halkias, "Electronic Devices and Circuits", Tata McGraw Hill

REFERENCE BOOKS:

1. Edminister J.A. "Theory and Problems of Electric Circuits" Schaum's Outline Series. McGrawHill Book Compay, 2nd Edition, 1983.
2. Hyatt W.H and Kemmerlay J.E. "Engineering Circuit Analysis", McGraw Hill Internatinal Editions, 1993.
3. D. P. Kothari and I. J. Nagrath" Electric Machines"Tata McGraw-Hill Education, 2004
4. Millman and Halkias, "Integrated Electronics", Tata McGraw Hill Edition, 2004.

BCS 2L2	COMPUTER PRACTICE LABORATORY	L	T	P	C
	Total Contact Hours - 45	0	0	3	1
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Department of Computer Science &Engineering				

OBJECTIVES: To impart basic computer knowledge

COURSE OUTCOMES (COs)

CO1	Demonstrate major algorithms and data
CO2	Implementation of array operations
CO3	Implementation of binary tree.
CO4	Implementation of linked list
CO5	Students will able to do analyse data using spread sheet
CO6	Student will able to understand the basics of C programming.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	H		H		L		H	H	H
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

A) WORD PROCESSING **6**

Document creation, Text manipulation with Scientific Notations. Table creation, Table formattin and Conversion. Mail merge and Letter Preparation. Drawing-Flow Chart

B) SPREAD SHEET **9**

Chart-Line Xy Bar and Pie – Formula-Formula Editor-Spread sheet-Inclusion of Object, Picture and Graphics Protecting the document and sheet-Sorting and Import/Export features.

C) SIMPLE C PROGRAMMING* **15**

Data types, Expression Evaluation, Condition Statement. Arrays structures and Unions – Functions

D) SIMPLE C++PROGRAMMING **15**

-Classes and Objects
-Constructor and Destructor

***For Programming exercises Flow chart and Pseudo code are essential.**

BEE2L1	**BASIC ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Basic Electrical and Electronics Engineering				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To enhance the student with knowledge on electrical and electronic equipments.

COURSE OUTCOMES (COs)

CO1	Students will able to handle basic electrical equipments.
CO2	Students will able to do staircase wiring.
CO3	Students will able to understand domestic wiring procedures practically.
CO4	Student will able to assemble electronic systems.
CO5	Students will understand all the fundamental concepts involving electrical engineering
CO6	Students will understand all the fundamental concepts involving electronics engineering

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	
	CO5	M	H	M			L		L		M	H	
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

I LIST OF EXPERIMENTS FOR ELECTRICAL ENGINEERING LAB

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit

4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

II LIST OF EXPERIMENTS FOR ELECTRONICS ENGINEERING LAB

1. Study of electronic components and equipments.
   a. Resistor colour coding using digital multi-meter.
   b. Assembling electronic components on bread board.
2. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

BPC 2L1	**PHYSICS AND CHEMISTRY LABORATORY**									**L**	**T**	**P**	**C**
	Total Contact Hours – 45									0	0	3	1
	Prerequisite – Physics and Chemistry												
	Course Designed by – Department of Physics & Chemistry												
OBJECTIVES: To impart knowledge to the students in practical physics and chemistry													
COURSE OUTCOMES (COs)													
CO1	Students will understand the concept of hall effect												
CO2	Students will understand the concept of semiconductors. .												
CO3	Student will understand the working of spectrometer.												
CO4	Student will able practically understand the chemical reactions.												
CO5	Students will Study the magnetic hysteresis and energy product												
CO6	Students understand the Determination of Band gap of a semiconductor												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/Term paper/ Seminar/ Internship (PR)	
				√									
4	Approval	37th Meeting of Academic Council, May 2015											

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser

2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BMA301	**MATHEMATICS – III**	**L**	**T**	**P**	**C**
	Total Contact Hours - 75	3	2	0	4
	Prerequisite – Engineering Mathematics-I, Engineering Mathematics -II,				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To understands the concepts of Fourier series analysis, Fourier transform techniques and Z transform techniques

COURSE OUTCOMES (COs)

CO1	To learn the problem solving methods in linear differential equations
CO2	To learn Dirichlet's condition and operations using Fourier series
CO3	To have a clear understanding about 2nd order equations and wave equations
CO4	Properties of Laplace transform and problem solving using it
CO5	Properties of Fourier transform and problem solving using it

CO6	To understand the concepts of various transform and partial differential equation technique

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+6

Formation-solutions of standard types of first order equations-LaGrange's equation-linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 9+6

Dirichlet's condition-General Fourier series-half range sine and cosine series-Parseval's identity. Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9+6

Classification of second order linear partial differential equations-Solutions of one-Dimensional wave equations, one-dimensional heat equations.

UNIT IV LAPLACE TRANSFORMS 9+6

Transforms of simple functions-basic operational properties-transforms of derivatives and integrals-Initial and Final value theorems-Inverse transforms-Convolution theorem. Periodic functions. Applications of Laplace Transforms for solving linear ordinary differential equations up to second order with constant coefficients and integral equations.

UNIT V FOURIER TRANSFORMS 9+6

Statement of Fourier integral theory-Fourier transforms pairs-Fourier Sine Cosine transforms-Properties-Transforms of simple functions-Convolution theory-Parseval's identity.

TEXT BOOKS:

1. Kreyszig, E."Advanced Engineering Mathematics"8th Edition, John Wiley and Sons, (Asia) Pvt., Ltd, Singapore, 2006.
2. Grewal, B.S.,"Higher Engineering Mathematics" (35thEdition), Khanna Publishers, Delhi2000.

REFERENCES:

1. Kandasamy, P., Thilakavathy, K., and Gunavathy,K. "Engineering Mathematics", Volumes 1 and 3(4th Edition) S Chand and Co., New.
2. Narayanan, S.ManicavachangamPillay, T.K.Ramanaiah, G."Advanced mathematics for Engineering Students", Volume2 and 3(2nd Edition), S.Viswanathan (printers & publishers Pte, Ltd.,) 1992.
3. Venkataraman, M.K"Engineering Mathematics"Volumes3-A&B, 13th Edition National Publishing Company, Chennai, 1998.
4. Shanmugam,T.N.:http:.www.annauniv.edu/shan/trans.html.

BAM301	SOLID MECHANICS	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Strength of materials, Mechanics of Machines				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in Solid Mechanics. The detailed concept, stresses in beams, Deflection of beams will be taught to the students. Stresses in helical springs and biaxial stresses will also be introduced to the students.

Course Outcomes

CO1 - To learn the statically determinate and indeterminate problems in tension & compression	
CO2 -To learn Shear force & bending moment diagrams – bending stresses – shear stress Variation in beams of symmetric sections – beams of uniform strength.	
CO3 -To learn deflection of beams strain energy by Macaulay's method in axial Bending, torsion and shear loadings	
CO4 -To learn Torsion of solid and hollow circular shaft.	
CO5 -To learn biaxial stress and determination of principal stresses.	

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		H	M	M	M	H	H	H	H
	CO2									M			
	CO3		H	H	M	H		H		H		H	H
	CO4	H					L		M		H		
	CO5			M		H		M		M		M	M
	CO6	L	M	M		M	H		L	M	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT – I AXIAL LOADING 12

Stresses and strains – Hooke's law – stress and strain diagrams - elastic constants – statically determinate and indeterminate problems in tension & compression – thermal stresses – impact loading.

UNIT – II STRESSES IN BEAMS 10

Shear force & bending moment diagrams – bending stresses – shear stress variation inbeams of symmetric sections – beams of uniform strength.

UNIT – III DEFLECTION OF BEAMS 12

Double integration method – Macaulay's method – moment area method – conjugate beam method – principle of superposition – Strain Energy in axial, bending, torsion and shear loadings. Castigliano's theorems and their applications.

UNIT – IV TORSION – SPRINGS – COLUMNS 14

Torsion of solid and hollow circular shafts – shear stress variation – power transmission in shafts – open and closed-coiled helical springs – stresses in helical springs – classification of columns – Euler buckling – columns with different end conditions.

UNIT – V BIAXIAL STRESSES 12

Stresses in thin-walled pressure vessels – combined bending, torsion and axial loading of circular shafts – Mohr's circle and its construction – determination of principal stresses.

TEXTBOOKS:

1. Gere & Timoshenko, 'Mechanics of Materials', McGraw Hill, 1993
2. William Nash, Strength of Materials, Tata McGraw Hill, 2004

REFERENCES:

1. Dym, C.L., and Shames, I.H., 'Solid Mechanics', McGraw Hill, Kogakusha, Tokyo, 1973.
2. Stephen Timoshenko, 'Strength of Materials', Vol I & II, CBS Publishers and Distributors, Third Edition.
3. R.K.Rajput, 'Strength of Materials', S. Chand and Co., 1999.
4. Timoshenko,S. and Young,D.H., Elements of Strength of Materials, T.Van Nostrand Co. Inc., Princeton, N.J., 1977.

BAM302	**AUTOMOTIVE PETROL ENGINES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – IC Engines, Thermal Engineering				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in Automotive Petrol Engines. The detailed concept, fuel supply system cooling and lubrication system and combustion and combustion chambers and other petrol engines will be taught to the students.

Course Outcomes

CO1 - To learn Engine Construction and Operation

CO2 - To learn Fuel supply system (Carburetor type) and electronic Fuel Injection system

CO3 - To learn different cooling and types lubrication system

CO4 – To learn detailed combustion system

CO5 – To learn other petrol engines

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	M		H	M	M	M	H	H	H	H
	CO2		M				M			M			M
	CO3		H		M	H		M		H		H	H
	CO4	H				H	L		M		H		
	CO5			M		H		M		H		M	H
	CO6	L	M	M		M	H		L	M	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I ENGINE CONSTRUCTION AND OPERATION 10

4 stroke engine - Constructional details, working principle. Otto cycle, Actual indicator diagram, Fuel air cycle. Cylinder layout and configurations. Firing order and its significance. Engine balancing. Materials of engine components.

UNIT – II FUEL SUPPLY SYSTEM 10

Carburettor working principle, Requirements of an automotive carburetor – starting, idling, acceleration and normal circuits of a carburetor – Compensation –Fuel filters-Constant vacuum carburetor, multi barrel and multiple venturi systems – Fuel Pumps– Mechanical and electrical pumps – Electronic Fuel Injection systems.

UNIT – III COOLING AND LUBRICATION SYSTEM 8

Need for cooling. Types of cooling system – air cooling and Liquid cooled systems. Forced circulation system, pressure cooling system – Need for Lubrication system. Mist lubrication system, wet sump lubrication – Properties of lubricants, properties of coolant- SAE standards of lubricants and coolants.

UNIT – IV COMBUSTION AND COMBUSTION CHAMBERS 9

Combustion in SI engine – Laminar Flame theory- Flame Propogation- Flame structure of turbulent and premixed flames- Stages of combustion– Rate of pressure rise – Abnormal combustion – Pre ignition and knock – Combustion chambers – Different types – Factors controlling combustion chamber design.

UNIT – V OTHER PETROL ENGINES 8

Two stroke engine – Types – construction and operation. Comparison of four stroke and two stroke engine operation- Rotary Engines.

TEXT BOOKS:

1. Ramalingam. K. K., Internal Combustion Engines, SciTech publications, Chennai, 2003
2. Ganesan.V, Internal Combustion Engines, Tata McGraw Hill Publishing Co., New York, 1994.

REFERENCES:

1. Heldt.P.M. High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1975.
2. William.H.Crouse, Automotive Engines, McGraw Hill Publishers, 1985.

BAM303	**ENGINEERING THERMODYNAMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – IC Engines, Thermal Engineering and Heat Transfer				
	Course Designed by- Department of Automobile Engineering				
OBJECTIVE:					
The main objective of this course is to impart knowledge in Engineering Thermodynamics. The detailed concept, Basic Thermodynamics, Air cycle and Compressors, Refrigeration and Air-conditioning, Heat Transfer and Heat exchangers will be taught to the students.					
Course Outcomes					
CO1 –To learn the detailed study of zeroth and first law of thermodynamics					
CO2 – To learn detailed study of Air cycle and Compressors					
CO3 – To learn detailed study and types of Refrigeration and Air conditioning					
CO4 – To learn detailed study of Heat Transfer					
CO5 – To learn detailed study of Heat exchangers and its types					

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M			M			M
	CO3		H		M	H		M		H		H	H
	CO4	H				H	M		M		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		M	H		L	M	M	H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences(BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)		Project/Term paper/ Seminar/ Internship (H)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT – I BASIC THERMODYNAMICS 16

Systems, Zeroth low, First law. Properties of gases and vapours. Steady flow energy equation. Heat and work transfer in flow and non-flow processes. Second law, Kelvin-Planck statement - Clausius statement - Concept of Entropy, Clausius inequality, Entropy change in non-flow processes.

UNIT – II AIR CYCLE AND COMPRESSORS 12

Otto, Diesel, Dual and Brayton cycles. Air standard efficiency. Mean effective pressure, reciprocating compressors – Intercooling – Minimum work requirement.

UNIT – III REFRIGERATION AND AIR-CONDITIONING 10

Principles of Psychometry and refrigeration - Vapour compression - Vapour absorption types -Co-efficient of performance, Properties of refrigerants – Basic Principle and types Air conditioning.

UNIT – IV HEAT TRANSFER 10

Conduction in parallel, radial and composite wall – Basics of Convective heat transfer - Fundamentals of Radiative heat transfer.

UNIT-V HEAT EXCHANGERS 12

Types of Heat Exchangers- Radiators-Types- Design of Parallel, Counter and Cross flow Heat Exchangers.

(Use of standard thermodynamic tables, Mollier diagram and Refrigerant property tables are permitted)

TEXT BOOKS:

1. Nag.P.K., “Engineering Thermodynamics”, Tata McGraw-Hill, New Delhi, 2007.

2. Rathakrishnan E., "Fundamentals of Engineering Thermodynamics", Prentice-Hall India, 2005**.**

REFERENCES:

1. Ramalingam K.K. "Thermodynamics", Sci-Tech Publications, 2006
2. Holman.J.P., "Thermodynamics", 3rd Ed. McGraw-Hill, 2007.
3. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
4. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.

BAM304	**ENGINEERING FLUID MECHANICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – Mechanics of materials, Thermal and Fluid Power engineering				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in Engineering Fluid Mechanics. The detailed concept, Basic theory of Engineering Fluid Mechanics, Basic Equations of fluid Flow Analysis, Incompressible Inviscid flow, Incompressible viscous flow and Fluid machinery will be taught to the students.

Course Outcomes

CO1 - To learn the basic theory of engineering fluid mechanics

CO2 - To learn basic Equations of fluid Flow Analysis

CO3 - To learn Incompressible in viscid flow

CO4 – To learn Incompressible viscous flow

CO5 – To learn different types of Fluid Machinery and Turbines

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		L	M			M
	CO3		H		M	H		M		H		H	H
	CO4	H				M	M		M		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I BASIC CONCEPTS 9

Introduction – Fluid properties – Newton's viscosity law – Classification of fluids and fluid motion – Fluid statics – Hydrostatic force on submerged surfaces – stability of floating bodies.

UNIT – II BASIC EQUATIONS OF FLUID FLOW ANALYSIS 10

Basic laws for a system in integral form – Conservation of mass – Newton's 2nd law – Laws of thermodynamics – Application of the basic laws for a control volume – Kinematics – Motion of a fluid particle – Fluid deformation – Differential analysis of fluid motion – Continuity equation

UNIT – III INCOMPRESSIBLE INVISCID FLOW 8

Euler's equations of motion – Bernoulli's equations – Applications – Methods of pressure measurement – Flow measurement – Orifice plate – Venturi meter – Irrotational flow – Stream function and velocity potential – Laplace equation – Elementary plane flows

UNIT – IV INCOMPRESSIBLE VISCOUS FLOW 8

Fully developed laminar flow between infinite parallel plates – Laminar and turbulent flow through pipes – Velocity profiles – Energy considerations in pipe flow – Calculation of head loss Pipe flow problems

UNIT – V FLUID MACHINERY 10

Introduction and classification of fluid machines – Turbo machinery analysis – The angular momentum principle – Euler turbo machine equation– Application to fluid systems – Working principle of turbines, fans, blowers, pumps and compressors.

TEXT BOOKS:

1. R.K.Bansal, Fluid Mechanics & Hydraulic Machines. Laxmi Publications (P) Ltd., New Delhi 2001
2. Fluid Mechanics, John F.Douglas.

REFERENCES

1. Yuan S W, 'Foundations of fluid Mechanics', Prentice-Hall, 1987
2. Milne Thompson L M, 'Theoretical Hydrodynamics', MacMillan, 1985
3. Rathakrishnan, E, 'Fundamentals of Fluid Mechanics', Prentice-Hall, 2007

BAM305	**PRODUCTION TECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engineering Materials and Metallurgy, Engineering Metrology, Tribology				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in Production Technology. The detailed concept of casting, metal Forming & powder metallurgy, Welding, and theory of metal Cutting & machining will be taught to the students.

Course Outcomes

CO01 - To learn the detailed study of casting and types.

CO02 - To learn the detailed study of metal forming & powder metallurgy.

CO03 - To learn the detailed study of welding and types.

CO04 – To learn the study of theory of metal cutting & machining process.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M		M		M		L	M		H	M
	CO3		H		M	H	H	M		H		H	H

	CO4	H		H		M	M		H		H		L
	CO5			H		H		M	M	L		M	H
	CO6	L	M	M		M	H		L	H	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I CASTING 9

Casting types, procedure to make sand mould, types of core making, moulding tools, Machine moulding, Special moulding processes-CO_2 moulding, Shell moulding, Investment moulding, Pressure die casting, Centrifugal casting, Continuous casting, Casting defects.

UNIT – II METAL FORMING & POWDER METALLURGY 9

Principles and applications of the following processes: Forging, Rolling, Extrusion, Wire drawing and Spinning, Powder metallurgy – Principle steps involved advantages, disadvantages and limitations of powder metallurgy.

UNIT – III WELDING 9

Classification of welding processes, Principles of Oxy-acetylene gas welding, A.C Metal arc welding, Resistance welding, Submerged arc welding, Tungsten Inert Gas welding, Metal Inert Gas welding, Electron beam welding, Laser beam welding, Defects in welding, Soldering and Brazing.

UNIT – IV THEORY OF METAL CUTTING 9

Mechanism of cutting, chip formation and types, tool materials, tool geometry, cutting forces, Cutting fluids, Tool wear and Tool life, machinability.

UNIT – V MACHINING 9

General principles of working and commonly performed operations in the following Machines: Lathe, Shaper, Planer, Horizontal milling machine, Universal Drilling machine, Cylindrical Grinding machine, Capstan and Turret lathe. Basics of CNC machines.

TEXTBOOKS:

1. Hajra Choudhury, "Elements of Workshop Technology", Vol. I & II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2005
2. Nagendra ParasharB.S and Mittal R.K., "Elements of Manufacturing Processes", Prentice – Hall of India Pvt., Ltd., 2007

REFERENCES:

1. R.K. Jain and S.C. Gupta, "Production Technology", Khanna Publishers, 16th Edition, 2001
2. "H.M.T. Production Technology – Hand Book", Tata McGraw Hill, 2000
3. Roy. A. Linberg, Process and Materials of Manufacture", PHI, 2000.

BAM3L1	AUTOMOTIVE PARTS AND ASSEMBLY DRAWING	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Engineering Graphics, Engineering and Technical Drawing				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVES

The main objective of this Study is to Design and drawing practice of Automotive Parts.

Course Outcomes

CO1 - To learn the Design and drawing practiceof machine and production drawing

CO2 - To learn the Design and drawing practice concepts of limits, tolerance, fits

CO3 - To learn the Design and drawing practice of Machine element joints

CO4 – To learn the detailed part drawing and assembly drawings and Computer aided design and drafting

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		H	M	M	M	H	H	H	H
	CO2									M			
	CO3		H	H	M	H		H		H		H	H
	CO4	H					L		M		M		
	CO5			M		H		M		M		M	M
	CO6	L	M	M		M	L		L	M	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT-I

Instruction to machine drawing & production drawing, classification of drawing – BIS conventions – Orthographic and sectional views.

UNIT-II

Reviews of the concepts of limits, tolerance, fits, surface roughness, and symbols terminology used in Production drawing.

UNIT-III

Machine element joints – Types of joints – Screw fasteners – Pin joints, couplings welded joints.

UNIT-IV

Detailed part drawing and assembly drawings (with suitable tolerances, machine symbols, specification of fit).

1) Screw jack

2) Shaper tool head
3) Non return valve
4) Plummer block
5) Foot step drawing
6) Machine vice
7) Four jaw chuck of lathe
8) Lathe tail stock
9) Square tool post
10) Universal coupling
11) Hydraulic & Pneumatic Assembly

UNIT-V

Introduction to Computer aided drafting – methods of preparation of drawings – Printing/ Plotting of technical drawings.

TEXT BOOK:

1. Narayana K.L., Kannaiah P and Venkata Reddy – "Production Drawing" New Age International Limited, Delhi 2004.

REFERENCE BOOKS:

1. Bhat N.D., "Machine Drawing", Charotar Publishing House, Anand 2000
2. Nagtal G.R., "Machine Drawing", Khanna Publishers, New Delhi 1994.
3. Sache Singh & P.L. Shah – Fundamentals of Machine Drawing, Prentice Hall India, 2003.

BCE3L2	**FLUID MECHANICS & STRENGTH OF MATERIALS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Solid Mechanics, Mechanics of Machines, Fluid Power systems and Hydraulic Engineering				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

The main objective of this Study is to lab practice of fluid flows, Determination of Flow through notches, weir and orifice. The practical study of strength of materials.

Course Outcome

CO01 - Determination of flow through pipes, losses in pipes.

CO02 - Calibration of orificemeter and venture meter.

CO03 - Performance characteristics of pumps and turbines.

CO04 – Tension and Torsion test of a mild steel rod

CO05 - Deflection test on helical springs, beams and Impact test on Metal

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		H	M	M	M	H	H	H	H
	CO2									M			
	CO3		H	H	M	H		H		H		H	H
	CO4	H					L		M		M		
	CO5			M		H		M		M		M	M
	CO6	L	M	M		M	L		L	M	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

FLUID MECHANICS LAB

1. Determination of flow through pipes, losses in pipes.
2. Calibration of orificemeter and venture meter.
3. Flow through notches and weir.
4. Flow through open orifice.
5. Buoyancy experiment-Metacentric height.
6. Impact of jet on vanes-inclined and curved vanes.
7. Verification of Bernoulli's equation.

FLUID MACHINERY LAB

1. Performance characteristics of Jet pump
2. Performance characteristics of Vane pump
3. Performance characteristics of Centrifugal pump
4. Performance characteristics of Reciprocating pump
5. Performance characteristics of Gear pump
6. Characteristics of Impulse turbine
7. characteristics of Reaction turbine

STRENGTH OF MATERIALS LAB

1. Tension test of a mild steel rod
2. Double shear test on mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Hardness test on metals- Brinell and Rockwell hardness
5. Deflection test on helical springs
6. Deflection test on beams
7. Double shear test in U.T.M
8. Impact test on Metals

BMA402	**NUMERICAL METHODS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 75	3	2	0	4
	Prerequisite – +2 Mathematics, Engineering mathematics I and II				
	Course Designed by- Department of Mathematics				

OBJECTIVE:

The main objective of this course is to impart knowledge in Numerical Methods. The detailed concept of Solution of Equations and Eigen Value problem, Interpolation (Finite Differences), Numerical Differentiation and Integration, Initial Value Problems for ordinary

Differential Equations, Boundary Value Problems for ODE and PDE will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of Solution of Equations and Eigen Value Problem

CO2 - To learn the detailed study of Interpolation (Finite Differences)

CO3 - To learn the detailed study of Numerical Differentiation and Integration

CO4 – To learn the detailed study of Initial Value Problems for ordinary Differential Equations

CO5 - To learn the detailed study of Boundary Value Problems for ODE and PDE

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	H	M
	CO2		M				M		L	M			M
	CO3		H		M	H		H		H		H	H
	CO4	H		M		M	M		H	M			
	CO5			M		H		H	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

UNIT- I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEM 9+6

Iterative method, Newton-Raphson method for single variable-solutions of linear system by Gaussian, Gauss-Jordan, Jacobian and Gauss-Siedel methods, Inverse of matrix by Gauss-Jordan method, Eigen value of a matrix power and Jacobian methods.

UNIT-II INTERPOLATION 9+6

Newton's Divide difference formula, Lagrange's interpolation-forward and backward difference formula-Stirling's Bessel's central difference formula

UNIT-III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+6

Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal Simpson's (Both 1/3" and 3/8") rule, Double integrals using Trapezoidal and Simpson's rule

UNIT -IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERNTIAL EQUATIONS 9+6

Single step methods, Taylor series, Euler and modified Euler, Runge kutta method of first and second order differential equations, multiple step methods, Milne and Adam's –Bash forth predic and corrected method

UNIT -V BOUNDARY VALUE PROBLEMS FOR ODE AND PDE 9+6

Finite difference for the second order ordinary differential equations, finite difference solutions for one dimensional heat equations (both implicit and explicit), one dimensional wave equation, Two dimensional, Laplace and Poisson equation

TEXTBOOKS:

1. M.K.Venkatraman'Numerical Methods', NPC, Chennai

REFERENCES:

1. Jain.M.K.Iyengar, S.R.K.Andjain, RK "Numerical Methods for Scientific and Engineering Computation",(3rd edition, New age International Pub,Co(1993))
2. Grewal.B.S."Higher Engineering Mathematics" (6th edition)Khanna Publisher, Delhi,2004.

BAM401	**THEORY OF MACHINES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Kinematics and Mechanics of Machines, Strength of Materials and Behavior of metals				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in Theory of Machines. The detailed concept of Mechanisms, Friction, Gearing and Cams, Balancing and Vibration will be taught to the students.

Course Outcomes

CO01 - To learn the detailed study of machines and structure

CO02 - To learn the detailed study of friction and types

CO03 - To learn the detailed study of gearing and cams

CO04 - To learn the detailed study of balancing

CO05 – To learn the detailed study of vibration

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		L	M			M
	CO3		H		M	H		M		H		H	H
	CO4	H				M	M		M		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I MECHANISMS 14

Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint & motion – Degrees of freedom slider crank – Single and double – Crank rocker mechanisms – Inversions – applications, Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT – II FRICTION 12

Types of friction – friction in screw and nut – pivot and collar – thrust bearings – collar bearing – plate and disc clutches – belt (flat & vee) and rope drives – creep in belts – Jockey pulley – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tensions – Effect of centrifugal and initial tension – condition for maximum power transmission.

UNIT – III GEARING AND CAMS 12

Gear profile and geometry – nomenclature of spur & helical gears – laws of gearing – interference – requirement of minimum number of teeth in gears – gear trains – simple and compound gear trains – determination of speed and torque in epicyclic gear trains – cams different types of followers – cam design for different follower motions.

UNIT – IV BALANCING 11

Static and dynamic balancing – single and several masses in different planes – primary and secondary balancing of reciprocating masses – balancing single and multi cylinder Engines – Governors and Gyroscopic effects.

UNIT – V VIBRATION 11

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multirotor systems – geared shafts – critical speed of shafts.

TEXT BOOKS:

1. Bansal Dr.R.K. " Theory of Machines" Laxmi Publications (P) Ltd., New Delhi 2001
2. Rattan S.S."Theory of machines" Tata McGraw Hill publishing Co., New Delhi, 2002.

REFERENCES:

1. Rao J.S.and Dukkipati R.V. "Mechanism and Machine Theory" Second Edition, Wiley Eastern Limited, 1992.
2. Malhotra D.R. and Gupta H.C "The Theory of machines" Satya Prakasam, Tech. India Publications, 1989
3. Gosh A and Mallick A.K. "Theory of Machines and Mechanisms" affiliated east west press, 1989

BAM402	AUTOMOTIVE CHASSIS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Automotive Technology, Automotive Braking and Suspension Systems				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in Automotive Chassis. The detailed concept of Introduction, Frame, Steering system, Propeller shaft and final drive, Axles and Tyres, Suspension system and Braking system will be taught to the students.

Course Outcomes													
CO01 - To learn the detailed study of frame, steering system													
CO02 - To learn the study of steering system													
CO03 - To learn the detailed study of propeller shaft and final drive													
CO04 – To learn the detailed study of sxles and tyres, Suspension system													
CO05 - To learn the detailed study of suspension system and braking system													
	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		H	M		M	M
	CO3		H		M	H		M		H			H
	CO4	H		H		H	M		M		L	M	
	CO5			M		H	H	M	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I INTRODUCTION, FRAME, STEERING SYSTEM 9

Types of Chassis layout, with reference to Power Plant location and drive, various types of frames, Loads acting on vehicle frame, Constructional details and materials for frames, Testing of frames, Types of Front Axles and Stub Axles, Front Wheel Geometry, namely, Castor, Camber, King Pin Inclination and Toe–in, Condition for True Rolling Motion of Wheels during Steering, Ackerman's and Davis Steering Mechanisms, Steering Error Curve, Steering Linkages, Different Types of Steering Gears, Slip Angle, Over–Steer and Under–Steer, Reversible and Irreversible Steering, Power–Assisted Steering- Hydraulic and Electrically assisted steering.

UNIT – II PROPELLER SHAFT AND FINAL DRIVE 9

Effect of Driving Thrust, torque reactions and side thrust, Hotchkiss drive, torque tube drive, radius rods and stabilizers, Propeller Shaft, Universal Joints, Constant Velocity Universal Joints, Front Wheel drive, Final drive, different types, Double reduction and twin speed final drives, Multi–axled vehicles, Differential principle and types, Differential housings, Non–Slip differential, Differential locks, Final drive of Crawler Tractors.

UNIT – III AXLES AND TYRES 9

Construction and Design of Drive Axles, Types of Loads acting on drive axles, Full – Floating, Three–Quarter Floating and Semi–Floating Axles, Axle Housings and Types, Types and Constructional Details of Different Types of Wheels and Rims, Different Types of Tyres and their constructional details.

UNIT – IV SUSPENSION SYSTEM 9

Need for Suspension System, Types of Suspension Springs, Constructional details and characteristics of Single Leaf, Multi–Leaf, Coil, Torsion bar, Rubber, Pneumatic and Hydro – elastic Suspension Spring Systems, Independent Suspension System, Shock Absorbers, Types and Constructional details, Design of Leaf and Coil Springs-Introduction to adaptive suspension systems.

UNIT – V BRAKING SYSTEM 9

Theory of Automobile Braking, Stopping Distance Time and Braking Efficiency, Effect of Weight Transfer during Braking, Theory of Drum Brakes, Leading and Trailing Shoes, Braking Torque, Constructional Details of Drum Brake and its Activators, Disc Brake Theory, Hydraulic, Mechanical, Pneumatic and Power–Assisted Braking System, Servo Brakes, Retarders, Anti–Lock Braking System.

TEXTBOOKS:

1. Kirpal Singh, Automobile Engineering, Standard Publisher, New Delhi, 2006
2. R.K. Rajput, A TextBook of Automobile Engineering, Laxmi Publications Private Limited, 2007.
3. N.K. Giri, Automotive Mechanics, Khanna Publishers, 2007

REFERENCES:

1. Heldt P.M., Automotive Chassis, Chilton Co., New York, 1990
2. Newton Steeds and Garret, Motor Vehicles, 13th Edition, Butterworth, London, 2005.
3. Heinz Hazler, Modern Vehicle Technology, Butterworth, London, 2005.

BAM403	**AUTOMOTIVE DIESEL ENGINES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Internal Combustion Engines, Automotive Engines				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in Automotive Diesel Engines. The detailed concept of Basic Theory, Fuel Injection System, Air Motion, Combustion and Combustion Chambers, Super charging and Turbo charging, Engine performance and Evaluation will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of Basic Theory of Diesel Engine

CO2 - To learn the detailed study of Fuel Injection System and types

CO3 - To learn the detailed study of AirMotion Combustion and Combustionchambers

CO4 – To learn the detailed study of supercharging and Turbo charging

CO5 - To learn study of Engine performance and Evolution

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		H	M		M	M
	CO3		H		M	H		M		H			H
	CO4	H		H		H	L		M		L	M	
	CO5			M		H	H	M	M	H		L	H
	CO6	L	M	M		M	H		L	H	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I BASIC THEORY 9

Diesel engine construction and operation. Two stroke and four stroke diesel engines. Diesel cycle – Fuel-air and actual cycle analysis. Diesel fuel. Ignition quality. Cetane number. Laboratory tests for diesel fuel. Standards and specifications- Alternate fuels in CI engines.

UNIT – II FUEL INJECTION SYSTEM 9

Requirements – solid injection. Function of components –common rail direct injection - Jerk and distributor type pumps. Pressure waves, Injection lag. Unit injector. Mechanical and pneumatic governors. Fuel injector, Types of injection nozzle, Nozzle tests. Spray formation, Spray dynamics, Spray models, Injection timing. Pump calibration. Pilot injection.

UNIT – III AIR MOTION, COMBUSTION AND COMBUSTION CHAMBERS 10

Importance of air motion – Swirl, squish and turbulence, Swirl ratio. Fuel air mixing. Stages of combustion. Delay period – factors affecting delay period. Knock in CI engines. Comparison of knock in CI & SI engines. Direct and indirect injection combustion chambers. Air cell chamber. Combustion chamber design – objectives – Different types of combustion chamber. MAN Combustion chamber.

UNIT – IV SUPERCHARGING AND TURBOCHARGING 8

Necessity and limitation – Charge cooling. Types of supercharging and turbocharging – Relative merits. Matching of turbocharger-Turbocharger waste gates- Variable geometry-Turbochargers.

UNIT – V ENGINE PERFORMANCE AND EVALUATION 9

Automotive and stationary diesel engine testing and related standards – Engine power and efficiencies – performance characteristics. Variables affecting engine performance – Methods to improve engine performance – Heat balance – Performance maps.

TEXT BOOKS:

1. K. K. Ramalingm, internal Combustion Engines, Scitech publications, Chennai, 2003.
2. Ganesan,V., Internal Combustion Engines, Tata-McGraw Hill Publishing Co., New Delhi, 1994.

REFERENCES:

1. Heldt,P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1985.
2. Maleev,V.M., Diesel Engine Operation and Maintenance, McGraw Hill, 1974.

BAM404	AUTOMOTIVE ELECTRICAL SYSTEMS	L	T	P	C

	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Automobile Electricity, Basic Electrical and Electronics				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in Automotive Electrical Systems. The detailed concept of Batteries, Starting system, Charging system, Ignition system, Lighting system & Accessories will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of Batteries,

CO2 - To learn the detailed study of Starting system

CO3 - To learn the detailed study of charging system

CO4 – To learn the detailed study of Ignition system

CO5 - To learn the detailed study of Lighting system & Accessories

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M			H	H		M	M		M	M
	CO3		H		M	H		M		H			H
	CO4	H		H		H	H		M		L	M	
	CO5			M		H	H	M	M	H		L	H
	CO6	L	M	L		M	M		L	H	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I BATTERIES 8

Principle and construction of lead-acid battery. Characteristics of battery, rating, capacity and efficiency of batteries. Various tests on battery condition, charging methods - Modern storage batteries- Lion- Nickel and others-Batteries for electric cars-Limitations

UNIT – II STARTING SYSTEM 9

Condition of starting Behavior of starter during starting. Series motor and its characteristics. Principle & construction of starter motor.Working of different starter drive units. Care & maintenance of starter motor, Starter switches.

UNIT – III CHARGING SYSTEM 9

Function, Components of DC and AC Charging System for Automobile, construction, operating principle, characteristics, charging circuit controls – cut out, relays, voltage and current regulators, troubleshooting

UNIT – IV IGNITION SYSTEM 10

Types, construction & working of battery coil and magneto ignition systems. Relative merits, centrifugal and vacuum advance mechanisms. Types and construction of spark plugs, Electronic Ignition systems. DLI systems.

UNIT – V LIGHTING SYSTEM & ACCESSORIES 9

Insulated & earth return systems. Positive & negative earth systems. Details of head light & side light. Head light dazzling & preventive methods. Electrical fuel-pump, Speedometer, Fuel, oil & temperature gauges, Horn, Wiper system, Trafficator, wiring system.

TEXT BOOK:

1. Judge,A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992.
2. Kholi,P.L., Automotive Electrical Equipment, Tata McGraw-Hill Co. Ltd., New Delhi, 1975.

REFERENCES:

1. Crouse,W.H., Automobile Electrical Equipment, McGraw Hill Book Co. Inc., New York, 1980.
2. Automotive Hand Book, fifth edition, Robert Bosch, Bently Publishers, 2003.
3. Kripal Singh, Automobile Engineering, Standard Publisher, New Delhi, 2006.

BCE406	**ENVIRONMENTAL STUDIES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – Physical Sciences				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To study the nature and facts about environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context
CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M			H	H		H	M		H	M
	CO3		H		M	H		M		H			H
	CO4	H		H		H	H		M		L	M	
	CO5			H		H	H	M	M	H		L	H
	CO6	L	M	L		M	L		L	H	M	H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences(BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)		Project/Term paper/ Seminar/ Internship (H)
				√									
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance, Need for public awareness.

Natural Resources : Renewable And Non – Renewable Resources

Natural resources and associated problems

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.
c) Mineral resources : Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing , effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.
f) Land resources : Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 8

Concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-

Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III BIODIVERSITY AND ITS CONSERVATION 7

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega-diversity nation, Hot-spots of biodiversity -Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution **7**

Definition, Causes, effects and control measures of ;- Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management : floods earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **8**

From Unsustainable to Sustainable development, Urban problems related to energy, nuclear accident and holocaust, case studies, wasteland reclamation, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection Act, Forest Conservation Act, Issues involved in enforcement of environmental Legislation, public awareness –

Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel – oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes – Noise produced by fire crackers – Noise pollution – Noise level standards for fire crackers – Intensity of sound – Impact on hearing – Safety measures.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **6**

Population growth, variation among nations, population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXTBOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297 0277-0, 2004.
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, 1989.
4. Benny Joseph, "Environmental Studies"., TATA McGraw Hill, 2010

REFERENCES

1. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, EnviroMedia 2009
2. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
4. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno Science Publications 2013
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB),2001.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment &

Security. Stockholm Env. Institute Oxford Univ. Press. 473p
8. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
9. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publish Co. Pvt. Ltd. 345p.
12. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut.
13. http://eng.mft.info/uploadedfiles/gfiles/c8e31c9e52d84c3.pdf

BAM4L1	**AUTOMOTIVE ENGINE OMPONENTS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Automotive Technology, IC Engines				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

Study of the following engines and its components by Dismantling, Comparing with Recent Engine Components and Assembling Various Parts**.**

Course Outcomes

CO01 – Dismantling procedure of LCV

CO02 – Dismantling procedure of HCV

CO03 – Study and Readings

CO04 – Assembling procedure of LCV and HCV

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		H	M	M	M	H	H	H	H
	CO2									M			
	CO3		H	H	M	H		H		H		H	H
	CO4	H					L		M		M		
	CO5			M		H		M		M		M	M
	CO6	L	M	M		M	L		L	M	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Study ofthe Following Engines and Its Components by Dismantling, Comparing With Recent Engine Components and Assembling Various Parts:

a) Tata Engine
b) Leyland Engine

c) Anyone type of CRDI engine
d) Anyone type of EFI engine
e) Two Stroke Engines

2. Engine Overhaul Procedure
3. Study, Dismantling and Assembling of aCarburetor
4. Study, Dismantling and Assembly ofa Mechanical Fuel Pump
5. Measurementof Critical Dimensions of
   a) Piston
   b) Connecting Rod
   c) Piston Rings
   d) Crankshaft
   e) Valves

6. Find the Cubic capacity and Compression ratio of a vehicle.
7. Other Engine Subsystems/Components.
   a) Fuel filter
   b) Injector
   c) Turbocharger
   d) Radiator
   e) Thermostat
   f) Water Pump
   g) Oil Pump
   h) Catalytic convertor
   i) Muffler

BAM4L2	**ENGINE TESTING & EMISSION MEASUREMENT LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Automotive Engines and Emission, IC Engines, Alternate Fuels				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

Performance study of Petrol and Diesel engines. Heat balance Test and Emission Measurements

Course Outcomes

CO1 – Study of Dynamometers

CO2 – Performance study of Petrol and Diesel engines

CO3 – Study of balance Test

CO4 – Study of Emission Test and Exhaust gas Analyzer

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		H	M	M	M	H	H	H	H
	CO2									M			
	CO3		H	H	M	H	H	H		H		M	H
	CO4	H					L		M		M		
	CO5			H		H		M		M		M	M
	CO6	L	M	M		M	L		L	M	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Study of Dynamometers.
2. Valve timing diagram.
3. Port timing diagram.
4. Performance test in single cylinder diesel engine.
5. Performance test in twin cylinder diesel engine.
6. Performance test in three cylinder petrol engine.
7. Morse test on Petrol engine.
8. Heat balance test on an automotive diesel engine.
9. Study of NDIR Gas Analyzer and FID.
10. Study of Gas Chromatography.
11. Study of Chemiliminescent NOx analyzer.
12. Measurement of HC, CO, CO_2, O_2 and NOX using exhaust gas analyzer.
13. Diesel smoke measurement.

BAM4L3	**AUTOMOTIVE ELECTRICAL LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic Electrical and Electronics, Automotive Electrical Technology				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

Laboratory study of Starting, Charging systems and Performance study of Alternator.

Course Outcomes

CO1 – Study of various types of Batteries

CO2 – Study of Automotive Electric system and Lighting Accessories

CO3 –Study of Starting, Charging systems

CO4 – Study of Electrical assisted power steering

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		H	M	M	M	H	H	H	H
	CO2									M			
	CO3		H	H	M	H	H	H		H		M	H
	CO4	H					L		M		M		
	CO5			H		H		M		M		M	M

	CO6	L	M	M		M	L		L	M	M	H		
3	Category	Humanities & Social Studies (HS)		Basic Sciences(BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term paper/ Seminar/ Internship (H)	
							√							
4	Approval	37th Meeting of Academic Council, May 2015												

LIST OF EXPERIMENTS

1. Study of various types of Batteries
2. Study of Automotive Electric system and Lighting Accessories
3. Battery testing – Specific gravity test, Voltage test.
4. Checking of cutoff voltage using electronic regulator.
5. Testing of ignition coil.
6. Performance test on Alternator.
7. Working of Stepper motors.
8. Study of Electrical assisted power steering.

BAM4S1	**TECHNICAL SEMINAR-I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic Engineering Sciences, Automotive Technology and Engineering Basics				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

The students know about the resent techniques in Automobile Evaluation will be made based on the reports, the presentations and the interactions during the question answer sessions.

Course Outcomes

CO1 –Ability and Skills to be improved

CO2 – self confidents to be improved

CO3 –leadership quality to be improved

CO4 –innovative ideas will be generated

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		H	M	M	M	H	H	H	H
	CO2									M			
	CO3		H	H	M	H	H	H		H		M	H
	CO4	H					L		M		M		
	CO5			H		H		M		M		M	M
	CO6	L	M	M		M	L		L	M	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
									√
4	Approval	37th Meeting of Academic Council, May 2015							

The students are expected to make presentations throughout the semester under the supervision of a team of respective department faculty. The students are to be grouped appropriately so that each student makes a minimum of two different presentations on engineering topics of current interest. Every student has to submit an approved technical report prior to his presentation. Evaluation will be made based on the reports, the presentations and the interactions during the question answer sessions.

BAM501	**COMPUTER CONTROL OF VEHICLE SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Electronic Engineering, Sensors and Actuators, Robotics and Automation				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

The main objective of this course is to impart knowledge in Computer Control of vehicles systems. The detailed concept of Introduction, Driveline control system, Safety and security system, Comfort system, Intelligent Transportation system will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of Components of chassis management system

CO2 - To learn the detailed study of Driveline control system

CO3 - To learn the detailed study of Safety and Security system

CO4 – To learn the detailed study of Comfort System

CO5 - To learn the detailed study of Intelligent Transportation System

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M			H	H		M	M		H	M
	CO3		H		M	H		M		H			H
	CO4	H		H		H	H		H		L	M	
	CO5			M		H	H	L	M	H		L	H
	CO6	L	M	L		M	M		L	H	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I INTRODUCTION 9

Components of chassis management system – role of various sensors and actuators pertain to chassis system – construction – working principle.

UNIT – II DRIVELINE CONTROL SYSTEM 9

Speed control – cylinder cut- off technology, Gear shifting control – Traction / braking control, brake by wire – Adaptive cruise control, throttle by wire. Steering - power steering, collapsible and tiltable steering column – steer by wire.

UNIT – III SAFETY AND SECURITY SYSTEM 9

Airbags, seat belt tightening system, collision warning systems, child Lock, anti lock braking systems, Vision enhancement, road recognition system, Anti theft technologies, smart card system, number plate coding.

UNIT – IV COMFORT SYSTEM 9

Active suspension systems, requirement and characteristics, different types, Vehicle Handling and Ride characteristics of road vehicle, pitch, yaw, bounce control, power windows, thermal management system, adaptive noise control.

UNIT – V INTELLIGENT TRANSPORTATION SYSTEM 9

Traffic routing system - Automated highway systems - Lane warning system – Driver Information System, driver assistance systems - Data communication within the car, Driver conditioning warning - Route Guidance and Navigation Systems - In-Vehicle Computing – Vehicle Diagnostics system – Hybrid / Electric and Future Cars – Case studies.

TEXT BOOKS:

1. U. Kiencke, and L. Nielsen,Automotive Control Systems,SAE and Springer-Verlag, 2000.
2. William B.Ribbens -Understanding Automotive Electronics, 5th edition, Butter worth Heinemann Woburn,1998.

REFERENCES:

1. Crouse, W.H. & Anglin, D.L., Automotive Mechanics, Intl. Student edition, TMH, New Delhi 1986.
2. Robert Bosch -Automotive Hand Book- SAE , 5th Edition, 2000
3. Internet References.

BAM503	AUTOMOTIVE TRANSMISSION	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Automotive technology, Automotive Braking and Suspension Systems				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

The main objective of this course is to impart knowledge in Automotive Transmission. The detailed concept of Clutch and Gear Box, Hydrodynamic Drive, Planetary Gear Boxes, Automatic Transmission Applications, Hydrostatic and Electric Drive will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of Clutch and Gear Box

CO2 - To learn the detailed study of Hydrodynamic Drive

CO3 - To learn the detailed study of Planetary Gear Boxes

CO4 – To learn the detailed study of Automatic Transmission Applications

CO5 - To learn the detailed study of Hydrostatic and Electric Drive

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		L	M			M
	CO3		H		M	H		M		H		H	H
	CO4	H				M	M		M		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I CLUTCH AND GEAR BOX 14

Problems on performance of automobile - such as resistance to motion, tractive effort, engine speed, engine power and acceleration. Requirement of transmission system. Different types of clutches, principle, Construction and torque capacity. Determination of gear ratios for vehicles. Different types of gearboxes such as Sliding mesh gearbox, Constant mesh gearbox and Synchromesh gearbox.

UNIT – II HYDRODYNAMIC DRIVE 12

Fluid coupling - Principle of operation, Constructional details, Torque capacity, Performance characteristics and Reduction of drag torque. Hydrodynamic Torque converter - Principle of operation, Constructional details and Performance characteristics. Multistage torque converters. Polyphase torque converters. Converter coupling

UNIT – III PLANETARY GEAR BOXES 10

Construction and operation of Ford – T-model gearbox, Wilson Gear box and Cotal electromagnetic transmission.

UNIT – IV AUTOMATIC TRANSMISSION APPLICATIONS 12

Need for automatic transmission, Principle of operation. Hydraulic control system for automatic transmission. Chevrolet "Turboglide" Transmission, Continuously Variable Transmission (CVT) – Types – Operations-Automated Manual Transmission systems.

UNIT – V HYDROSTATIC AND ELECTRIC DRIVE 12

Hydrostatic drive - Various types of hydrostatic systems, Principles of Hydrostatic drive system. Advantages and limitations. Comparison of hydrostatic drive with hydrodynamic drive, Construction and Working of typical Janny hydrostatic drive. Electric drive - Principle of operation of Early and Modified Ward Leonard Control system, Advantages & limitations.

TEXT BOOKS:

1. Newton and Steeds, Motor vehicles, Illiffe Publishers, 2000.
2. Judge, A.W., Modern Transmission systems, Chapman and Hall Ltd., 1990.

REFERENCES:

1. Heldt, P.M., Torque converters, Chilton Book Co., 1992.
2. Crouse, W.H., Anglin, D.L., Automotive Transmission and Power Trains construction, McGraw Hill, 1992.

BAM504	**ELECTRONICS AND INSTRUMENTATION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Electrical and Electronics, Electronics and Instrumental Techniques				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

The main objective of this course is to impart knowledge in Electronics and Instrumentation. The detailed concept of Classification of design & Reduction of Stress concentration. , Design of Shafts and springs, Gear Design, Flywheels, Design of Bearings will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of Classification of design & Reduction of Stress Concentration.

CO2 - To learn the detailed study of Design of analog and digital circuits

CO3 - To learn the detailed study of Automatic Control System

CO4 – To learn the detailed study of Application and Control system

CO5 – To learn the detailed study of Microprocessors and Applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		L	M			M
	CO3		H		H	H		M		H	L	H	H
	CO4	H				M	M		M		H		L

	CO5			M		M		M	H	H		M	H
	CO6	L	M	M		M	H		L	H	M	H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences(BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term paper/ Seminar/ Internship (H)	
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT – I ELECTRONIC COMPONENTS AND DEVICES 10

Resistors, Capacitors, Inductors and Transformers - properties, types. Simple PN Junction Diodes, Zener diode, Bipolar Junction transistor and Field Effect Transistors – operating principles and characteristics. Other Devices - UJT, SCR, LED, Photo detectors.

UNIT – II ANALOG AND DIGITAL CIRCUITS 10

Rectifier and Power Supply Circuits, clipper, clamper using diodes, Operational Amplifiers (Ideal) - properties and typical circuits like differentiator, integrator, summer, comparator, single-stage BJTs and FETs amplifiers - Multistage Amplifier Principles- Flip-Flops, Shift-Registers, Counters, Decoders/Drivers, Timer, Display Devices, A/D and D/A Converters.

UNIT – III AUTOMATIC CONTROL SYSTEM 10

Basic elements- Feedback Principle-Implication of Measurements Error Detectors-Final actuating elements-Two position multi position floating proportional controls- Relays- Servo amplifier- Servomotor- Mechanical, Electrical, Magnetic, Electronic, Hydraulic and Pneumatic systems.

UNIT – IV APPLICATION OF CONTROL SYSTEM 7

Governing of speed kinetic and Process control- Pressure, Temperature, Fluid level, Flow thrust and Flight control Photo electric controls.

UNIT – V MICROPROCESSORS AND APPLICATIONS 8

Architecture of 8085 processors, Address Modes Instruction set, simple programming like addition, subtraction, multiplication, logical operation, Peripherals and Interfacing – 8255, 8251. Applications like motor control, keyboard and PC interfacing.

TEXT BOOKS:

1. Millman.J. and Grabel.S., Integrated Electronics, Tata McGraw Hill, 1995.
2. M.Gopal, Automatic Ccntrol systems, Tata McGraw Hill Edition.
3. Goankar.R.S., Microprocessor Architecture, Programming and Applications, Wiley Eastern 1992.

REFERENCES:

1. Malvino.A.P., Leach.D.P., Digital Principles & Applications, Tata McGraw Hill, 1990.
2. Helfrick.A.D. and Cooper.W.D. Modern Electronics Instrumentation and Measurement Techniques, Prentice Hall 1990.

BAM505	ENGINEERING DESIGN FOR AUTOMOBILEENGINEERS	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engineering Graphics, Machine and Component Drawing, Machine Deign				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

The main objective of this course is to impart knowledge in Engineering Design for Automobile Engineers. The detailed concept of Classification of design and Reduction of stress concentration will be taught to the students**.**

Course Outcomes

CO1 - To learn the detailed study of Classificationof design and Reduction of Stress concentration

CO2 - To learn the detailed study of Design of shafts and springs

CO3 - To learn the detailed study of Gear Design

CO4 – To learn the detailed study of Flywheels

CO5 – To learn of detailed study of Design of Bearings

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		L	M			M
	CO3		H		M	H		M		H		H	H
	CO4	H				M	M		M		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT – I INTRODUCTION 12

Classification of design – Engineering materials and their physical properties as applied to design – Selection of materials – Factors of safety in design – Endurance limit of materials – Determination of endurance limit for ductile materials – Notch sensitivity – Principle of design optimization – Future trends – CAD Euler's formula – – Rankine's formula – Tetmajer's formula – Johnson formula – Design of push rods and eccentricity loaded columns – Reduction of stress concentration.

UNIT – II DESIGN OF SHAFTS AND SPRINGS 12

Introduction – Material and design stresses – Design of axles – Design of shafts on the basis of strength – Design of shaft on the basis of rigidity – Design of hollow shafts – Design of close coiled helical spring subjected to axial loading – Torsion of helical springs.

UNIT – III GEAR DESIGN 12

Design considerations – strength of gear teeth – Lewis equation – Terminology of gears – Dynamic tooth load – Design of spur gears – helical gears – herringbone gears – bevel gears and worm gears. .

UNIT – IV FLYWHEELS 12

Determination of the mass of a flywheel for a given co-efficient of speed fluctuation. Engine flywheels stresses of rim of flywheels. Design of hubs and arms of flywheel – Turning moment diagram.

UNIT – V DESIGN OF BEARINGS 12

Design of journal bearings - Ball and Roller bearings – Types of Roller bearings – Bearing life – Static load capacity – Dynamic load capacity – Bearing material – Boundary lubrication – Oil flow and temperature rise.

TEXTBOOKS:

1. Jain,R.K., Machine Design, Khanna Publishers, 1992.
2. Sundararaja Murthy,T.V., Machine Design, Khanna Publishers, New Delhi, 1991.
3. T.J. Prabhu, Fundamentals of Machine Design, 2009.
4. T.J. Prabhu, Design of Transmission Elements, 2009.

REFERENCES:

1. Sigley, Machine Design, McGraw Hill, 1981.
2. Design Data Book, PSG College of Technology, Coimbatore, 1992.

BBA501	**VALUE EDUCATION AND PROFESSIONAL ETHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
- To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)

CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing
CO4	To learn more of Engineer as Responsible Experimenter.
CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To learn more of Responsibilities and Rights as Professional and facing Global Challenges

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (GOE	Project/Term paper/ Seminar/ Internship (PR)
		√											
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I : PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II : SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE) 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.

UNIT III: MIND CULTURE & TENDING PERSONAL HEALTH 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelising the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV: ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS'S RESPONSIBILITIES FOR SAFETY 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Chalenger, case study. Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies.

UNIT V: ENGINEERS'S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.
Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership

TEXT BOOKS:

1. Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata Mcgraw Hill, Newyork 2005 (Units IV & V)

REFERENCE:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New AgeInternational Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004(for Units IV-V)

BAM5L1	**AUTOMOTIVE CHASSIS COMPONENTS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	1
	Prerequisite – Automotive Technology, Automotive Braking and Suspension Systems, Vehicle Body Engineering and Chassis Management systems				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

Study of the Following Engines and Its Components by Dismantling, Comparing With Recent Engine Components and Assembling Various Parts

Course Outcomes

CO1 – Dismantling procedure of Clutch, Gear Box, Brake system

CO2 – Dismantling procedure of Differential Unit

CO3 – Study and Propeller Shaft Unit

CO4 – Assembling procedure of Clutch, Gear Box, Brake system, Differential Unit

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		H	M	M	M	H	H	H	H
	CO2									M			
	CO3		H	H	M	H	H	H		H		M	H
	CO4	H					L		M		M		
	CO5			H		H		M		M		M	M
	CO6	L	M	M		M	L		L	M	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Study, Dismantling & Assembling of Clutch Assembly
2. Study, Dismantling & Assembling of Gear Box Assembly
3. Study, Dismantling & Assembling of Differential Unit
4. Study of Propeller Shaft Unit
5. Study, Dismantling & Assembling of Steering Gear Boxes
   a) Rack and Pinion (Power and Manual) types
   b) Recirculating Ball type
6. Measurement Of Critical Dimensions of
   a) Ladder Frame Chassis
   b) Monocoque Body
7. Calculation Of Gear Ratios
   a) Differential Unit
   b) Gear Box
8. Study of Pneumatic/ Hydraulic Brake system.
9. Study of Front axle assembly –critical dimensions

BME5L1	**MACHINE SHOP PRACTICE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Production Engineering, Lathe Technology, Mechanical Measurements and Tribological practices, Metrology sciences				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

Exercise on production process of using different machines.

Course Outcomes

CO1 – Exercise on Plane turning, taper turning, thread cutting and Eccentric turning

CO2 – Exercise on drilling, reaming and taping and Welding

CO3 – Study & Exercise on Slotting (Both internal & external keyway cutting)

CO4 – Exercise in Surface Grinding.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		H	M	M	M	H	H	H	H
	CO2									M			
	CO3		H	H	M	H	H	H		H		M	H
	CO4	H					L		M		M		
	CO5			H		H		M		M		M	M

	CO6	L	M	M		M	L		L	M	M	H		
3	Category	Humanities & Social Studies (HS)		Basic Sciences(BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term paper/ Seminar/ Internship (H)	
							√							
4	Approval	37th Meeting of Academic Council, May 2015												

LIST OF EXPERIMENTS

Part-A

1. Exercise on Plane turning, taper turning, thread cutting and Eccentric turning.
2. Exercise on drilling, reaming and taping.
3. Exercise on Spur Gear Milling, Helical Gear Milling and Bevel Gear Milling
4. Study & Exercise on Boring Machine.
5. Study & Exercise on Slotting (Both internal & external keyway cutting).
6. Practice in Capstan & Turret lathes.
7. Exercise in Surface Grinding.

Part-B

Welding Practice

1. Arc welding
2. Gas welding

BEC5L1	**AUTOMOTIVE ELECTRONICS &MICROPROCESSOR LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Automotive Electrical and Electronic Systems, Basic Electrical and Electronics, Microprocessor and its applications				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

Laboratory study of Automotive Electronics and Microprocessor

Course Outcomes

CO1 – Verification of truth table of Logic Gates,

CO2 – Characteristics of rectifiers – Half wave & Full wave

CO3 – Characteristics of SCR.

CO4 – Assembly language programming exercise

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		H	M	M	M	H	H	H	H
	CO2									M			
	CO3		H	H	M	H	H	H		H		M	H
	CO4	H					L		M		M		
	CO5			H		H		M		M		M	M
	CO6	L	M	M		M	L		L	M	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Verification of truth table of Logic Gates.
2. Verification of truth table of Adder, Subtractor & Flip-Flops.
3. Characteristics of rectifiers – Half wave & Full wave.
4. Timer – 555
5. Characteristics of SCR.
6. D/A and A/D converters.
7. Interfacing stepper motor control and CRT terminal
8. Assembly language programming exercise.
9. Interfacing A/D converter and simple data acquisition.

BAM5C1	**COMPREHENSION I**	**L**	**T**	**P**	**C**
	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses up to fifth semester				
	Course Designed by – Dept. Automobile Engineering				
OBJECTIVES					
• To provide a complete review of Automobile Engineering topics covered up to fifth semesters, so that a comprehensive understanding is achieved. • It will also help students to face job interviews, competitive examinations and also to enhance the employment potential. • To provide overview of all topics covered and to assess the overall knowledge level up to fifth semester.					

BAM601	**VEHICLE DYNAMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Computer aided vehicle Deign data characteristics, Vehicle Deign systems, Vehicle Handling and Stability control				
	Course Designed by- Department of Automobile Engineering				
OBJECTIVE:					
The main objective of this course is to impart knowledge in introduction vehicle dynamics, multi degree freedom introduction vehicle dynamics systems numerical methods, vehicle handling and stability of vehicles, suspension, tyres concentration will be taught to the students.					
Course Outcomes					

CO1 - To learn the detailed study ofintroduction vehicle dynamics													
CO2 - To learn the detailed study of multi degree freedom introduction vehicle dynamics systems													
CO3 - To learn the detailed study of numerical methods													
CO4 – To learn the detailed study of vehicle handling and stability of vehicles													
CO5 – To learn of detailed study of suspension, tyres													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		L	M			M
	CO3		H		M	H		M		L		H	H
	CO4	H				M	M		M		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		M	H		H	H	M	H	
3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)			
						√							
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT – I INTRODUCTION 9

Fundamentals of vibration, single degree of freedom, two degree of freedom, multidegree freedom, free, forced and damped vibrations, modeling and simulation studies, model of an automobile, magnification factor, transmissibility, vibration absorber.

UNIT – II MULTI DEGREE FREEDOM SYSTEMS 9

Closed and far coupled system, eigen value problems, orthogonality of mode shapes, modal analysis, forced vibration by matrix inversion.

UNIT – III NUMERICAL METHODS 9

Approximate methods for determining fundamental frequency, Dunkerleys lower bound, Rayleighs upper bound, Holzer method for closed coupled system and branched systems.

UNIT – IV VEHICLE HANDLING AND STABILITY OF VEHICLES 9

Load distribution, calculation of acceleration, tractive effort and reactions for different drives, stability of a vehicle on a curved track, slope and a banked road. Oversteer, under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.

UNIT – V SUSPENSION, TYRES 9

Requirements, sprung mass frequency, wheel hop, wheel wobble, wheel shimmy, choice of damper characteristics and suspension spring rate, calculation of effective spring rate, vehicle suspension in fore and aft direction, roll axis and vehicle under the action of side forces. Tyre – Requirements, types, testing, dynamics, ride characteristics, power consumed by a tyre.

TEXT BOOKS:

1. Gillespie, T.D., Fundamentals of vehicle dynamics society of Automotive Engineers, USA, 1992.
2. T.Y.Wong, *"Theory of Ground Vehicles"*, JohnWiley & Sons Inc ,New York

REFERENCES:

1. W.Steeds, "Mechanics of Road Vehicles", llliffe Books Ltd,London,1960
2. Heldt,P.M., Automotive Chassis, Chilton Co., New York, 1992.
3. Giri N.K – Automotive Mechanics, Khanna Publishers, 2007.

BAM602	**ELECTRONIC ENGINE MANAGEMENT SYSTEM**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Sensors and Actuators, Hydraulic and Pneumatic Systems, Engine Management and Control				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in fundamentals of automotive electronics, sensors and actuators, SI engine management, CI engine management; digital engine control system concentration will be taught to the students.

Course Outcomes

CO01 - To learn the detailed study offundamentals of automotive electronics

CO02 - To learn the detailed study of sensors and actuators

CO03 - To learn the detailed study of SI engine management

CO04 – To learn the detailed study of CI engine management

C005 – To learn of detailed study ofdigital engine control system

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		L	H			M
	CO3		H		M	H		M		H		H	H
	CO4	H				M	H		M		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I FUNDAMENTALS OF AUTOMOTIVE ELECTRONICS 9

Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables, introduction to modern control strategies like Fuzzy logic and adaptive control. Parameters to be controlled in SI and CI engines.

UNIT – II SENSORS AND ACTUATORS 9

Inductive, Hall Effect, hot wire, thermistor, piezo electric, piezoresistive, based sensors. Throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors.

UNIT – III SI ENGINE MANAGEMENT 9

Three way catalytic converter, conversion efficiency versus lambda. Layout and working of SI engine management systems like Bosch Monojetronic, L-Jetronic and LH-Jetronic. Group and sequential injection techniques. Working of the fuel system components. Advantages of electronic ignition systems. Types of solid state ignition systems and their principle of operation, Contactless electronic ignition system, Electronic spark timing control.

UNIT – IV CI ENGINE MANAGEMENT 9

Fuel injection system parameters affecting combustion, noise and emissions in CI engines. Pilot, main, advanced post injection and retarded post injection. Electronically controlled Unit Injection system. Layout of the common rail fuel injection system. Working of components like fuel injector, fuel pump, rail pressure limiter, flow limiter, EGR valve.

UNIT – V DIGITAL ENGINE CONTROL SYSTEM 9

Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, open loop control of fuel injection and closed loop lambda control – Integrated engine control system, Exhaust emission control engineering, Electromagnetic compatibility – EMI Suppression techniques – Electronic dash board instruments – Onboard diagnosis system.

TEXT BOOKS:

1. William B Ribbens, "Understanding Automotive Electronics", 5th edition, Butterworth, Hienemann Wobum, 1998.

REFERENCES:

1. Tom Weather Jr and Cland C. Hunter, "Automotive Computers and Control System", Prentice Hall Inc., New Jersey.

BAM603	INSTRUMENTATION AND EXPERIMENTAL TECHNIQUES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Electrical and Electronics, Instrumentation Engineering and applied sciences				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in vehicle experimental techniques, transducers modifiers and terminating devices, mechanical measurement, engine experimental techniques, fundamentals of measurement systems concentration will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study offundamentals of measurement systems

CO2 - To learn the detailed study of transducers, modifiers and terminating devices

CO3 - To learn the detailed study of mechanical measurement													
CO4 – To learn the detailed study of engine experimental techniques													
CO5 – To learn of detailed study of vehicle experimental techniques													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		L	H			M
	CO3		H		M	H		M		H		H	H
	CO4	H				M	H		M		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences(BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term paper/ Seminar/ Internship (H)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT – I MEASUREMENT SYSTEMS 6

Static and Dynamic Measurement systems- Requirement and characteristics- Analysis of experimental detail, Error analysis.

UNIT – II TRANSDUCERS, MODIFIERS AND TERMINATING DEVICES 8

Transducers for Automotive Applications- Amplifiers- Filters- Data Acquisition- Indicators, Printers and Displays- Signal Analyzing.

UNIT – III MECHANICAL MEASUREMENT 10

Instrumentation for Measuring weight, Force, Torque, Pressure Power, Temperature, Fluid flow, Vibration, Rotational speed, Velocity, Acceleration and Angular motion.

UNIT – IV ENGINE EXPERIMENTAL TECHNIQUES 12

I S Code for Engine testing- Instrumentation for Performance testing of engine- Instrumentation for Research and Development, Instrumentation for noise, vibration, in cylinder gas flow, Flame temperature dynamic cylinder pressure measurements.

UNIT – V VEHICLE EXPERIMENTAL TECHNIQUES 9

Laboratory tests- Tests tracks-Endurance tests-Crash tests- Wind tunnel tests-Brake tests.

TEXTBOOK:

1. J.G. Giles, "Engine and Vehicle Testing", Illiffe books Ltd., London, 1968.
2. T.G. Beckwith and Buck, "Mechanical Measurements", Oxford and IBH Publishing House, New Delhi, 1995.

REFERENCE:

1. A.W. Judge, "Engineering Precision Measurement", Chapman and Hall Ltd, Essex Street W.C., 1951.
2.D.Patambis, "PrincipleofIndustrialInstrumentation",TataMcGraw Hill PublishingCompany, New Delhi, 1990.
3. Rangan, Sharma and Mani, "Instrumentation Devices and Systems ", Tata McGraw Hill Publishing Company, New Delhi, 1990.

BAM604	**AUTOMOTIVE AERODYNAMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Race car Aerodynamics, Vehicle Handling Characteristics and Stability control, Ground Vehicle Structure and Body design				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in introduction of automotive aerodynamics, aerodynamic drag of cabs, shape optimization of cabs, vehicle handling and wind tunnels for automotive aerodynamics systems concentration will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study ofintroduction

CO2 - To learn the detailed study of aerodynamic drag of cabs

CO3 - To learn the detailed study of shape optimization of cabs

CO4 – To learn the detailed study of vehicle handling

CO5 – To learn of detailed study of wind tunnels for automotive aerodynamics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		L	H			M
	CO3		H		H	H		M		H		H	H
	CO4	H				M	H		M		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I INTRODUCTION 10

Scope – historical development trends – Fundamentals of fluid mechanics – Flow phenomenon related to vehicles – External & Internal flow problems – Resistance to vehicle motion – Performance – Fuel consumption and performance – Potential of vehicle aerodynamics.

UNIT – II AERODYNAMIC DRAG OF CABS 8

Car as a bluff body – Flow field around car – drag force – types of drag force – analysis of aerodynamic drag – drag coefficient of cars – strategies for aerodynamic development – low drag profiles.

UNIT – III SHAPE OPTIMIZATION OF CABS 7

Front and modification – front and rear wind shield angle – Boat tailing – Hatch back, fast back and square back – Dust flow patterns at the rear – Effect of gap configuration – effect of fasteners.

UNIT – IV VEHICLE HANDLING 10

The origin of force and moments on a vehicle – side wind problems – methods to calculate forces and moments – vehicle dynamics Under side winds – the effects of forces and moments – Characteristics of forces and moments – Dirt accumulation on the vehicle – wind noise – drag reduction in commercial vehicles.

UNIT – V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS 10

Introduction – Principles of wind tunnel technology – Limitation of simulation – Stress with scale models – full scale wind tunnels – measurement techniques – Equipment and transducers – road testing methods – Numerical methods.

TEXTBOOK:

1. Hucho, W.H., Aerodynamics of Road vehicles, Butterworths Co. Ltd., 1997.

REFERENCES

1. Pope, A, Wind Tunnel Testing, John Wiley & Sons, 2nd Edn., New York, 1994.
2. Automotive Aerodynamics: Update SP-706, SAE, 1987.
3. Houghton, Aerodynamics

BAM6L1	**AUTOTRONICS LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic Mechanical Engineering, Hydraulics and Pneumatics, Fluid Power Systems.				
	Course Designed by- Department of Automobile and Mechatronics Engineering				

OBJECTIVE

Study and performance of pneumatic and hydraulic applications in automobiles

Course Outcomes

CO1 –Design and testing of hydraulic circuits

CO2 – Design and testing of pneumatic circuits

CO3 – Design of speed control circuits and Design of synchronizing circuit

CO4 – Design of sequence circuit

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		L	H			M
	CO3		H		H	H		H		H		M	H
	CO4	H				M	H		M		H		
	CO5			M		H		M	M	H		M	H

	CO6	L	M	M		M	H		L	H	M	L		
3	Category	Humanities & Social Studies (HS)		Basic Sciences(BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term paper/ Seminar/ Internship (H)	
							√							
4	Approval	37th Meeting of Academic Council, May 2015												

LIST OF EXPERIMENTS

1. Design and testing of hydraulic circuits such as
   a) Pressure control
   b) Flow control
   c) Direction control
   d) Design of circuit with programmed logic sequence, using an optional PLC inhydraulic Electro hydraulic Trainer.
2. Design and testing of pneumatic circuits such as
   a) Pressure control
   b) Flow control
   c) Direction control
   d) Circuits with logic controls
   e) Circuits with timers
   f) Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.
3. Design of speed control circuits
   a) Meter – In Circuit
   b) Meter – Out Circuit
4. Design of continuous cycle circuit
5. Design of synchronizing circuit
6. Design of sequence circuit

BAM6L2	**VEHICLE DYNAMICS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Computer aided Vehicle Design Data Characteristics, Vehicle Stability and Control, Body Building Technology				
	Course Designed by- Department of Automobile and Mechatronics Engineering				

OBJECTIVE

Study and performance of stability of vehicle under test conditions

Course Outcomes

CO1 –Total Resistance for various Vehicles.

CO2 – Find the displacement velocity, acceleration and inertia force.

CO3 – Determine the Pressure distribution over a car model.

CO4 – Determine the Pressure distribution in a 2D spoiler.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M

	CO2		M				M		L	H			M
	CO3		H		H	H		H		H		M	H
	CO4	H				M	H		M		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

Part-A

1. Total Resistance for various Vehicles.
2. To find the DHP, DF & Mechanical Efficiency.
3. Find the displacement velocity, acceleration and inertia force.
4. Find the thrust turning moment and combined turning movement.

Part-B

1. Determine the Pressure distribution over a car model.
2. Determination of co-efficient of lift and drag over a car model.
3. Determine the Pressure distribution in a 2D spoiler.

BAM5S1	**TECHNICAL SEMINAR-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	1
	Prerequisite – Basic Engineering Sciences, Automotive Technology and Engineering Basics				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

The students know about the resent techniques in Automobile Evaluation will be made based on the reports, the presentations and the interactions during the question answer sessions.

Course Outcomes

CO1 –Ability and Skills to be improved

CO2 – self confidents to be improved

CO3 –leadership quality to be improved

CO4 –innovative ideas will be generated

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M		H	M	M	M	H	H	H	H
	CO2									M			
	CO3		H	H	M	H	H	H		H		M	H
	CO4	H					L		M		M		

	CO5			H		H		M		M		M	M
	CO6	L	M	M		M	L		L	M	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
									√
4	Approval	37th Meeting of Academic Council, May 2015							

The students are expected to make presentations throughout the semester under the supervision of a team of respective department faculty. The students are to be grouped appropriately so that each student makes a minimum of two different presentations on engineering topics of current interest. Every student has to submit an approved technical report prior to his presentation. Evaluation will be made based on the reports, the presentations and the interactions during the question answer sessions.

BAM701	**VEHICLE MAINTENANCE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Mechanical Engineering, Automotive systems with Maintenance and repair, Automotive technology				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge maintenance records and schedule, maintenance, repair and overhauling of chassis drive line components, maintenance, repair and servicing of electrical systems, maintenance, repair and servicing of cooling, lubrication system, fuel system and body will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study ofmaintenance records and schedule

CO2 - To learn the detailed study of maintenance, repair and overhauling of engine

CO3 - To learn the detailed study of maintenance, repair and overhauling of chassis drive line components

CO4 – To learn the detailed study of maintenance, repair and servicing of electrical systems

CO5 – To learn of detailed study of maintenance, repair and servicing of cooling lubrication system, fuel system and body

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	H	M
	CO2		M				H		L	H			M
	CO3		H		M	H		H		M		M	H
	CO4	H				M	M		H		H		
	CO5			M		H		H	M	H		M	H
	CO6	L	M	M		L	H		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I MAINTENANCE RECORDS AND SCHEDULE 9

Importance of maintenance. Scheduled and unscheduled maintenance. Preparation of check lists. Chassis lubrication. Cost effectiveness. Pre-trip, Post-trip. Inspection forms. Log books. Trip sheets. Other maintenance record forms.

UNIT – II MAINTENANCE, REPAIR AND OVERHAULING OF ENGINE 9

Dismantling of engine components. Cleaning methods. Visual inspection and dimensional check of various engine components. Minor and Major tune up Reconditioning, repairing methods of engine components. Assembly procedure. Special tools used for maintenance, repair and overhauling.

UNIT – III MAINTENANCE, REPAIR AND OVERHAULING OF CHASSIS DRIVE LINE COMPONENTS 9

Clutch – Mechanical, Automatic types. Gear box – Mechanical, Automatic types. Final reduction. Propeller shaft. Front and rear suspension system. Rigid and independent types. Brakes systems – Hydraulic, Servo, Air. Air bleeding. Steering system. Wheel alignment. Types.

UNIT – IV MAINTENANCE, REPAIR AND SERVICING OF ELECTRICAL SYSTEMS 9

Battery – Testing methods. Starter motor. Charging system – DC Generator, AC Alternator, Regulator. Ignition systems – Coil ignition, Transistor assisted ignition, Capacitor discharge ignition. Electric Horn, Wiper, Flasher, Electric fuel pump, Gauges. Lighting system. Head lights focusing. Wiring system.

UNIT – V MAINTENANCE, REPAIR AND SERVICING OF COOLING LUBRICATION SYSTEM, FUEL SYSTEM AND BODY 9

Cooling system – types, water pump, radiator, thermostat valve, anti corrosion and anti freezing solutions. Lubricating system – Oil analysis, oil topping up, oil change, oil filters, oil relief valve. Fuel system – Petrol, diesel fuel feed system components. Body repair tools, minor body panel beating, tinkering, soldering, polishing, painting. Door locks mechanism. Window glass actuating mechanism.

TEXTBOOKS:

1. Judge,A.N., Motor vehicle engine servicing, 3rd Edition, Pitman Paperpack, London, ‘69.
2. Venk.Spicer, Automotive Maintenance and Trouble shooting.

REFERENCES:

1. Judge,A.W., Maintenance of High speed diesel engines, Chapman Hall Ltd., London, ’56.

2. Maleev,V.L., Diesel Engine operation and Maintenance, McGraw Hill Book Co., New York, 1954.

BAM702	VEHICLE BODY ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Body Building Technology, Aerodynamics of Cars				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge of car body details, Vehicle aerodynamics, bus body details, commercial vehicle details, body materials, trim and mechanisms will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study ofcar body details

CO2 - To learn the detailed study of vehicle aerodynamics

CO3 - To learn the detailed study of bus body details

CO4 – To learn the detailed study ofcommercial vehicle details

CO5 – To learn of detailed study ofbody materials, trim and mechanisms

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		L	H			M
	CO3		H		H	H		H		H		M	H
	CO4	H				M	H		H		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I CAR BODY DETAILS 10

Types of Car - Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility- regulations, driver's visibility, improvement in visibility and tests for visibility. Safety - safety design, safety equipments for vehicles. Car body construction. Various panels of car bodies.

UNIT – II VEHICLE AERODYNAMICS 9

Objectives, Vehicle drag and types. Various types of forces and moments. Effects of forces and moments. Side wind effects on forces and moments. Various body optimization techniques for minimum drag. Wind tunnels – Principle of operation, Types. Various wind

tunnel testing such as: Flow visualization techniques, Airflow management test and Test to measure forces and moments.

UNIT – III BUS BODY DETAILS 9

Types – based on capacity, based on distance traveled and based on construction such as Mini bus, Single Decker, Double Decker, Two level, Split-level and Articulated bus. Bus body lay out, Types of metal sections used, Regulations. Constructional details of Conventional and Integral type construction.

UNIT – IV COMMERCIAL VEHICLE DETAILS 8

Different types of commercial vehicle bodies. Light commercial vehicle body types. Construction details of flat platform body, Tipper body & Tanker body – Dimensions of driver's seat in relation to controls – Drivers cab design.

UNIT – V BODY MATERIALS, TRIM AND MECHANISMS 9

Steel sheet, timber, plastics, GRP, properties of materials. Corrosion: Anticorrosion methods, Modern painting process. Body trim items – Body mechanisms.

TEXTBOOK:

1. Powloski, J., Vehicle Body Engineering, Business Books Ltd., 1998.

REFERENCES:

1. Giles, G.J., Body construction and design, lliffe Books Butterworth & Co., 1991.
2. Dieler Anselm., The passenger car body, SAE International, 2000.
3. John Fenton, "Vehicle Body Layout and Analysis", Mechanical Engineering Publication Ltd., London.

BAM703	**VEHICLE DESIGN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Basic Mechanical Engineering, Engineering Design, Machine and Component Drawing				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge vehicle frame and suspension, front axle and steering systems, clutch, gear box, drive line and rear axle will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study ofvehicle frame and suspension

CO2 - To learn the detailed study of front axle and steering systems

CO3 - To learn the detailed study of gear box

CO4 – To learn the detailed study of drive line and rear axle

CO5 – To learn of detailed study ofdrive line and rear axle

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				H		L	H			M
	CO3		H		H	H		H		H		M	H
	CO4	H				M	H		H		H		

	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		L	H		H	H	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I VEHICLE FRAME AND SUSPENSION 12

Study of loads - moments and stresses on frame members. Design of frame for passenger and commercial vehicle - design of leaf springs - Coil springs and torsion bar springs.

UNIT – II FRONT AXLE AND STEERING SYSTEMS 12

Analysis of loads - moments and stresses at different sections of front axle. Determination of bearing loads at Kingpin bearings. Wheel spindle bearings. Choice of bearings. Determination of optimum dimensions and proportions for steering linkages ensuring minimum error in steering. Design of Front Axle Beam.

UNIT – III CLUTCH 12

Torque capacity of single plate, multi plate and cone clutch. Design of clutch components, Design details of roller and sprag type of clutches. .

UNIT – IV GEAR BOX 12

Gear train calculations, layout of gear box constant mesh and synchrono mesh gear box. Design of three speeds and four speed gear boxes.

UNIT – V DRIVE LINE AND REAR AXLE 12

Design of propeller shaft and types of propeller shaft. Design details of final drive gearing. Design details of full floating. Semi-floating and three quarter floating rear shafts and rear axle housings. Design aspects of final drive.

TEXT BOOKS:

1. Heldt,P.M., Automotive Chassis, Chilton Book Co., 1992.
2. Heldt,P.M., Torque Converters, Chilton Book Co., 1992.

REFERENCES:

1. Giri,N.K., Automobile Mechanics, Khanna Publishers, New Delhi, 1998.
2. W. Steeds, "*Mechanics of Road Vehicles*", lliffe Books Ltd, London, 1990.

BAM7L1	VEHICLE MAINTENANCE LABORATORY	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic Mechanical Engineering, Vehicle Maintenance and repair, Automotive technology				

	Course Designed by- Department of Automobile Engineering

OBJECTIVE

Study of an automobile repair, service and maintenance shop.

Course Outcomes

CO1 –Engine tune up for Diesel and Petrol Engines.

CO2 – Study of fuel filters and air cleaners.

CO3 – Fault diagnosis in electrical ignition system, gasoline fuel system, diesel Fuel system.

CO4 – Removal and fitting of tires and tubes.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				H		L	H			M
	CO3		H		M	H		H		M		M	H
	CO4	H				M	H		H		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		L	H		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

1. Study of an automobile repair, service and maintenance shop.
2. Study and preparation of different statements/records required for the repair and maintenance works.
3. Study of different types of tools and instruments required for repair and Maintenance.
4. Engine tune up for Diesel and Petrol Engines.
5. Fault diagnosis in electrical ignition system, gasoline fuel system, diesel fuel system.
6. Study of the faults in the electrical systems such as headlights, side or parking lights, electric horn system, windscreen wiper system, starting and lighting system.
7. Study of fuel filters and air cleaners.
8. Study and adjustment of pedal play in clutch, hand brake and steering wheel play.
9. Practices on air bleeding from hydraulic brakes, air bleeding of diesel fuel system.
10. Removal and fitting of tires and tubes.

BAM7L2	COMPUTER AIDED DRAFTING AND	L	T	P	C

	MANUFACTURING LAB				
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Technical and Machine Drawing, Engineering Graphics, Computer Integrated Manufacturing, CAD-CAM, AutoCAD and Pro-E Basics				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

Study of Computer aided drafting and manufacturing

Course Outcomes

CO1 –CNC milling machines; Production of various contour shapes.

CO2 – Introduction to component modeling.

CO3 – NC code generation using CAD/CAM software

CO4 – Manual Part programming for CNC machines using a standard G-codes and M-codes.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	H	M
	CO2		M				H		L	H			M
	CO3		H		M	H		H		M		M	H
	CO4	H				M	M		H		H		
	CO5			M		H		H	M	H		M	H
	CO6	L	M	M		L	H		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

COMPUTER AIDED MANUFACTURING

1. Manual Part programming for CNC machines using a standard G-codes and M-codes. Simulation of tool path, machining practice on trainer type CNC machines - straight cut, Taper turning, Profile, Parting, Thread cutting.
2. CNC milling machines; Production of various contour shapes.
3. Computer assisted part programming-APT PROGRAMMING LANGUAGE - Part programming using APT and other NC programming languages.
4. Introduction to component modeling.
5. NC code generation using CAD/CAM software - Post Processing for standard CNC controlslike FANUC, SIMUMERIC etc.,

COMPUTER AIDED DRAFTING

CAD introduction to computer aided drawing, 2D drawing Orthographic view, Isometric views, 2D -Sectional views , Part drawing, Assembly drawing, Detailed drawing,

Dimensioning, Annotations, Symbols, Welding, Surface finish, Threads, Text, Bill of materials. Exercise - Knuckle Joint, Gib and Cotter Joint, Screw Jack, Foot step Bearing.

3D drawing part modeling - Protrusion, Cut Sweep, Draft and Loft-Modify/ Edit - Pattern-Transformation, Boolean operation. Assembly - creating assembly from parts, Modify / Edit - Pattern conversion of 3D solid model to 2D model. Surface modeling - Tabulated, Revolve, Ruled and edge surfaces, Exercise-Piston, Connecting Rod, Knuckle Joint, Universal Joint and Couplings.

PROGRAMMING

1. LISP programming
   i) Generation of simple drawings using LISP, C program to analyze the followingmechanism

ii) Four bar mechanism

iii) Slider Crank mechanism

2.C/C++ program for the following Finite Element method problem.

BAM7P1	**TERM PAPER**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	0	0	4	2
	Prerequisite – Professional Courses				
	Lab Manual Prepared by – Dept of Automobile Engineering				

OBJECTIVES

To teach the student the procedures and methodologies for understanding the literature survey and preparation for research paper.

COURSE OUTCOMES (COs)

CO1	To identify the area of research.
CO2	To prepare list of literatures in the relevant area.
CO3	Compile the abstract from the literatures.
CO4	Focus the search to a well defined theme and title.
CO5	Make and exhaustive report by compiling all the literatures that students surveyed.
CO6	To prepare a research paper for publications in journal/conference proceedings.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	H	M
	CO2		M				H		L	H			M
	CO3		H		M	H		H		M		M	H
	CO4	H				M	M		H		M		
	CO5			H		H		H	M	H		M	H
	CO6	L	M	M		L	H		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
									√
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF TASKS

1. **PREPARING PROPOSAL**
   Proposed Research Topic
   Purposes
   Background
   Method: (suggested methods – develop your own to suit your research topic)

2. **CONDUCTING LITERATURE REVIEW**
   Exploring and Sharpening your Topic
   Evaluating Information
   Taking Notes and Keeping Records

3. **COMPLETING ANNOTATED BIBLIOGRAPHY**
   Citing Your Sources and Avoiding Plagiarism
   Writing and Annotated Bibliography

4. **IDENTIFYING PROBLEM STATEMENT**
   Meeting the Challenges of Research
   Developing New Information

5. **COMPLETING OUTLINE FOR THE RESEARCH**

Organizing Your Project into an outline
   Pick up your critique paper and begin editing and incorporate the suggestions from guide

6. **SUBMITTING FIRST DRAFT**
   Drafting your Project
   Entering Conversations and Supporting Your Claims

7. **SUBMITTING WORKS CITED**
   Create the individual citations
   Apply the formatting rules

8. **SUBMITTING FULL PAPER**
   Revising, Editing, and Proofreading
   Designing and Presenting Your Project
   Conducting Research in the Disciplines
   Documenting Sources

REFERENCES:

1. Website.
2. Printed Journals.

BAM7V1	INPLANT TRAINING	L	T	P	C
		0	0	0	1
	Prerequisite – Automotive Design and Service Engineering, Vehicle Maintenance and Repair Course Designed by- Department of Automobile Engineering				

Students should undergo Inplant training in an industry during their holidays for 15 days to acquire practical knowledge and to explore the activities going on in the Industry. A report and Inplant training certificate may be submitted for evaluation.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	H	M
	CO2		M				H		L	H			M
	CO3		H		M	H		H		M		M	H
	CO4	H				M	M		H		M		
	CO5			H		H		H	M	H		M	H
	CO6	L	M	M		L	H		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
									√
4	Approval	37th Meeting of Academic Council, May 2015							

BAM8C1	COMPREHENSION II	L	T	P	C
	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses up to eighth semester				
	Course Designed by – Dept. of Automobile Engineering				

OBJECTIVES

- To provide a complete review of Automobile Engineering topics covered up to eighth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to eighth semester.

BAM8P1	PROJECT WORK	L	T	P	C
	Total Contact Hours – 18 Periods Per Week	0	0	18	6
	Prerequisite – Design and Fabrication with Analysis, Research article writing and Literature Survey				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

The objective of project work is to enable the students, to work in convenient groups of not more than four members in a group, on a project involving some design and fabrication work or theoretical and experimental studies related to the respective engineering discipline.

Course Outcomes

CO1 –comprehensive report

CO2 – literature survey

CO3 – problem statement, project work details

CO4– project work details, estimation of cost and conclusions

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	H	M
	CO2		M				H		L	H			M
	CO3		H		M	H		H		M		M	H
	CO4	H				M	M		H		M		
	CO5			H		H		H	M	H		M	H
	CO6	L	M	M		L	H		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
									√
4	Approval	37th Meeting of Academic Council, May 2015							

The objective of project work is to enable the students, to work in convenient groups of not more than four members in a group, on a project involving some design and fabrication work or theoretical and experimental studies related to the respective engineering discipline. Every project work shall have a Guide who is a member of the faculty of the University. Twelve periods per week shall be allotted in the Time table for this important activity and this time shall be utilized by the students to receive directions from the Guide, on library reading, laboratory work, computer analysis, or field work as assigned by the Guide and also to present in periodical seminars or viva to review the progress made in the project. Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details, estimation of cost and conclusions. This final report shall be in typewritten form as specified in the guidelines. The continuous

assessment and semester evaluation may be carried out as specified in the guidelines to be issued from time to time.

CORE ELECTIVE (CE)-I

BAM014	ADVANCED THEORY OF IC ENGINES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – IC engines, Automotive Pollution and Control, Environment and Ecosystems				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in introduction, combustion of fuels, combustion modelling, non-conventional ic engines, combustion analysis in ic engines will be taught to the students.

Course Outcomes

CO01 - To learn the detailed study of introduction

CO02 - To learn the detailed study of combustion of fuels

CO03 - To learn the detailed study of combustion modelling

CO04 – To learn the detailed study of non-conventional IC engines

CO05 - To learn the detailed study of combustion analysis in IC engines

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	H	M
	CO2		M				H		L	H			M
	CO3		H		M	H		H		H		M	H
	CO4	H				M	M		H		H		
	CO5			M		H		H	M	H		M	H
	CO6	L	M	H		L	H		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I INTRODUCTION 7

Fuel air cycle and Actual cycle analysis, Properties of IC engine fuels, Refining process, chemical composition and molecular structure of fuels, octane number, cetane number. Knock rating of SI engine fuels.

UNIT – II COMBUSTION OF FUELS 12

Combustion Stoichiometry of petrol, diesel, alcohol and hydrogen fuels – Chemical energy and heating values – Chemical equilibrium and maximum temperature – SI engine

combustion – Flame velocity and area of flame front –performance number – CI engine combustion. Fuel spray characteristics – droplet size, penetration and atomization.

UNIT – III COMBUSTION MODELLING 10

Basic concepts of engine simulation – Governing equations, thermodynamic models – SI engine and CI engine models.

UNIT – IV NON-CONVENTIONAL IC ENGINES 8

Adiabatic and L.H.R. engines – Variable compression ratio engine – Wankel rotary combustion engine – Free piston engine - MAN combustion chamber and multi fuel engines – Stratified charge and lean burn engines – Locomotive and marine engines.

UNIT – V COMBUSTION ANALYSIS IN IC ENGINES 8

Photographic studies of combustion processes – P-θ diagrams in SI and CI engines, Rate of heat release – hot wire and laser Doppler anemometry and velocimetry for flow and combustion analysis in IC engines

TEXTBOOK

1. Ganesan,V., Internal combustion engines, Tata McGraw Hill Publishing Co., 1994.
2. Heldt,P.M., High Speed Combustion Engines, Oxford IBH Publishing Co., Calcutta, 1985.

REFERENCES

1. Ramalingam. K.K., Internal combustion engine, scitech publications, Chennai, 2003.
2. Ganesan,V., Compute Simulation of Spark Ignition engine process, Universities Press (India) Ltd., Hyderabad, 1996.
3. John,B., Heywood, Internal Combustion Engine Fundamentals, McGraw Hill Publishing Co., New York, 1990.

BME002	**FINITE ELEMENT METHODS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Numerical Methods, Engineering Mathematics-I and II, Kinematics of Machines				
	Course Designed by- Department of Mechanical Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in introduction, discrete elements, continuum elements, isoparametricelements, field problem will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of introduction
CO2 - To learn the detailed study of discrete elements
CO3 - To learn the detailed study of continuum elements
CO4 – To learn the detailed study of iso parametric elements
CO5 - To learn the detailed study of field problem

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	H			M
	CO3		H		H	H		H		M		H	M
	CO4	H				M	H		H		M		

	CO5			H		H		H	M	H		M	H
	CO6	L	M	M		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I INTRODUCTION 8

Review of various approximate methods – Raleigh Ritz's, Galerkin and finite difference methods- Governing equation and convergence criteria of finite element method.

UNIT – II DISCRETE ELEMENTS 10

Bar elements, uniform section, mechanical and thermal loading, varying section, truss analysis. Beam element - problems for various loadings and boundary conditions - longitudinal and lateral vibration. Use of local and natural coordinates.

UNIT – III CONTINUUM ELEMENTS 8

Plane stress, Plane strain and axisymmetric problems, constant and linear strain, triangular elements, stiffness matrix, axisymmetric load vector,

UNIT – IV ISOPARAMETRIC ELEMENTS 10

Definitions, Shape function for 4, 8 and 9 nodal quadrilateral elements, Stiffness matrix and consistent load vector, Gaussian integration

UNIT – V FIELD PROBLEM 9

Heat transfer problems, Steady state fin problems, Derivation of element matrices for two dimensional problems, Torsion problems

TEXT BOOKS:

1. Tirupathi.R. Chandrapatha and Ashok D. Belegundu – Introduction to Finite Elements in Engineering – Printice Hall India, Third Edition, 2003.
2. Rao. S.S., Finite Element Methods in Engineering, Butterworth and Heinemann, 2001

REFERENCES:

1. Reddy J.N. – An Introduction to Finite Element Method – McGraw Hill – 2000.
2. Krishnamurthy, C.S., Finite Element Analysis, Tata McGraw Hill, 2000.
3. Robert D Cook, David S Malkus, Michael E Plesha, 'Concepts and Applications of Finite Element Analysis', 4th edition, John Wiley and Sons, Inc., 2003.

BAM017	SPECIAL TYPES OF VEHICLES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3

	Prerequisite – Tractors and Farm Equipment's, Automotive Engines and Emissions, Two and Three Wheeler Systems
	Course Designed by- Department of Automobile Engineering

OBJECTIVE:

The main objective of this course is to impart knowledge earth moving and constructional equipments, power train concepts, sub systems of stv , farm equipments, military and combat vehicles, special purpose vehicles for industrial applications will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study ofearth moving and constructional equipment's

CO2 - To learn the detailed study of power train concepts

CO3- To learn the detailed study of sub systems of stv

CO4– To learn the detailed study offarm equipments, military and combat vehicles

CO5 – To learn of detailed study ofspecial purpose vehicles for industrial applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	H			M
	CO3		H		H	H		H		M		H	M
	CO4	H				H	H		H		M		
	CO5			H		H		H	H	H		M	H
	CO6	L	M	M		L	L		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – IEARTH MOVING AND CONSTRUCTIONAL EQUIPMENTS 11

Construction layout, capacity and applications of earthmovers like dumpers, front-end loaders, bulldozers, excavators, backhoe loaders, scrappers, motor graders, and Water sprinklers etc. criteria for selection of prime mover fro dumpers and front end loaders based on vehicle performance characteristics.

UNIT – IIPOWER TRAIN CONCEPTS 7

Engine – converter match curves. Hauling & cyclic type transmissions. Selection criteria for universal joints. Constructional details of steerable and drive axles of dumper.

UNIT – III SUB SYSTEMS OF STV 11

Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics. Hydro-pneumatic suspension cylinders. Power steering system. Kinematics for loader and bulldozer operational linkages. Safety features, safe warning system for dumper. Tractor controls and the starting of the tractor engines – Basic notions

and definition – Engine cycles – Operation of multicylinder engines – General engine design – Basic engine performance characteristics.

UNIT – IV SPECIAL PURPOSE VEHICLES FOR INDUSTRIAL APPLICATION 8

Cranes- Types, Constructional features, capacity and stability, Vibratory compactors, Material Handling vehicles- Forklift- Tippers-Others.

UNIT – V FARM EQUIPMENTS, MILITARY AND COMBAT VEHICLES 8

Ride and stability characteristics, power take off, special implementations. Special features and constructional details of tankers, gun carriers and transport vehicles. Classification of tractors – Main components of tractor – Safety rules.Working attachment of tractors – Farm equipment – Classification – Auxiliary equipment – Trailers and body tipping mechanism.

TEXTBOOKS:

1. Abrosimov. K. Bran berg.A. and Katayer.K.,"Road making Machinery", MIR Publishers, Moscow, 1971.
2. Wong.J.T., " Theory of Ground vehicles ", John Wiley & Sons, New York, 1987.
3. Rodichev and G.Rodicheva, Tractor and Automobiles, MIR Publishers, 1987.

REFERENCES:

1. Off the road wheeled and combined traction devices - Ashgate Publishing Co. Ltd. 1998.
2. Astokhov, Truck Cranes, MIR Publishers, Moscow.
3. Kolchin,A., and V.Demidov, Design of Automotive Engines for Tractor, MIR Publishers, 1972.

CORE ELECTIVE (CE)-II

BAM001	**COMPUTER SIMULATION OF IC ENGINE PROCESSES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – IC Engines and Emissions, Automotive Engines and Combustion Characteristics,				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in introduction, adiabatic flame temperature, spark ignition engines, si engine simulation with adiabatic combustion, si engine simulation with gas exchange process will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of introduction

CO2 - To learn the detailed study of adiabatic flame temperature

CO3 - To learn the detailed study of spark ignition engines

CO4 – To learn the detailed study of **SI** engine simulation with adiabatic combustion

CO5 - To learn the detailed study of **SI** engine simulation with gas exchange process

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				H		L	H			M
	CO3		H		M	H		H		M		M	H

	CO4	H				M	M		H		H		
	CO5			M		H		H	M	H		M	H
	CO6	L	M	H		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I INTRODUCTION 8

Simulation, advantages of computer simulation, step – by – step approach, reactive processes, heat reaction, measurement of URP, measurement of HRP.

UNIT – II ADIABATIC FLAME TEMPERATURE 8

Introduction, complete combustion C/H/N/O/ systems, constant – volume adiabatic combustion, constant – pressure adiabatic combustion, calculation of adiabatic flame temperature, isentropic changes of state.

UNIT – III SPARK IGNITION ENGINES 9

Introduction, Basic details and nomenclature, cylinder pressure indicator diagram, indicated power, brake power, SI Engine simulation with air as working medium, deviation between actual and ideal cycle.

UNIT – IV SI ENGINE SIMULATION WITH ADIABATIC COMBUSTION 10

Introduction, Engine details, temperature drop due to fuel vaporization, full throttle operation, work output and efficiency calculation, part-throttle operation, engine performance at part throttle, super charged operation, SI Engines simulation with progressive combustion.

UNIT – V SI ENGINE SIMULATION WITH GAS EXCHANGE PROCESS 10

Introduction, gas exchange process, Heat transfer process, friction calculation, compression of simulated values, validation of the computer code, engine performance simulation, pressure crank angle diagram, brake power, brake thermal efficiency, effect of speed on performance, simulation of two stroke SI Engine.

TEXTBOOK:

1. Ganesan,V., Computer Simulation of spark ignition engine process, Universities Press (I) Ltd., Hyderabad, 1996.

REFERENCES:

1. Ramoss,A.L., Modelling of Internal Combustion Engines Processes, McGraw Hill Publishing Co., 1992.
2. Ashley Campbel, Thermodynamics analysis of combustion engines, John Wiley & Sons, New York, 1986.

BAM010	PRODUCT DESIGN	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Product design and Development, Process Planning And Control, Product Architecture and New product Development				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in project selection and evaluation, new product development, new product planning, new product development, product architecture will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of project selection and evaluation

CO2 - To learn the detailed study of new product development

CO3 -To learn the detailed study of new product planning

CO4 – To learn the detailed study of new product development

CO5 - To learn the detailed study of product architecture

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	H			M
	CO3		H		H	H		H		M		H	M
	CO4	H				M	H		H		M		
	CO5			H		H		H	H	H		M	H
	CO6	L	M	M		L	L		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
							√		

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I - PROJECT SELECTION AND EVALUATION **9**

Collection of ideas and purpose of project - Selection criteria - screening ideas for new products (evaluation techniques).

UNIT II - NEW PRODUCT DEVELOPMENT **9**

Research and new product development - Patents - Patent search - Patent laws International code for patents - Intellectual property rights (IPR).

UNIT III - NEW PRODUCT PLANNING **9**

Design of prototype - testing - quality standards - marketing research introducing new products.

UNIT IV - NEW PRODUCT DEVELOPMENT **9**

Journeys in Product Development, Product Development Process Tools, Scoping Product Developments: Technical and Business Concerns. Understanding Customer Needs, Establishing Product Function.

UNIT V - PRODUCT ARCHITECTURE **9**

Product Teardown and Experimentation, Benchmarking and Establishing Engineering Specifications, Product Architecture.

TEXT BOOK:

1. Barclay, Z. Dann, P. Holroyd, "New Product development I, Published by BH Butterworth-Heinemann a division of Reed Educational and professional publishing limited.

REFERENCES:

1. Harry Nystrom, "Creativity and innovation", John Wiley & Sons, 1979.
2. Brain Twiss, "Managing technological innovation", Pitman Publishing Ltd.,1992.

BAM025	**TWO AND THREE WHEELERS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Automotive Engines and Sub Systems, Automotive Technology- Service and Repair.				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in the power unit, chassis and sub-systems, brakes and wheels, two wheelers, three wheelers will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of the power unit

CO2 - To learn the detailed study of chassis and sub-systems

CO3 - To learn the detailed study of brakes and wheels

CO4 – To learn the detailed study of two wheelers

CO5 - To learn the detailed study of three wheelers

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	L			M
	CO3		H		H	H		H		M		H	M
	CO4	H				H	H		M		M		
	CO5			H		H		H	H	H		M	H
	CO6	L	M	M		L	H		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)

							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I THE POWER UNIT 9

Two stroke and four stroke SI engine, merits and demerits, Symmetrical and unsymmetrical port timing diagrams. Types of scavenging processes, merits and demerits, scavenging efficiency. Scavenging pumps. Rotary valve engine. Fuel system. Lubrication system. Magneto coil and battery coil spark ignition system. Electronic ignition System. Starting system. Kick starter system.

UNIT – II CHASSIS AND SUB-SYSTEMS 8

Main frame and its types, Chassis and shaft drive. Single, multiple plates and centrifugal clutches, Gear box and gear controls. Front and rear suspension systems. Shock absorbers, Panel meters and controls on handle bar.

UNIT – III BRAKES AND WHEELS 8

Drum brakes, Disc brakes, Front and rear brake links lay-outs. Spoked wheel, cast wheel. Disc wheel. Disc types. Tyres and tubes.

UNIT – IV TWO WHEELERS 10

Case study of motor cycles, scooters and mopeds. Servicing and maintenance.

UNIT – V THREE WHEELERS 10

Case study of Auto rickshaws, Pick up van, Delivery van and Trailer. Servicing and maintenance.

TEXTBOOK:

1. Irving,P.E., Motor cycle Engineering, Temple Press Book, London, 1992.

REFERENCES:

1. The Cycle Motor Manual, Temple Press Ltd., London, 1990.
2. Encyclopedia of Motor cycling, 20 volumes, Marshall Cavensih, New York and London, 1989.

BAM003	**ALTERNATE FUELS AND ENERGY SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Alternate Fuels and Jet Propulsion, Internal Combustion Engines and Emissions, Environment Pollution and Control				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE

The main objective of this course is to impart knowledge in Alternate Fuels and Energy Systems. The detailed concept of Classification of design and Reduction of stress concentration, Alcohols, Natural Gas, LPG, Hydrogen and Biogas, Vegetable Oils, Electric and Solar Powered Vehicles will be taught to the students.

Course Outcomes

CO1-To learn the detailed study of Availability of alternate fuels and other alternate Energy sources

CO2-To learn the detailed study of Alcohols

CO3-To learn the detailed study of Natural Gas, LPG, Hydrogen and Biogas

CO4-To learn the detailed study of Vegetable Oils
CO5 -To learn of detailed study of Electric and Solar Powered Vehicles

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				H		L	H			M
	CO3		H		H	H		H		M		M	H
	CO4	H				M	M		H		M		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	H		L	M		H	L	M	L	
3	Category	Humanities & Social Studies (HS)		Basic Sciences(BS)		Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
									√				
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT – I INTRODUCTION 6

Estimation of petroleum reserve "World Energy Scenerio, Energy Survey of India" – Need for alternate fuel – Availability of alternate fuels- Other alternate energy sources

UNIT – II ALCOHOLS 9

Properties as engine fuels, alcohols and gasoline blends, Performance in SI engine. Methanol and gasoline blends - Performance combustion and emission characteristics.

UNIT – III NATURAL GAS, LPG, HYDROGEN AND BIOGAS 9

Availability of CNG, properties, modification required to use in engines – performance and emission characteristics of CNG and LPG in SI & CI engines. Performance and emission for LPG – Hydrogen – Storage and handling, performance and safety aspects.

UNIT – IV VEGETABLE OILS 10

Various vegetable oils for engines – Transesterification – Performance in engines – Performance and emission characteristics.

UNIT – V ELECTRIC AND SOLAR POWERED VEHICLES 11

Layout of an electric vehicle – advantage and limitations – Specifications – System component, Electronic control system – High energy and power density batteries – Hybrid vehicle – Solar powered vehicles. Fuel cell vehicles.

TEXTBOOKS:

1. Ramalingam. K.K., Internal combustion engine, scitech publications, Chennai, 2003.
2. Bechtold,R.L., Alternative Fuels Guide Book, SAE, 1997.

REFERENCES:

1. Nagpal, Power Plant Engineering, Khanna Publishers, 1991.
2. Alcohols and motor fuels progress in technology, Series No.19, SAE Publication USA 1980.

BAM018	HYBRID ELECTRIC AND FUEL CELL VEHICLES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Hybrid Technology and Fuel cells, Basic Electrical and Electronics, Alternate Energy resources				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in fuel cell technology, fuel cell based vehicles structure, hybrid electric technology and electric drivetrains, hybrid electric vehicles, hybrid vehicle technology will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of fuel cell technology

CO2 - To learn the detailed study offuel cell based vehicles structure

CO3 -To learn the detailed study of hybrid electric technology and electric drivetrains

CO4 –To learn the detailed study of hybrid electric vehicles

CO5 - To learn the detailed study of combustion analysis inhybrid vehicle technology

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				H		L	H			M
	CO3		H		H	H		H		M		M	H
	CO4	H				M	M		H		M		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	H		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I - FUELCELL TECHNOLOGY **9**

Structures, Operations and properties of Fuel cells – (Phosphoric Acid Fuel cell, Proton Exchange membrane Fuel cell, Direct Methanol fuel cell Alkaline Fuel Cells, Solid Oxide Fuel Cell, Molten Carbonate Fuel Cell) -Characteristics. Electrochemical energy conversion – Theoretical efficiency – Factors affecting electrochemical energy conversion- Helmholtz double layer model.

UNIT II - FUEL CELL BASED VEHICLES STRUCTURE 9

PEMFC: Operating principle (membranes, electrodes and electrolysis, optimization of membrane and electrode assembly, impurities) – Technology development (single cell and stacks, composite plates) – Fuel processing – Modeling studies (membrane, electrode, membrane-electrode assembly, fuel cell, stack and system) – Technology development and applications. DMFC: Operating principle – Noble metal issue – Electro-oxidation of methanol (Catalysts, oxygen electroreduction, electrolyte, non catalytic aspects) - Methanol crossover.

UNIT III - HYBRID ELECTRIC TECHNOLOGY AND ELECTRIC DRIVETRAIN 9

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT IV - HYBRID ELECTRIC VEHICLES 9

Principles of Hybrid Electric Drive trains, Architectures – Electrical distribution, Hybrid control Strategies – Parallel Hybrid, Series Hybrid - (Charge Sustaining, Charge Depleting), Practical Models – Toyota Prius, Honda Insight. Hybridization Effects. 42 V System for Traction Applications - Lightly Hybridized vehicles, Low –Voltage Storage System, Low – Voltage main system with High voltage bus for propulsion. Heavy Vehicles Hybrid Electric Heavy Duty Vehicles, Fuel cell Heavy duty vehicles.

UNIT V - HYBRID VEHICLE TECHNOLOGY 9

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems. Energy Management Strategies in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

TEXT BOOKS:

1. Basu .S, "Recent Trends in Fuel cell Science and Technology", Anamaya Publishers, New Delhi.,2007.
2. Viswanathan, B. and Aulice Scibioh, M., "Fuel Cells Principles and Applications", Universities Press (India) Pvt. Ltd., Hyderabad, 2006.
3. Hoogers, G., Edr. "Fuel Cell Technology Handbook", CRC Press, Washington D. C,2003.

REFERENCES:

1. Larminie, J. and Dicks, A., "Fuel Cell Systems Explained" John Wiley & Sons, Ltd., New York,2001.
2. Ali Emadi, Mehrdad Ehsani, John M. Muller, "Vehicular Electric Power Systems", Marcel Dekker,Inc., 2004.

CORE ELECTIVE III

BAM004	SIMULATION OF VEHICLE SYSTEMS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Vehicle Technology and Body Engineering, CIM, Vehicle stability and Control				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in longitudinal dynamics and control, lateral dynamics and electronic stability control, modelling of passive automotive suspensions, modelling of semi active and active automotive Suspensions, lateral and longitudinal tire forces will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of longitudinal dynamics and control

CO2 - To learn the detailed study of lateral dynamics and electronic stability control

CO3 -To learn the detailed study of modelling of passive automotive suspensions

CO4 – To learn the detailed study of modelling of semi active and active automotive Suspensions

CO5 - To learn the detailed study of lateral and longitudinal tire forces

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	H			M
	CO3		H		H	H		H		M		M	H
	CO4	H				M	M		H		M		
	CO5			M		H		H	M	H		M	H
	CO6	L	M	H		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I LONGITUDINAL DYNAMICS AND CONTROL 9

Aerodynamic drag force - Longitudinal tire force - Rolling resistance - Calculation of normal tire forces - Calculation of effective tire radius - Driveline Dynamics - Torque converter - Transmission dynamics - Engine dynamics - Wheel dynamics - Cruise Control - Anti-Lock Brake Systems - Automated Highway Systems - Longitudinal Control Architecture.

UNIT II LATERAL DYNAMICS AND ELECTRONIC STABILITY CONTROL 9

Lateral Systems - Kinematic Model - Bicycle Model. Motion of Particle Relative to a rotating Frame. Dynamic Model in Terms of Error with Respect to Road, Yaw Rate and Slip Angle. Road Model. Differential Braking Systems - Steer-By-Wire Systems - Independent All Wheel Drive Torque Distribution

UNIT III MODELING OF PASSIVE AUTOMOTIVE SUSPENSIONS 9

Introduction - Modal Decoupling - Performance Variables - Natural Frequencies and Mode Shapes - Approximate Transfer Functions - Analysis of Vibrations in the Sprung Mass Mode and Unsprung Mass Mode - Verification Using Quarter Model. Half-Car and Full-Car Suspension Models.

UNIT IV MODELING OF SEMIACTIVE AND ACTIVE AUTOMOTIVE SUSPENSIONS 9

Semi-Active Suspension Model - Optimal Semi-Active Control Law - Calculation of Transfer Function Plots - Performance of Semi-Active Suspension Systems. Active Automotive Suspensions - Trade-offs and Limitations - Invariant Points and Their Influence - Hydraulic Actuators for Active Suspensions

UNIT V LATERAL AND LONGITUDINAL TIRE FORCES 9

Tire Forces - Tire Structure - Longitudinal Tire Force at Small Slip Ratios - Lateral Tire Force at Small Slip Angles - Magic Formula Tire Model - Dugoff's Tire Model - Dynamic Tire Model - Development of Lateral Tire Model for Uniform Normal Force Distribution and Parabolic Normal Pressure Distribution - Combined Lateral and Longitudinal Tire Force Generation.

TEXT BOOK

1. Rajesh Rajamani, "Vehicle Dynamics and Control", Springer, 2006.

BAM019	**COMPUTER AIDED DESIGN AND DRAFTING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Machine Drawing, Automotive Parts and Assembly drawing,CIM				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in computer aided design and drafting, transformation and modelling of curves and surfaces with automation techniques. It also deals with FMS and CAPP.

Course Outcomes

CO1 - To learn the detailed study of CAD/CAM

CO2 - To learn the detailed study on CIM

CO3 - To learn the detailed study on surface and curve modeling

CO4 – To learn the detailed study on CAPP and Automation

CO5 - To learn the detailed study on Flexible manufacturing System

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		H				M		L	H			M
	CO3		H		H	H		H		M		M	H
	CO4	H				M	M		H		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	H		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Introduction to CAD/CAM, Historical developments, Industrial look at CAD/CAM, Comparison of CAD with traditional designing, Introduction to CIM; Basics of geometric and solid modeling, Packages for CAD/CAM/CAE/CAPP.

UNIT II TRANSFORMATIONS 9

Introduction, transformation of points and line, 2-D rotation, reflection, scaling and combined transformation, homogeneous coordinates, 3-D scaling, shearing, rotation, reflection and translation, combined transformations, orthographic and perspective projections, reconstruction of 3-D objects.

UNIT III MODELING OF CURVES & SURFACES 9

Algebraic and geometric forms, tangents and normal, blending functions reparametrization, straight lines, conics, cubic splines, Bezier curves and B-spline curves. Plane surface, ruled surface, surface of revolution, tabulated cylinder, bi-cubic surface, bezier surface, B-spline surfaces and their modeling techniques.

UNIT IV AUTOMATION AND NUMERICAL CONTROL AND APPLICATIONS OF CAD 9

Introduction, fixed, programmable and flexible automation, types of NC systems, MCU and other components, NC manual part programming, coordinate systems, G & M codes, Part program for simple parts, computer assisted part programming.

Introduction, Need and importance of solid and surface models for Interference detection, Assembly modeling, finite element analysis, and computer aided part programming, computer aided process planning, automated layout and drafting and computer aided manufacturing.

UNITV FLEXIBLE MANUFACTURING SYSTEMS & COMPUTER AIDED PROCESS PLANNING 9

Introduction, FMS components, types of FMS, FMS layouts, planning for FMS, advantages and applications Conventional process planning, types of CAPP, Steps in variant process planning, planning for CAPP.

TEXT BOOKS

1. CAD/ CAM by Groover and Zimmer, Prentice Hall.
2. CAD/ CAM Theory and Practice by Zeid, McGraw Hill
3. Numerical Control and Computer Aided Manufacturing by Kundra, Rao & Tiwari, TMH.

REFERENCE BOOKS

1 CAD/CAM (Principles, Practice & Manufacturing Management) by Chirs Mc Mohan & Jimmie Browne, Published by Addison- Wesley.

BAM018	**HYBRID ELECTRIC AND FUEL CELL VEHICLES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Hybrid Technology and Fuel cells, Basic Electrical and Electronics, Alternate Energy resources				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in fuel cell technology, fuel cell based vehicles structure, hybrid electric technology and electric drive trains, hybrid electric vehicles, hybrid vehicle technology will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of fuel cell technology

CO2 - To learn the detailed study offuel cell based vehicles structure

CO3 -To learn the detailed study of hybrid electric technology and electric drive trains

CO4 –To learn the detailed study of hybrid electric vehicles

CO5 - To learn the detailed study of combustion analysis inhybrid vehicle technology

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				H		L	H			M
	CO3		H		H	H		H		M		M	H
	CO4	H				M	M		H		M		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	H		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I - FUELCELL TECHNOLOGY **9**

Structures, Operations and properties of Fuel cells – (Phosphoric Acid Fuel cell, Proton Exchange membrane Fuel cell, Direct Methanol fuel cell Alkaline Fuel Cells, Solid Oxide Fuel Cell, Molten Carbonate Fuel Cell) -Characteristics. Electrochemical energy conversion – Theoretical efficiency – Factors affecting electrochemical energy conversion- Helmholtz double layer model.

UNIT II - FUEL CELL BASED VEHICLES STRUCTURE **9**

PEMFC: Operating principle (membranes, electrodes and electrolysis, optimization of membrane and electrode assembly, impurities) – Technology development (single cell and stacks, composite plates) – Fuel processing – Modeling studies (membrane, electrode, membrane-electrode assembly, fuel cell, stack and system) – Technology development and applications. DMFC: Operating principle – Noble metal issue – Electro-oxidation of methanol (Catalysts, oxygen electroreduction, electrolyte, non catalytic aspects) - Methanol crossover.

UNIT III - HYBRID ELECTRIC TECHNOLOGY AND ELECTRIC DRIVETRAIN 9

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.

UNIT IV - HYBRID ELECTRIC VEHICLES 9

Principles of Hybrid Electric Drive trains, Architectures – Electrical distribution, Hybrid control Strategies – Parallel Hybrid, Series Hybrid - (Charge Sustaining, Charge Depleting), Practical Models – Toyota Prius, Honda Insight. Hybridization Effects. 42 V System for Traction Applications - Lightly Hybridized vehicles, Low –Voltage Storage System, Low – Voltage main system with High voltage bus for propulsion. Heavy Vehicles Hybrid Electric Heavy Duty Vehicles, Fuel cell Heavy duty vehicles.

UNIT V - HYBRID VEHICLE TECHNOLOGY 9

Sizing the drive system: Matching the electric machine and the internal combustion engine (ICE), Sizing the propulsion motor, sizing the power electronics, selecting the energy storage technology, Communications, supporting subsystems. Energy Management Strategies in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Case Studies: Design of a Hybrid Electric Vehicle (HEV), Design of a Battery Electric Vehicle (BEV).

TEXT BOOKS:

1. Basu .S, “Recent Trends in Fuel cell Science and Technology”, Anamaya Publishers, New Delhi.,2007.
2. Viswanathan, B. and Aulice Scibioh, M., “Fuel Cells Principles and Applications”, Universities Press (India) Pvt. Ltd., Hyderabad, 2006.
3. Hoogers, G., Edr. “Fuel Cell Technology Handbook”, CRC Press, Washington D. C,2003.

REFERENCES:

1. Larminie, J. and Dicks, A., “Fuel Cell Systems Explained” John Wiley & Sons, Ltd., New York,2001.
2. Ali Emadi, Mehrdad Ehsani, John M. Muller, “Vehicular Electric Power Systems”, Marcel Dekker,Inc., 2004.

NON MAJOR ELECTIVE (NE)-I

BAM008	MODERN MANUFACTURING PROCESS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Production Engineering, Automotive Manufacturing Systems, Modern Vehicle Technology, Process Planning and Control				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in advances in casting, advanced forming and powder metallurgy processes, fabrication of microelectronic devices, manufacturing of composites, rapid prototyping will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of advances in casting
CO2 - To learn the detailed study ofadvanced forming and powder metallurgy processes
CO3 -To learn the detailed study of fabrication of microelectronic devices
CO4 – To learn the detailed study of manufacturing of composites
CO5 - To learn the detailed study of rapid prototyping

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	H			M
	CO3		H		L	H		H		M		H	M
	CO4	H				M	H		H		M		
	CO5			H		H		H	H	H		M	H
	CO6	L	M	M		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ADVANCES IN CASTING 9

Newer casting techniques - Expendable pattern casting - Plaster mold and ceramic mold casting – Vacuum casting - Squeeze casting - Rapid solidification for amorphous alloys – Casting techniques for single crystal components.

UNIT II ADVANCED FORMING AND POWDER METALLURGY PROCESSES 9

High speed forging machines - Die materials - semisolid metal forming- Peen forming of sheet metals - Super plastic forming – Forming and shaping glass. Design consideration for Powder Metallurgy forming - Production of metal powders – Compaction – Sintering – Finishing of sintered parts – Secondary and finishing operations.

UNIT III FABRICATION OF MICRO ELECTRONIC DEVICES 9

Semiconductors and silicon - Crystal growing and wafer preparation - Film deposition, Oxidation, Lithography, Etching, Diffusion and ion implantation, Metallization and testing - Bonding and packing.

UNIT IV MANUFACTURING OF COMPOSITES 9

Introduction- Fibre reinforced, Metal matrix, Ceramics matrix composites, Nanocomposites - structure, Properties, manufacturing processes and applications.

UNIT V RAPID PROTOTYPING 9

Rapid prototyping- overview, Techniques-Stereo lithography, Laminated object manufacturing, Selective laser sintering, fused deposition modeling, solid ground curing, 3D ink jet printing-Applications of rapid prototyping-Rapid tooling-Rapid manufacturing-Future development-Virtual prototyping.

TEXT BOOKS

1. Serope Kalpakjian, "Manufacturing Engineering and Technology", 3rd Edition, Addison-Wesley Publishing Co., Boston, 2009.
2. Madou M. J, "Fundamentals of micro fabrication and nanotechnology", 3rd edition, CRC Press, USA, 2011.

REFERENCES

1. Amstead B. H, Ostwald Phillips and Bageman R.L, "Manufacturing Processes", John Wiley & Sons, New York, 1987.
2. Jaeger R.C, "Introduction to microelectronic Fabrication", Addision Wesley Boston, 1988.
3. Chua C. K, "Rapid Prototyping - Principles and Applications", World Scientific Publishing Company, 2010.
4. Hilton P. D and "Marcel Dekker", Rapid Tooling, New York, 2000.

BAM006	**NOISE VIBRATION AND HARSHNESS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Mechanical Vibration and Control Techniques, Industrial Automation				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in basics of vibration analysis, vibration control techniques,noise fundamentals, nvh measurements, automotive noise sources and control techniques will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of basics of vibration analysis
CO2 - To learn the detailed study ofvibration control techniques
CO3 -To learn the detailed study of noise fundamentals
CO4 – To learn the detailed study of nvh measurements
CO5 - To learn the detailed study of automotive noise sources and control techniques

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	H			M
	CO3		H		H	H		H		M		H	M
	CO4	H				M	H		H		M		
	CO5			H		H		H	M	H		M	H
	CO6	L	M	M		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

INTRODUCTION TO NVH

Noise, Vibration and Harshness (NVH) and its role in automotive design and development. Physiological effects of noise and vibration, sources of vibration and noise in automobiles.

UNIT I BASICS OF VIBRATION ANALYSIS 9

Basic concepts, mathematical models, formulating the equations of motion linear and torsional system characteristics and response – damped and undammed single & two degree of freedom systems under harmonic force, coordinate coupling, generalized coordinates and modal analysis.

UNIT II VIBRATION CONTROL TECHNIQUES 9

Vibration isolation, tuned absorbers, untuned viscous dampers, damping treatments, Applications: isolation of the engine from vehicle structure and control of torsional oscillation amplitudes in engine crankshaft.

UNIT III NOISE FUNDAMENTALS 9

Fundamentals of acoustics – general sound propagation – structure borne sound & air borne sound, Plane wave propagation - wave equation, specific acoustic impedance, acoustic intensity, Spherical wave propagation – acoustic near and far fields, Reference quantities, The decibel scale, relationship among sound power, sound intensity and sound pressure level, summation of pure tones, Decibel addition, subtraction and averaging, Effects of reflecting surfaces on sound propagation, octave band analysis, Anatomy of Human Ear, Mechanism of hearing, loudness, weighting networks, equivalent sound level.

UNIT IV NVH MEASUREMENTS 9

Vibration and Noise Standards – Pass/Drive by noise, noise from stationary vehicles, interior noise in vehicles, NVH measurement tools and techniques, Modal parameter (natural frequency, mode shape and damping) estimation techniques, signal and system analysis.

UNIT V AUTOMOTIVE NOISE SOURCES AND CONTROL TECHNIQUES 9

Methods for control of engine noise, Transmission Noise, Intake and Exhaust Noise, Aerodynamic Noise, Tyre Noise, Brake noise. Noise control strategy, noise control at source

– along the path – isolation, damping, balancing, resonators, absorption, barriers and enclosures.

TEXT BOOK:

1. Matthew Harrison, "Vehicle Refinement: Controlling Noise and Vibration in Road Vehicles", Elsevier, 2004.

REFERENCES:

1. Bell, L. H. and Bell, D. H., "Industrial Noise Control – Fundamentals and Applications", Marcel Dekker Inc, New York, 1994.
2. Xu Wang, "Vehicle Noise and Vibration Refinement", CRC Press, 2010
3. Ambekar, A. G., "Mechanical Vibrations and Noise Engineering", Prentice Hall of India, New Delhi, 2006.
4. Beranek, L. L. and Ver, I, L., "Noise and Vibration Control Engineering –Principles and Application", John Wiley & Sons, Inc, 1 992.
5. Wilson, C. E., "Noise Control – Measurement, Analysis, and Control of Sound and Vibration", Harper & Row Publishers, New York, 1989.
6. Thomson, W. T., "Theory of Vibrations with Applications", CBS Publishers Delhi.

BAM026	**INDUSTRIAL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Engineering Sciences, Human Values and Professional Ethics, Statistical Quality and Control, Reliability engineering				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in production, productivity and efficiency, plant layout, group technology and material handling/ loading and scheduling, statistical quality control, work study will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study ofproduction, productivity and efficiency

CO2 - To learn the detailed study ofplant layout

CO3 -To learn the detailed study of group technology and material handling/ loading and scheduling

CO4 – To learn the detailed study ofstatistical quality control

CO5 - To learn the detailed study of work study

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M				M		L	H			M
	CO3		H		H	H		H		H		M	H
	CO4	H				M	H		M		H		
	CO5			M		H		M	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PRODUCTION, PRODUCTIVITY AND EFFICIENCY 9

Definitions - Productivity, Effectiveness, Partial Productivity, Total Productivity- Productivity cycle - Factors influencing productivity- Techniques to improve productivity- Technology based techniques- Material based productivity improvement - Improvement control - M.R.P - Quality circles - brainstorming Pareto analysis cause and effect analysis- Total quality management - Zero Defects - Flextime- Just in time - Kanban - Ergonomics - Reliability improvement - Modular Design - Difference between reliability and quality maintainability.

UNIT-II PLANT LAYOUT 8

Types of layout - Product/Process/Fixed position/Group-advantage/Disadvantage of Product/Process/Fixed - preference of Product/Process/Fixed position layout - Flow patterns - Tools and Techniques of layout - Operation Process chart - Flow diagram - String diagram - Travel chart method - Plant location - Plant location decision.

UNIT-III GROUP TECHNOLOGY AND MATERIAL HANDLING/ LOADING AND SCHEDULING 9

Introduction - Part families - Group technology layout - Limitation of Group technology - Design and Manufacturing attributes - The composite part concept - Machine cell design - part classification and coding - Automatic storage and retrieval system - Principle of material handling - Loading - Master scheduling - Perpetual loading - Order scheduling - Loading by scheduled method - Index method of scheduling - Factors influencing scheduling - Random number table - Production planning and control - Routing - Dispatching - Job card - Job order - Production control - Order control chart machine load chart

UNIT-IV STATISTICAL QUALITY CONTROL 9

Introduction to quality control - Statistical measures - Control chart - Types - Control chart for attributes - Control chart for number of defects per unit acceptance sampling - Basic probability - normal basic distribution - Acceptance quality level - lot tolerance percent defective (LTPD) - Average outgoing quality (AOQ)

UNIT-V WORK STUDY 9

Techniques of work - Procedure of work study - Method study - Multiple activity chart utility - Unit work measurement - Micro motion study - Predetermined Motion time system - Work sampling - Job analysis - Job evaluation and merit rating - wage and wage incentive

TEXT BOOK:

1. Khanna O.P. "Industrial Engineering and Management", Khanna Publishers, New Delhi.

REFERENCES:

1. B. Kumar "Industrial Engineering" Khanna Publishers. New Delhi, 1999
2. Gupta and Patel, "Work Study" Khanna Publishers. New Delhi, 1998.

BAM016	**VEHICLE AIR-CONDITIONING SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Automotive Air-conditioning, Automotive Technology, Engines and Emissions, Thermodynamics and Heat Transfer				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledgeautomotive air conditioning fundamentals, refrigerant heating and air conditioning system, air routing & temperature control, heater – air conditioner trouble shooting & service will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study ofautomotive air conditioning fundamentals

CO2 - To learn the detailed study of refrigerant

CO3 - To learn the detailed study of heating and air conditioning system

CO4 – To learn the detailed study ofair routing & temperature control

CO5 – To learn of detailed study ofheater – air conditioner trouble shooting & service

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				H		L	H			M
	CO3		H		M	H		H		M		M	H
	CO4	H				M	M		H		H		
	CO5			M		H		H	M	H		M	H
	CO6	L	M	H		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I AUTOMOTIVE AIRCONDITIONING FUNDAMENTALS 10

Basic air conditioning system – Components – types of Compressor, Condenser, Expansion devices and Evaporators. Location of air conditioning components in a car – Schematic layout of a air conditioning system. Compressors- Types- components – Thermostatic expansion valve & orifice tube – Expansion valve calibration – Evaporator temperature control methods.

UNIT – II REFRIGERANT 9

Requirements for refrigerants – Classification of refrigerants- Refrigerant selection-Storage of refrigerants – Handling refrigerants – Discharging, Charging & Leak detection – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

UNIT – III HEATING AND AIRCONDITIONING SYSTEM 10

Manually controlled air conditioner – Automatically controlled air conditioners-Electronic automatic temperature control - Auxiliary Rear Heating and Cooling systems

UNIT – IV AIR ROUTING & TEMPERATURE CONTROL 10

Objectives – Evaporator case air flow through the Dash recirculating unit – Conditioned air distribution – Ducting system in Passenger car and Bus– Controlling flow – Air conditioner safety devices - Temperature and Pressure cutoff switches - Relief valves

UNIT – V HEATER–AIR CONDITIONER TROUBLE SHOOTING & SERVICE 6

Air conditioner maintenance and service – Safety cautions for air-conditioning service - Testing the vacuum control systems - Air conditioner performance test - Checking refrigerant system pressures - Leak detectors - Charging and Discharging.

TEXT BOOK:

1. William H Crouse and Donald L Anglin, Automotive Air conditioning, McGraw Hill Inc., 1990.

REFERENCES:

1. Paul Weisler, Automotive Air Conditioing, Reston Publishing Co. Inc., 1990.
2. McDonald,K.L., Automotive Air Conditioning, Theodore Audel series, 1978.
3. Goings,L.F., Automotive Air Conditioning, American Technical services, 1974.

NON MAJOR ELECTIVE (NE)-II

BAM005	**COMPUTER INTEGRATED MANUFACTURING SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Flexible manufacturing system, CAPP, CAD/CAM				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledgeautomotive air conditioning fundamentals, refrigerant heating and air conditioning system, air routing & temperature control, heater – air conditioner trouble shooting & service will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study on CAD Basics

CO2 - To learn the detailed study on Flexible manufacturing System

CO3 - To learn the detailed study on CAPP and its control

CO4 – To learn the detailed study on CIM concept and CNC

CO5 – To learn the detailed study on Product and Tolerance modeling

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				H		L	H			H

	CO3		H		M	H		H		M		M	H
	CO4	H				M	H		H		H		
	CO5			M		H		H	M	H		M	H
	CO6	L	M	H		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I INTRODUCTION TO CAD 9

Fundamental concepts in manufacturing and automation – Need for automation – Automation stages – Economic analysis and production – Fundamentals of CIMS. Elements of CAD system – Graphics hardware – ALU – CPU – Input/Output devices – Geometric modeling – Automated drafting

UNIT – II MANUFACTURING SYSTEMS 9

Basics of numerical control – Types of NC systems – CNC and DNC machines – Machining centre – Tool magazine – NC tape format – Programming – Manual part programme – Simple programmes – Computer assisted part programming – APT language – Simple examples

UNIT – III FLEXIBLE MANUFACTURING SYSTEMS 9

Group technology – Part families – Part classification and coding – Production flow analysis – Machine cell design – Description of FMS – Equipment, Tooling and fixture. Design for Manufacturing and Assembly - Process Planning Techniques - Total approach to product development - Concurrent Engineering – Rapid prototyping

UNIT – IV COMPUTER AIDED MANUFACTURING 9

Computers in manufacturing – Automated manufacturing systems – Work piece handling – Types of transfer – Continuous, Intermittent and Non-synchronous walking beam – Computer aided process planning – Computer aided inspection – Computer aided quality control – Basic model of CIMS – Interfacing methods of CAD and CM – Computer Process Monitoring.

UNIT – V PRODUCTION PLANNING AND CONTROL 9

Introduction to production planning and control - Shop Floor Control Systems - Just in time approach - Emerging Challenges in CAD / CAM, Product Data Management - Product Modeling - Assembly and Tolerance Modeling.

TEXT BOOKS:

1. Groover,M.P., Automation Production Systems and CAM, Prentice Hall, 1990.
2. Ibrahim Zeid, " CAD - CAM Theory and Practice ", Tata McGraw-Hill Publishing Co. Ltd., 1998.

REFERENCES:

1. Groover,M.P., CAD/CAM Computer Aided Design and Manufacturing, Prentice Hall, 1990.
2. S.Kant Vajpayee, , " Principles of Computer Integrated Manufacturing ", Prentice Hall of India Ltd., 1999
3. Barry Hawker, CAD/CAM Processes, Pitman, 1988

BAM015	**AUTOMOTIVE SAFETY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Vehicle Safety and Comfort systems, Computer control of vehicle Systems. Sensors and Actuators				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in introduction, safety concepts, safety equipments, collision warning and avoidance, comfort and convenience systemwill be taught to the students.

Course Outcomes

CO1 - To learn the detailed study ofintroduction

CO2 - To learn the detailed study ofsafety concepts

CO3 -To learn the detailed study of safety equipment's

CO4 – To learn the detailed study ofcollision warning and avoidance

CO5 - To learn the detailed study of comfort and convenience system

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	H	M
	CO2		M				H		L	H			M
	CO3		H		M	H		H		H		M	H
	CO4	H				M	M		H		H		
	CO5			M		H		H	M	H		M	H
	CO6	L	M	H		L	H		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I INTRODUCTION 9

Design of the body for safety, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumble zone, safety sandwich construction.

UNIT – II SAFETY CONCEPTS 9

Active safety: driving safety, conditional safety, perceptibility safety, operating safety- passive safety: exterior safety, interior safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

UNIT – III SAFETY EQUIPMENTS 9

Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety, antiskid braking system, regenrative braking system, speed control devices.

UNIT – IV COLLISION WARNING AND AVOIDANCE 9

Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions, driver fitness detection.

UNIT – V COMFORT AND CONVENIENCE SYSTEM 9

Steering and mirror adjustment, central locking system , Garage door opening system, tyre pressure control system, rain sensor system, environment information system, manual and automated wiper system, satellite control of vehicle operation for safe and fast travel.

TEXT BOOK:

1. Automotive Handbook" - 5th edition - SAE publication - 2000.Bosch - "

REFERENCES:

1. J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.
2. Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.

BAM013	**QUALITY CONTROL AND RELIABILITY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Industrial Engineering, Statistical Quality and Control, Reliability Engineering				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in statistical quality control, acceptance sampling, reliability engineering, failure data analysis, reliability prediction and management will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study ofstatistical quality control
CO2 - To learn the detailed study ofacceptance sampling
CO3 -To learn the detailed study of reliability engineering
CO4 – To learn the detailed study offailure data analysis
CO5 - To learn the detailed study of reliability prediction and management

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	H			M
	CO3		H		H	H		H		M		H	M
	CO4	H				M	H		H		M		

	CO5			H		H		H	H	H		M	H
	CO6	L	M	M		L	L		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I - STATISTICAL QUALITY CONTROL **9**

Methods and Philosophy of Statistical Process Control - Control Charts for Variables and Attributes –Cumulative sum and Exponentially weighted moving average control charts - Other SPC Techniques – Process - Capability Analysis Six sigma concept.

UNIT II - ACCEPTANCE SAMPLING **9**

Acceptance Sampling Problem - Single sampling plans for attributes – double sampling - multiple sampling - sequential sampling - Military standards - The Dodge Roming sampling plans – Random sampling.

UNIT III - RELIABILITY ENGINEERING **9**

Definition of reliability – Performance and reliability - Reliability requirements – System life cycle – Mean time between failures – Mean time to failure - Mortality Curve -Availability – Maintainability.

UNIT IV - FAILURE DATA ANALYSIS **9**

Statistical failures of components – failure distributions – Bath tub curve – Negative exponential distribution – Normal distribution - log normal distribution – Gamma distribution - Weibull distribution Life distribution measurements – Accelerated life tests -Data requirements for reliability.

UNIT V - RELIABILITY PREDICTION AND MANAGEMENT **9**

Failure rate estimates - Effect of environment and stress - Series and Parallel systems -RDB analysis – Standby Systems - Complex Systems - Reliability demonstration testing- Reliability growth testing - Duane curve - Risk assessment – FMEA and Fault tree analysis.

TEXT BOOKS:

1. Khanna O.P, “Statistical Quality Control”, Dhanpat Rai Publications (P) Ltd., 2001.
2. Lewis E.E, “Introduction to Reliability Engineering”, John Wiley and Sons, 1987.

REFERENCES:

1. Mohamed Zairi, “Total Quality Management for Engineers”, Woodhead Publishing Limited1991.
2. Harvid Noori and Russel, “Production and Operations Management - Total Quality and Responsiveness”, McGraw-Hill Inc, 1995.
3. Douglus C. Montgomery, “Introduction to Statistical Quality Control”, 2nd Edition, John Wiley and Sons, 1991.

BAM020	MEASUREMENTS AND METROLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engineering Materials and Metallurgy, Production Engineering, Tribology and Measurements				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in Measurements and Metrology. The detailed concept of Linear Measurement, Pressure measurement, Flow and Temperature measurement and Force and Torque measurement will be taught to the students.

Course Outcomes

CO1 - To learn the detailed concept of linear measurement.

CO2 - To learn the detailed study of Pressure measurement and types.

CO3 - To learn the detailed of flow and temperature measurement.

CO4 – To learn the detailed of force and torque measurement and types.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	M	H	H	H	H	M
	CO2		M		M		H		L	M		L	M
	CO3		H		M	H		M		H		H	H
	CO4	H		H		M	M		H		H		L
	CO5			H		H		M	M	H		M	H
	CO6	L	M	M		M	H		L	H	M	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I LINEAR MEASUREMENT 9

Units and standards, errors in measurement, linearity, repeatability, precision and accuracy, calibration. Linear measuring instruments, taper, wire and thickness gauge, vernier instruments, micrometer, internal measurements slip gauges and its accessories, dial gauges, comparators.

UNIT – II INTERFEROMETRY 9

Interferometry surface texture measurements, flatness testing, collimators, angular measurements, metrology of screw threads, measurement and testing of gears, measuring machines.

UNIT – III PRESSURE MEASUREMENT 9

Bourden tube, diaphragm, bellows and pressure capsules: Transducers used in pressure measurement- potentiometer, strain gauges, LVDT, capacitive and variable reluctance type transducers. Dynamic pressure measurement piezo electric and piezo resistive transducers.

Farnboro engine indicator. Low pressure measurement Mc leod gauge, Pirani gauge,thermal conductivity type pressure measurement.

UNIT – IV FLOW AND TEMPERATURE MEASUREMENT 9

Obstruction type flow meter, Positive displacement flow meters – turbine flow meter, flouted tube flowmeter, anemometer, ultrasonic flow meter, magnetic flow meters. Alcock viscous air flow meter. Temperature scales – mechanical temperature sensors, liquid in glass, vapour pressure, bimetal temperature gauges. RTD, Thermistors, thermocouples, Pyrometers.

UNIT – V FORCE AND TORQUE MEASUREMENT 9

Force measuring devices- Balances, platform scales, weigh bridges, load cells, proving ring. Torque measurement – prony brake, rope brake and fan type brakes. Dynamometers – hydraulic, electric cradle and eddy current dynamometers. Transmission dynamometers. Chassis dynamometers.

TEXT BOOKS:

1. Jain R.K., Engineering metrology, Khanna publishers, New Delhi, 2005
2. Rangan C.S., Sarma G.E and Mani V.S Instrumentation devices and systems. TMH Publishing Co. New Delhi, 2001
3. Beckwith T.G & Buck N.L Mechanical measurements, Oxford and IBH publishing house New Delhi, 2004

NON MAJOR ELECTIVE (NE)-III

BAM009	**ROBOTICS FOR AUTOMOBILE ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engineering Design, Industrial automation and its application				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in introduction to robot application, end effectors and sensors, robot cell design, robot programming, industrial applications will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of introduction to robot application
CO2 - To learn the detailed study ofend effectors and sensors
CO3 -To learn the detailed study of robot cell design
CO4 – To learn the detailed study of robot programming
CO5 - To learn the detailed study of industrial applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	H			M
	CO3		H		L	H		H		M		H	M
	CO4	H				M	H		H		M		
	CO5			H		H		H	H	H		M	H
	CO6	L	M	M		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I - INTRODUCTION TO ROBOT APPLICATION **9**

Basic concepts - Robot anatomy - Manipulators - kinematics: Forward and inverse kinematics - Precision movement, robot specifications and Work volume, Types of Robot drives - Basic robot motions - Point to point control, continuous path control. Robot control - unit control system concept - servo and non-servo control of robot joints, adaptive and optimal control.

UNIT II - END EFFECTORS AND SENSORS **9**

End effectors - classification - mechanical, magnetic, vacuum and adhesive gripper - gripper force analysis and design. Sensor devices, Types of sensors - contact, position and displacement sensors, Force and torque sensors - Proximity and range sensors - acoustic sensors Robot vision systems - Sensing and digitizing - Image processing and analysis.

UNIT III - ROBOT CELL DESIGN **9**

Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis.

UNIT IV - ROBOT PROGRAMMING **9**

Robot language classification - programming methods - off and on line programming - Lead through method - Teach pendent method - VAL systems and language, simple program.

UNIT V - INDUSTRIAL APPLICATIONS **9**

Application of robots - Material handling - Machine loading and unloading, Assembly, Inspection, Welding, Spray painting, Mobile robot, Microbots-Recent developments in robotics-safetyconsiderations.

TEXT BOOKS:

1. Deb S. R, "Robotics technology and flexible automation", Tata McGraw Hill publishingcompany limited, New Delhi, 2010
2. Mikell P. Groover, "Industrial Robotics Technology Programming and Applications", McGraw Hill Co., Singapore, 2008.

REFERENCES

1. Klafter, R. D, Chmielewski, T. A. and Noggins, "Robot Engineering: An Integrated Approach", Prentice Hall of India Pvt. Ltd., New Delhi, 2011
2. Fu, K. S., Gonzalez, R. C., & Lee, C.S.G., "Robotics control, sensing, vision and Intelligence",McGraw Hill Book Co., Singapore, Digitized 2007
3. Craig, J. J., "Introduction to Robotics mechanics and control", AddisonWesley, London, 2008.

BAM005	TYRE TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Automotive Chassis Systems, Braking and Suspension Systems, Automotive Tyre manufacturing				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge infabric preparation, calendaring, thread extrusion and bead construction, tyre building, green tyre preparation & curing will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of fabric preparation

CO2 - To learn the detailed study of calendering

CO3 -To learn the detailed study of thread extrusion and bead construction

CO4 – To learn the detailed study of tyre building

CO5 - To learn the detailed study of green tyre preparation & curing

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	H			M
	CO3		H		H	H		H		M		M	M
	CO4	H				M	M		H		M		
	CO5			M		H		H	M	H		M	H
	CO6	L	M	M		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

INTRODUCTION TO BASICS OF TYRES **5**

Types of tyres, tyre components and its role, tread patterns, outline of production of tires, Requirements and function of tyres - Major departments of a Tyre Industry – An explanation of their function and relation to other departments. Factors influencing the performance of tyre: Compound design, degree of mixing: (open mill & internal mixing), parameters (temperature, time, speed), degree of vulcanization - Testing and dispatch of mixes, Basic quality control and mill room control Laboratory.

UNIT I - FABRIC PREPARATION **8**

Fabrics of the Tyre Industry: Cotton, Rayon, Nylon & steel cords – manufacture, construction

– styles and presentations. Bonding methods – Fabric bonding necessities of stronger fabrics leading to bonding methods developments. Wet & dry bonding systems – dip and hot stretch process for Nylon. REL-VP latex systems – and parameters for dip & hot stretch process for Nylon. Modified surface treatment needed for polyesters & glass fabric - Metal coating for steel cord. Recent developments in Radical Tyre fabrics – Aromatic Nylon (Kevlar) and other special fabric reinforcement systems and their use - Testing of dipped fabrics 'U', 'H' and other tests. Dip pick up and the relation to adhesion etc.

UNIT II - CALENDERING 8

Calendering process: 3 and 4 roll calenders. Skimming & frictioning process preparation of bead wrapper and chaffer-on fabrics on 3 roll calenders. Topping process on calendar - Limitation of 3 roll calenders and advantages of 4 roll calenders-process control aspects – economics - Relation between ends per inch and calendering process. Inner, outer and breaker fabrics. Compound fabric ratios and compound design consideration for different styles of fabrics - Defects of calendered fabrics and their remedies. Parameters for scrap control in fabric processes in the tyre industry requirement of total quality control involving fabric supplier's dipping, calendering and bias cutting operations. Economics of fabric usage.

UNIT III - THREAD EXTRUSION AND BEAD CONSTRUCTION 8

Basic concepts of Extrusion. Die swell & shrinkage phenomenon – effect of compounding parameters on these phenomenon. Die design and theoretical calculation of tread weight. Effect of viscosity & temperature on extrusion. Dimensions and weight control extusion operation parameters like feeding rate, screw speed, take off conveyor speed on tread extrusion. Extruded tread profile – critical dimensions. Duel extruder – Cap & base concept relation to tyre wear parameters like tread wear heat buildup etc. Cross head extruder wire coating process - Bias cutting and pocket making: Bias angle specification and the significance Horizontal and vertical laying of coated wore. Apex preparation on extruder and profile calender Bead wrapping and flipping operations. Single and double bead concept and preliminary calculation of bead safety factors. Width and angle adjustments splicing and identification. Bias plies pocket 3-3-2 4-4-2 ply constructions Defects of pockets wrong identification over splicing wrinkles, parallel plies etc.

UNIT IV - TYRE BUILDING 8

Tyre building inputs: Inner liners, plies, beads, tread, side wall and gum strips – their inspection Drum inspection for drumset, drum circumference Significance of parameters for tyre building. Size making on finished tyre and the relation to building specifications. Tyre building specifications sequence of building. Intermitant consolidation use of various cements and gum strips. Importance of the state of the Art Technology. Appraisal of Tyre building as most crucial operation correlation of some of the cured tyre & service returned tyres to the lack of building skill. Green tyre inspection procedures weight tolerancetechno-commercial importance of green tyre weight. Green tyre storage considerations.

UNIT V - GREEN TYRE PREPARATION & CURING 8

Internal and External painting – Awling – Bagging in case of Air bag cure Bag-omatic and Air bag curing – mold lubrication- Bladder assembly bead curing rings – Dimension criticality Services to the Bag-o-matic presses Curing cycle – shaping – HPS, and hot water circulation. Dome steam cold water & vacuum cycles. Determination of optimum cure of tyres by thermocouple built tyres. Economics of curing post cure inflation of Nylon tyres cured tyre inspection. Defects of tyres – Tyre classification for defects – causes and discussions - Examination of: (i) Returned tyres (ii) Tyres for retreading - Norm of tyre adjustments for fastwear, poor retreading Bead/casing failures. Hot and cold process

retreading concept of total price/km run increasing competition and future trends in the industry and open house discussion.

TEXT BOOK:

1. Tom French, Tyre technology, The University of Michigan, 1989.

REFERENCES:

1. Blow. C. M, Rubber Technology and Manufacture, Butterworth- Heinemann, London, 1982.
2. Maurice Morton, "Rubber Technology", Springer, 3rd edition, 1987.
3. Claude Hepburn, "Rubber Technology and Manufacture", Third Edition,2005
4. Kovac. F. J, "Tyre Technology", Good Year Tire & Rubber Company, 1973.
5. Different tyre manufacturer's websites.

BAM011	**OPERATIONS REASERCH FOR AUTOMOBILE ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Numerical Methods, Engineering Mathematics-I and II, Research Methodology				
	Course Designed by- Department of Mathematics				

OBJECTIVE:

The main objective of this course is to impart knowledge resource scheduling and networks, resource scheduling and networks, inventory models, queuing models, decision model will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of linear programming

CO2 - To learn the detailed study of resource scheduling and networks

CO3- To learn the detailed study of inventory models

CO4 – To learn the detailed study of queuing models

CO5 – To learn of detailed study of decision models

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				H		L	H			M
	CO3		H		H	H		H		M		H	H
	CO4	H				M	H		H		M		
	CO5			H		H		H	H	M		M	H
	CO6	L	M	M		L	L		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
							√		

4	Approval	37th Meeting of Academic Council, May 2015

UNIT – I LINEAR PROGRAMMING 9

Introduction to phase of an operation research study-Linear programming-Formulation of the programming-Graphical method-Simplex method-two phase method-assignment problems-Transportation models Vogel's approximation method-MODI method-unbalanced transportation-degeneracy in transportation models. Integer programming

UNIT – II RESOURCE SCHEDULING AND NETWORKS 9

Resource scheduling-Sequence in job through 2 machines and 3 machines network: PERT AND CPM-Network diagrams-Shortest route-minimum spanning tree-probability of achieving completion date-Crash time-Cost analysis-resource smoothing and resource leveling

UNIT – III INVENTORY MODELS 9

Inventory models-deterministic models-production models-economic ordering quantity models-quantity discount model-stochastic inventory models-Multi product models-inventory control models in practice.

UNIT – IV QUEUING MODELS 9

Queuing theory-queuing system and structures-notation parameter-Poisson arrival and exponential service time-Characteristics of queuing models-Single channel and multiple models-Simulation.

UNIT – V DECISION MODELS 9

Game theory: Two person zero sum games, Replacement models: Replacement of items that deteriorate with time-equipment that fails completely and their analysis-factor for evaluation of proposals of capital expenditures and comparison of alternatives-present value average investment –rate of return-pay off period-individual and group replacement policy.Application of OR models-Case studies.

TEXT BOOKS:

1. Gupta and Hira D.S. "Operation Research", S.Chand & Sons, New Delhi,1995

REFERENCE BOOKS:

1. H.A.Taha, "Operation Research" , Prentice hall of India,1999, Sixth Edition
2. Kanti Swarup,Gupta,P.K. and Manmohan, "Operation Research", S.Chand & Sons,1993.

BAM012	**TRANSPORT MANAGEMENT AND MOTOR INDUSTRY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Road Transport Management, Traffic Engineering, Inventory and Shop Control, Managerial Principles and Industrial Engineering				
	Course Designed by- Department of Automobile Engineering				

OBJECTIVE:

The main objective of this course is to impart knowledge in introduction on transportation modes, transport organization and development, planning for new transport organization, motor vehicle act, accident & prevention will be taught to the students.

Course Outcomes

CO1 - To learn the detailed study of introduction on transportation modes	
CO2 - To learn the detailed study of transport organization and development	
CO3 -To learn the detailed study of planning for new transport organization	
CO4 – To learn the detailed study of motor vehicle act	
CO5 - To learn the detailed study of accident & prevention	

		Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low											
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	H			M
	CO3		H		H	H		H		M		H	M
	CO4	H				M	H		H		M		
	CO5			H		H		H	M	H		M	H
	CO6	L	M	M		L	M		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION ON TRANSPORTATION MODES 9

Elements of Mass Transportation, History of transport, modes of transport, types of transport systems

UNIT II TRANSPORT ORGANIZATION AND DEVELOPMENT 9

Transport organization structure, operations, General set up, transport industry, government / (STU) State Government Undertakings and private Bus transport organizations. Bus depot organization structure. Truck fleet operators organization. Economics of Road Transport: Theory of fares and cost of services, fare charging, costing and statistics of operating cost

UNIT III PLANNING FOR NEW TRANSPORT ORGANIZATION 9

Geographical considerations, economic factors, vehicles used, planning of trips. Concept of BRTS operations. Organization of Transport Services: Records and fleet management, vehicles schedule, booking and reservation, statistical records and shipment center, recording of goods transport

UNIT IV MOTOR VEHICLE ACT 9

Acts & definitions, Licensing of drivers and conductors , registration of vehicles, control of transport, RTO and other regulations , offences, penalties and procedures, types of form and procedures, licensing of taxies and buses, rules and regulations, testing and passing of vehicles. Taxation: Structure, method of laying taxation, goods vehicle taxation, passenger vehicle taxation, mode of payment, tax exemption, one / life time taxation. Service Life of vehicles. Toll tax- reasons & operational management. Build Operate Transfer arrangement.

UNIT V ACCIDENT & PREVENTION 9

Vehicle accident, laws, injury, safety precautions, road transport regulations. Insurance & Finance Classes/types of insurance, accident claims and settlements, duty of driver in case of accident, hire purchase.

TEXT BOOK:

1. Motor Vehicles Acts, Law Publishers
2. Myer Kutz, "Handbook of Transportation Engineering", Volume 1: SystemsandOperations,Second Edition, Tata McGraw Hill Edition, 2011.
3. Coleman O'Flaherty, "Transport Planning and Traffic Engineering", 4th Edition, Butterworth Heinemann Publications, 2010.
4. Roger P. Roess and Elena S. Prassas, "Traffic Engineering", 4th Edition.

REFERENCES:

1. Schumer, Economics of transport, TMH
2. Fair and Williams, "Economics of transportation", East West Press.
3. Hudson, "Motor transportation", TMH.
4. M.V. Act 1988-RTO rules and regulation manual
5. Fuel Economy of Motor Vehicle, Allied Publishers

BBA001	**PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR**	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management Studies				

OBJECTIVES

Familiarize the students with the fundamental concepts of Management and to highlight the approaches in organization behavior

COURSE OUTCOMES (COs)	
CO1	Understanding the concepts of Management
CO2	Knowledge on Management Functions
CO3	Understanding the Organization Theory & Approach.
CO4	Knowledge on the Concepts of Motivation
CO5	Clear insight on the factors contributing to discipline
CO6	In-depth Understanding about the concepts of Group Behavior

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	L			M
	CO3		H		H	H		H		M		H	M
	CO4	H				H	H		M		M		
	CO5			H		H		H	H	H		M	H
	CO6	L	M	M		L	H		H	L	M	L	

3	Category	Humanities and Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/TermPaper/ Comprehension/ Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT -I NATURE OF MANAGEMENT 9

Definition – theory and practice – effective management – Management : Science of Art – Management in India. Development of Management thoughts – Taylor's – Henry Fayol – Hawthrone experiment – Barnard & Social system – Herbert Simon – Peter Drucker – Various approaches – Management thoughts.

UNIT- II MANAGEMENT PROCESS 9

Co-ordination – Functions of management – Managers and environment – External and internal Business Ethics – Planning – Fundamentals – Definitions & Features – Steps in planning – types of planning – Objectives – Concepts and features – Hierarchy of objectives – role – Process of MBO – Policy & Strategy – Decision making process – Individual Vs Group Decisions.

UNIT- III ORGANIZATION STRUCTURE 9

Organizing – Theory & Approach –Authority & Responsibility – Delegation – Centralization & Decentralization – Line & Staff Relationship – Staffing – Fundamentals – System approach – Manpower Planning – Recruitment & Selection – Training and development – Performance appraisal – Direction – Fundamentals Motivation – Theories of Motivation-Maslow's Hersberg's MaClelland's theory X,Y & Z leadership – Theories and Styles – Communication – Type – Controlling – System and Process.

UNIT- IV ORGANIZATIONAL BEHAVIOUR 9

Definition – Organization – Managerial Role and Functions – Organizational Approaches, Individual behaviour – Causes – Environmental effect – Behaviour and performance, perception – Organizational implications, Personality – Contributing factors – Dimension, Motivation – Need Theories – Process Theories – Job satisfaction, Learning and Behaviour – Learning Curves, Work Design and Approaches.

UNIT -V GROUP BEHAVIOUR 9

Groups – Contributing factors –Group Norms, types – Causes – Intergroup relations – Conflict and Resolution – Change Process –Resistance to change.

TEXT BOOKS:

1. Herald Knootz and Heinz weihrich, 'Essentials of Management', McGraw Hill publishing Company, Singapore International Edition, 2004.
2. Ties AF, Stoner and R. Edward Freeman, "Management" Prentice Hall of India Pvt. Ltd., New Delhi -110011, 1995.

REFERENCE BOOKS :

1. Joseph I. Massie 'Essentials of Management', Prentice Hall of India Pvt. Ltd., New Delhi -110011, 2004.
2. L.M. Prasad "Principles and Practice of Management", Sultan Chand & Sons.2001
3. Uma Sekaran, "Organizational Behaviour", Tata McGraw Hill, 2007.

BBA002	**ENTREPRENEURSHIP DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by- Department of Business Administration				

OBJECTIVE:

- To learn about types of entrepreneurship.
- To study about major motivation methods.
- To study about government policies for small scale industries.

Course Outcomes

CO1 - To learn difference between entrepreneur and interpreneur.

CO2 – To learn about entrepreneurship development programs.

CO3 – To study about economic feasibility methods.

CO4 – To learn about taxation.

CO5 – To study about corrective measures methods.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		L	H			M
	CO3		H		H	H		H		M		H	M
	CO4	H				H	H		H		M		
	CO5			H		H		H	H	H		M	H
	CO6	L	M	M		L	H		H	L	M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences(BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term paper/ Seminar/ Internship (H)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ENTREPRENEURSHIP 8

Entrepreneur- Types of Entrepreneurs - Difference Between Entrepreneur and Interpreneur- Role of Entrepreneurship in Economic Growth- Women and Rural Entrepreneurship - Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION 8

Major Motives Influencing Entrepreneur – Achievement Motivation Training, Self Rating – Business Game – Thematic Apperception Test – Stress Management – Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9

Small Enterprise – Definition, Classification – Characteristics- Ownership Structure – Project Formulation – Steps Involved in Setting up a Business – Identifying, Selecting a Good Business Opportunity- Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports- Project Appraisal- Sources of Information- Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 10

Need – Sources of Finance- Terms Loans, Capital Structure- Financial Institutions, Management of Working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/ CPM –Taxation – Income Tax – Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 10

Sickness in Small Business- Concept, Magnitude, Causes and Consequences, Corrective Measures- Government Policy for Small Scale Enterprises- Growth Strategies in Small Industry – Expansion- Diversification, Joint Venture, Merger, Sub Contracting.

TEXT BOOKS:

1. S.S.Khanka, "Entrepreneurial Development", S. Chand & Co. Ltd., Ram Nagar, New Delhi, 1999.
2. Hisrich RD and Peters MP, "Entrepreneurship", 5th Edition, Tata McGraw Hill, 2002.

REFERENCES:

1. Rabindra Kanungo, "Entrepreneurship and Innovation" , Sage Publications, New Delhi, 1999
2. ED II. Faculty & External Experts-A Hand book for New Entrepreneurs Publishers: Entrepreneurial Development, Institute Of India, and Ahmedabad, 1986.

BBA003	**MARKETING MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Marketing Principles and Evolution, Managerial Techniques and Entrepreneurship development				
	Course Designed by- Department of Business Administration				

OBJECTIVE:

- To learn about consumer marketing.
- To study about demographic factors.
- To study about retailing process.

Course Outcomes

CO1 - To learn marketing concepts between industry and consumer.

CO2 – To learn about demographic factors.

CO3 – To study about pricing methods.

CO4 – To learn about portfolio analysis.

CO5 – To study about advertising and sales methods.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H		H	M	H	H	H	H	M	M
	CO2		M				M		H	H			M
	CO3		H		L	H		H	H	M		H	M
	CO4	H				H	H		H		M		
	CO5			M		H		H	H	H		L	H
	CO6	L	M	M		L	H		H	L	M	L	
3	Category	Humanities & Social Studies (HS)		Basic Sciences(BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/Term paper/ Seminar/ Internship (H)
											√		
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION 9

Definition- Marketing Process- Dynamics- Needs- Wants and demands-Marketing Concepts- Environment- Mix- Types- Philosophies- Selling Vs Marketing- Organizational- Industrial Vs Consumer Marketing- Consumer Goods- Industrial Goods- Product Hierarchy.

UNIT II BUYING BEHAVIOUR & MARKET SEGMENTATION 9

Cultural- Demographic Factors- Motives- Types- Buying Decisions- Segmentation factors- Demographic- Psychographic & Geographic Segmentation- Process- Patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives- Pricing- Decisions & Pricing Methods- Pricing Management- Introduction- Uses- Process of Marketing Research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan- Strategy formulation and marketing process- Implementation- Portfolio analysis- BCG- GEC grids.

UNIT- V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics- Impact- Goals- Types- Sales promotion- Point of Purchase- Unique selling proposition- Characteristics- Whole selling- Retailing- Channel Design- Logistics- Modern trends in retailing.

TEXT BOOKS:

1. Ramasamy and Nama Kumari, "Marketing Environment: Planning, implementation and control the Indian context",2002
2. Govindarajan.M, "Industrial marketing management:", Vikas Publishing Pvt. Ltd, 2003

REFERENCES:

1. Philip Kotler, Marketing Management, Analysis, Planning, Implementation and

control, 1998.
1. Khanna O.P. – Industrial Engineering and Management, Khanna Publishers, New Delhi, 2000.
2. Green Paul.E and Donald Tull, "Research for marketing decisions", Prentice Hall of India. 1995

4 .Donald S. Tull and Hawkins, "Marketing Research", Prentice Hall of India- 1997

BBA 004	**ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT**	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept. of Management Studies				

OBJECTIVES

Acquire knowledge of economics to facilitate the process of economic decision making
Acquire knowledge on basic financial management aspects
Develop the skills to analyze financial statements

COURSE OUTCOMES (COs)

CO1	Evaluate the economic theories, cost concepts and pricing policies
CO2	Understand the market structures and integration concepts
CO3	Understand the measures of national income, the functions of banks and concepts of globalization
CO4	Apply the concepts of financial management for project appraisal
CO5	Understand accounting systems
CO6	analyze financial statements using ratio analysis

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low**1**

1	COs/POs	a	b	c	d	e	F	g	h	i	j	K	l
2	CO1												
	CO2	M			M				M				H
	CO3							H			H		H
	CO4					L			M				H
	CO5		L								H		
	CO6	L				L							

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT- I ECONOMICS, COST AND PRICING CONCEPTS 9

Economic theories – Demand analysis – Determinants of demand – Demand forecasting – Supply – Actual cost and opportunity cost – Incremental cost and sunk cost – Fixed and

variable cost – Marginal costing – Total cost – Elements of cost – Cost curves – Breakeven point and breakeven chart – Limitations of break even chart – Interpretation of break even chart – Contribution – P/V-ratio, profit-volume ratio or relationship – Price fixation – Pricing policies – Pricing methods.

UNIT –II CONCEPTS ON FIRMS AND MANUFACTURING PRACTICES 9

Firm – Industry – Market – Market structure – Diversification – Vertical integration – Merger – Horizontal integration

UNIT-III NATIONAL INCOME,MONEY AND BANKING, ECONOMIC ENVIRONMENT 9

National income concepts – GNP – NNP – Methods of measuring national income – Inflation – Deflation – Kinds of money – Value of money – Functions of bank – Types of bank – Economic liberalization – Privatization – Globalization

UNIT- IV CONCEPTS OF FINANCIAL MANAGEMENT 9

Financial management – Scope – Objectives – Time value of money – Methods of appraising project profitability – Sources of finance – Working capital and management of working capital

UNIT- V ACCOUNTING SYSTEM, STATEMENT AND FINANCIAL ANALYSIS 9

Accounting system – Systems of book-keeping – Journal – Ledger – Trail balance – Financial statements – Ratio analysis – Types of ratios – Significance – Limitations

TEXT BOOKS:

1. Prasanna Chandra, ―Financial Management‖ (Theory & Practice) TMH
2. Weston & Brigham, ―Essentials of Managerial Finance‖

REFERENCES:

1. Pandey, I. M., ―Financial Management‖
2. Fundamentals of Financial Management‖- James C. Van Horne.
3. http://stanford.edu/dept/MSandE

BBA008	**TOTAL QUALITY MANAGEMENT**	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

To introduce to the student about the basic terms related to quality and concepts of quality management

To familiarize the student about the basic principles of total quality management

To acquaint the student with the basic statistical tools used in process control

To introduce to the student about the various tools used in implementing and checking total quality management

To familiarize the student about the different quality systems used in auditing the quality of a company/industry/organization

COURSE OUTCOMES (COs)

CO1	By understanding about various quality terms, it will be helpful for the student to maintain quality in his/her organization

CO2	The student will be able to formulate new plans/procedures to be implemented to achieve the desired quality status by knowing about the various principles of quality management
CO3	The student will be able to analyze the periodical data in quality control using statistical tools
CO4	The total quality management tools will help the student to understand the procedures in measuring the quality of the organization/process and will also enable him/her to identify the parameters that are improving/depriving the quality
CO5	By knowing about the quality ISO systems, the student will be maintain processes/documentation properly so that the quality maintained by his/her organization gets recognized

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (GOE	Project/Term Paper Seminar/ Internship (PR)
											√		
4	Approval	37th Meeting of Academic Council, May 2015											

CO6	As a whole the students will understand the importance of quality in all the fields of engineering and the social circle.

UNIT I INTRODUCTION 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation

UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership –Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System –Elements, Implementation of Quality System, Documentation, Quality Auditing, TS16949, ISO 14000 – Concept, Requirements and Benefits

TEXT BOOKS:

3. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education, Inc.2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCE BOOKS:

1. Evans. J. R. & Lindsay. W,M "The Management and Control of Quality", (5th Edition),South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991.
3. Oakland.J.S. "Total Quality Management", Butterworth Hcinemann Ltd., Oxford,1989.
4. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks",New Age International 1996.
5. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991.
6. freecomputerbooks.com/Total-Quality-Management-

BBA006	**INDIAN CONSTITUTION AND SOCIETY**	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management studies				

OBJECTIVES

To know about Indian constitution. To know about central and state government functionalities in India. To know about Indian society.

COURSE OUTCOMES (COs)	
CO1	To understand the historical background and fundamental rights
CO2	To understand the structure and functions of governments
CO3	To understand the Indian social structure
CO4	To gain knowledge in Indian federal system
CO5	To gain knowledge Indian social structure
CO6	To gain knowledge the right of women, children and SC&ST

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	L		H									
	CO2					H			M	L			
	CO3	L					H			L			
	CO4							M		L			L
	CO5	L					M		M				L
	CO6												

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I HISTORY 9

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT II CENTRAL STRUCTURE **9**

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STATE STRUCTURE **9**

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV PARLIAMENTARY SYSTEM **9**

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V SOCIAL STRUCTURE **9**

Society : Nature, Meaning and definition; Indian Social Structure; Castle, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

TEXT BOOKS:

1. Durga Das Basu, " Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
2. R.C.Agarwal, " (1997) Indian Political System ", S.Chand and Company, New Delhi.

REFERENCES:

1. Sharma, Brij Kishore, "Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.

2. U.R.Gahai, "(1998) Indian Political System ", New Academic Publishing House, Jalaendhar.
3. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.
4. Yogendra Singh, "(1997) Social Stratification and Charge in India ", Manohar, New Delhi
5. Maciver and Page, "Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.
6. K.L.Sharma, " (1997) Social Stratification in India: Issues and Themes ", Jawaharlal Nehru University, New Delhi.
7. www.cgsird.gov.in/constitution.pdf

REGULATIONS 2015

CHOICE BASED CREDIT SYSTEM

(Applicable to the batches admitted from July 2015)

CURRICULUM AND SYLLABUS

B.Tech - MECHANICAL ENGINEERING

(FULL TIME)

I – VIII SEMESTERS

SEMESTER I						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN101	HS	English-I	3	1	0	3
BMA101	BS	Mathematics –I	3	1	0	3
BPH 101	BS	Engineering Physics – I	3	0	0	3
BCH101	BS	Engineering Chemistry – I	3	0	0	3
BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
BSS101	HS	Personality Development	1	1	0	2
BBT 102	BS	Biology for Engineers	2	0	0	2
BCE101	ES	Basic Civil Engineering	2	0	0	2
BME101	ES	Engineering Graphics-E	2	3	0	4
PRACTICAL						
BCM1L1	ES	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	3	1
BPC1L1/2L1*	BS	Physics and Chemistry Laboratory	0	0	3	0
BSS1L4/ 1L5/IL6	HS	NCC/NSS/NSO (to be conducted during week ends)	0	1	2	1
*Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)						
Total No. of Contact Hours: 37 Total No. of Credits: 27						

SEMESTER II						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN 201	HS	English-II	3	1	0	3
BMA201	BS	Mathematics- II	3	1	0	3
BPH 201	BS	Engineering Physics – II	3	0	0	3
BCH201	BS	Engineering Chemistry – II	3	0	0	3
BFR201#	HS	Foreign/Indian Language	3	0	0	3
BME202	ES	Engineering Mechanics	3	1	0	3
BEE201	ES	Basic Electrical and Electronics Engineering	2	0	0	2
PRACTICAL						
BCS2L2	ES	Computer Practices Lab	0	0	3	1
BEE2L1	ES	Basic Electrical and Electronics Engineering Practices	0	0	3	1
BPC1L1/2L1*	BS	Physics and Chemistry Laboratory	0	0	3/3	1
BSS2L7	HS	Yoga	0	1	2	1
# Any one of the following courses: BFR201 – French, BGM201 – German, BJP201- Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 – Tamil						
*Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)						
Total No. of Contact Hours: 35				**Total No. of Credits: 24**		

SEMESTER III						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BMA301	BS	Mathematics III	3	2	0	4
BME301	PC	Kinematics of Machines	4	0	0	4
BME302	PC	Thermodynamics	4	0	0	4
BME303	PC	Mechanics of Solids	4	0	0	4
BME304	PC	Fluid Mechanics and Machinery	3	0	0	3
BME305	PC	Manufacturing Technology –I	4	2	0	3
PRACTICAL						
BME3L1	PC	Machine Drawing	2	0	2	3
BCE3L3	PC	Fluid Mechanics, Machinery and Strength of Materials Lab	0	0	3	2
Total No. of Contact Hours: 33 Total No. of Credits: 27						

SEMESTER IV						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BMA401	BS	Numerical Methods	3	2	0	4
BME401	PC	Dynamics of Machines	4	0	0	4
BME402	PC	Thermal Engineering I	4	0	0	4
BME403	PC	Industrial Metallurgy	3	0	0	3
BME404	PC	Engineering Metrology and Instrumentation	3	0	0	3
BCE406	BS	Environmental Studies	3	0	0	3
PRACTICAL						
BME4L1	PC	Metrology and Metallurgy Lab	0	0	3	2
BME4L2	PC	Manufacturing Technology Lab-I	0	0	3	2
BME4L3	PR	Technical Seminar-I	0	0	2	1
Total No. of Contact Hours: 30 Total No. of Credits: 26						

SEMESTER V						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BME501	PC	Machine Design I	3	2	0	4
BME502	PC	Thermal Engineering II	3	0	0	3
BME503	PC	Fluid Power Systems	3	0	0	3
BME504	PC	Automobile Engineering	3	0	0	3
BME505	PC	Manufacturing Technology –II	3	0	0	3
BME5E1	CE	Core Elective -I	3	0	0	3
PRACTICAL						
BME5L1	PC	Thermal Engineering Lab	0	0	3	2
BME5L2	PC	Manufacturing Technology Lab-II	0	0	3	2
BME5L3	PC	Instrumentation and Dynamics lab	0	0	3	2
BME5C1	PR	Comprehension-I	0	0	0	1
Total No. of Contact Hours: 29					**Total No. of Credits: 26**	

SEMESTER VI						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BME601	PC	Machine Design II	4	0	0	4
BME602	PC	Finite element analysis	4	0	0	4
BME603	PC	Heat and Mass Transfer	4	0	0	4
BME604	PC	CAD/CAM	3	0	0	3
BSS601	HS	Value Education and Professional Ethics	3	0	0	3
BME6E2	CE	Core Elective- II	3	0	0	3
PRACTICAL						
BME6L1	PC	Heat Transfer Lab	0	0	3	2
BME6L2	PC	CAD/CAM Lab	0	0	3	2
BME6L3	PR	Technical Seminar –II	0	0	2	1
Total No. of Contact Hours: 29			**Total No. of Credits: 26**			

SEMESTER VII						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BME701	PC	Industrial Engineering	3	0	0	3
BME702	BS	Operations Research for Engineers	4	0	0	4
BME5E3	CE	Core Elective- III	3	0	0	3
BME7E4	NE	Non Major Elective- I	3	0	0	3
BME7E5	NE	Non Major Elective- II	3	0	0	3
BME7E6	OE	Open Elective- I	3	0	0	3
PRACTICAL						
BMT7L1	PC	Fluid Power Automation Lab & Microprocessor Lab	0	0	3	2
BME7L1	PC	Computer Aided Analysis and Simulation Lab	0	0	3	2
BME7P1	PR	Term Paper	0	0	4	2
Total No. of Contact Hours: 29		**Total No. of Credits: 25**				

SEMESTER VIII						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BME8E7	NE	Non Major Elective –III	3	0	0	3
BME8E8	OE	Open Elective –II	3	0	0	3
PRACTICAL						
BME8P1	PR	Project work	0	0	18	9
BME8C1	PR	Comprehension-II	0	0	0	1
Total No. of Contact Hours: 24		**Total No. of Credits: 16**				

OVERALL CREDITS: 197

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

/

S.No.	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	6	7	-	-	-	3	-	-	16	08.12
2	Maths &Basic Sciences (BS)	11	10	4	7	-	-	4	-	36	18.27
3	Engineering Sciences (ES)	10	7	-		-	-	-	-	17	08.63
4	Professional Core (PC)	-	-	23	18	22	19	7	-	89	45.18
5	Core Electives (CE)	-	-	-		3	3	3	-	9	04.57
6	Non major Electives (NE)	-	-	-		-	-	6	3	9	04.57
7	Open Electives (OE)	-	-	-		-	-	3	3	6	03.05
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	-	1	1	1	2	10	15	07.61
	Total Credit	27	24	27	26	26	26	25	16	197	100%
	Total Contact Hour	37	35	33	30	29	29	29	24	246 Hrs	-

LIST OF ELECTIVES

List of Core Elective (CE) - I:

Code No.	Course Title	L	T	P	C
BME001	Advanced Internal Combustion Engines	3	0	0	3
BME002	Special Casting Process	3	0	0	3
BME003	Mechanical Vibrations	3	0	0	3
BME004	Plant layout and Material Handling	3	0	0	3

List of Core Elective (CE) - II:

Code No.	Course Title	L	T	P	C
BME005	Design of Heat Exchangers	3	0	0	3
BME006	Combustion Engineering	3	0	0	3
BME 007	Composite materials and Technology	3	0	0	3
BME008	Mechanics of Fracture	3	0	0	3

List of Core Elective (CE) - III :

Code No.	Course Title	L	T	P	C
BME009	Design for Manufacturing	3	0	0	3
BME010	Advanced Turbo Machines	3	0	0	3
BME 011	Process planning and cost Estimation	3	0	0	3
BME012	Jigs, Fixtures and Press tools	3	0	0	3

List of Non Major Elective (NE) - I :

Code No.	Course Title	L	T	P	C
BGE001	Vibration Control and Condition Monitoring	3	0	0	3
BGE002	Wind and Solar Energy	3	0	0	3
BGE003	New and Renewable Sources of Energy	3	0	0	3
BGE 004	Electronics for Mechanical systems	3	0	0	3

List of Non Major Elective (NE) - II :

Code No.	Course Title	L	T	P	C
BGE005	Industrial Robotics	3	0	0	3
BGE006	Power Plant Engineering	3	0	0	3
BGE007	Gas Dynamics and Space Propulsion	3	0	0	3
BBA008	Total Quality Management	3	0	0	3

List of Non Major Elective (NE) - III:

Code No.	Course Title	L	T	P	C
BGE009	Nuclear Engineering	3	0	0	3
BGE010	Rapid prototyping	3	0	0	3
BGE011	Computational Fluid Dynamics	3	0	0	3
BGE012	MEMS & Nanotechnology	3	0	0	3

List of Open Elective (OE) - I:

Code No.	Course Title	L	T	P	C
BBA001	Principles of Management and Organizational Behavior	3	0	0	3
BBA002	Entrepreneurship Development	3	0	0	3
BBA003	Marketing Management	3	0	0	3
BBA009	Intellectual Property Rights	3	0	0	3
BSS001	NSS Paper I	2	0	2	3

List of Open Elective (OE) - II:

Code No.	Course Title	L	T	P	C
BBA004	Engineering Economics and Financial Accounting	3	0	0	3
BBA005	Energy Engineering and Management	3	0	0	3
BBA006	Indian Constitution and Society	3	0	0	3
BBA007	Engineering Economics and Cost Analysis	3	0	0	3
BSS002	NSS Papaer II	2	0	2	3
BMO001	Massive Open Online Course	3	0	0	3

BEN101	ENGLISH - I	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Dept of English				

OBJECTIVES

To make the students learn the basic modes of communication for fluency and attainment of confidence in speech, reading and writing.

COURSE OUTCOMES (COs)

CO1	Understand the importance of being responsible, logical, and thorough.
CO2	Respond to the situations where short reports and instructions are required.
CO3	Explain "how things work", and what to suggest when "things don't work
CO4	Develop our confidence and authority in the practical use of language.
CO5	Understand the importance of being responsible, logical, and thorough.
CO6	Able to Face interviews and competitive examinations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H	H	M	L	L	H	H	H	H
	CO2							L					
	CO3	H						H		H			H
	CO4	H	M				M	L	H	H			H
	CO5							L					
	CO6	H		H	H	H	H	L		H	H	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I STRUCTURES 12

Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT IITRANSCODING 12

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT IIIREPORTING **12**

Degrees of comparison – Positive, Comparative, Superlative - questions- SI units -Lab reports - Physics chemistry, workshop and Survey report for introducing new product in the market.

UNIT IVFORMAL DOCUMENTATION **12**

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT VMETHODOLOGY **12**

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives , prepositional relatives.

TEXT BOOK

1. Department Of Humanities and Social Sciences Division, Anna University, Oxford University Press, 2013.

REFERENCES:

1. S.P.Danavel, English and Communication for Students of Science and Engineering, Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007.
3. Murali Krishna and Sunitha Moishra, Communication Skills for Engineers . Pearson, New Delhi, 2011.

BMA101	**MATHEMATICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – + 2 Level Mathematics				
	Course Designed by – Dept of Mathematics				

OBJECTIVES

To make the students learn Mathematics in order to formulate and solve problems effectively their respective fields of engineering.

COURSE OUTCOMES (COs)

CO1	Study the fundamentals of mathematics
CO2	Students learn multiple integral techniques
CO3	Students gain knowledge in application of variables
CO4	Find area and volume based on a function with one or more variables.
CO5	Apply matrix operations to solve relevant real life problems in engineering.
CO6	Formulate a mathematical model for three dimensional objects and solve

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2			M		H							
	CO3		H				M						
	CO4								L				
	CO5							H			L		
	CO6											L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT-1 MATRICES 12

Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes-Envelopes- Applications of Evolutes and Envelopes.

UNIT 1V FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives- Euler's theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobians- Taylor's expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates- Area as double integral- Volume as triple integral.

TEXT BOOK:

1. Ravish R.Singh and Mukkul Bhatt, "Engineering Mathematics-I" First Reprint, Tata

McGraw Hill Pub Co., New Delhi. 2011.
2. Grewal.B.S, "Higher Engineering Mathematics", 40th Edition, Khanna Publications, Delhi. 2007.

REFERENCES:

1. Ramana.B.V. "Higher Engineering Mathematics", Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, "Advanced Engineering Mathematics", 7thEdition, Pearson Education, 2007.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley and Sons, New York, 2003.
4. Murray R.Spiegel, "Advanced Calculus", Schaum's Outline Series, First Edn, McGraw Hill Intl Book Co.,New Delhi, 1981.

PH101	**ENGINEERING PHYSICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES:

To enhance the fundamental knowledge in Physics and its applications relevant to various stre of Engineering and Technology

COURSE OUTCOMES (COs)

CO1	Understand the Principles and Laws of Physics
CO2	To understand the impact of Crystal Physics
CO3	Learn the Properties of Elasticity and Heat transfer.
CO4	Acquire Knowledge on Quantum Physics.
CO5	Understand the concepts on Laser & Ultrasonic's and its Applications
CO6	Understand the Principle of Laser and its Applications in Engineering and Medicine.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	A	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M			H		
	CO2		L	H		M				M		L	H
	CO3												
	CO4	H		M	L						L		M
	CO5		L	L								L	L
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity-Hooke's law - Relationship between three modulii of elasticity (qualitative) – stress - strain diagram – Poisson's ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young's modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton's law of cooling - Linear heat flow – Lee's disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck's theory (derivation) – Deduction of Wien's displacement law and Rayleigh – Jeans' Law from Planck's theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Schrödinger's wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine's formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion –Einstein's A and B coefficients - derivation. Types of lasers – Nd:YAG, CO2, Semiconductor lasers (homo junction & hetero junction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TEXT BOOKS:

1. Jayaraman D Engineering Physics I. Global Publishing House, 2014.
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai Publishers, 2009.
4. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
4. http://ocw.mit.edu/courses/find-by-topic
5. http://nptel.ac.in/course.php?disciplineId=122
6. https://en.wikipedia.org/wiki/Engineering_physics

BCH101	ENGINEERING CHEMISTRY - I	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level Chemistry				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving the different application orien topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Understand the principles of water characterization and treatment for portable industrial purposes.
CO2	To impart knowledge on the essential aspects of Principles of polymer chemistry engineering applications of polymers
CO3	Having a sound knowledge in the Field of the Conventional and non-Conventi energy
CO4	To impart knowledge on the essential aspects of electrochemical cells, emf applications of EMF measurements
CO5	To make the students understand the Principles of corrosion and corrosion control .
CO6	To impart knowledge about the Conventional and non-conventional energy sources energy storage devices

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)

			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I WATER TECHNOLOGY 9

Introduction-Characteristics : Hardness of water – types - temporary and permanent hardness - estimation by EDTA method Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –Domestic water treatment – disinfection methods (Chlorination, Ozonation , UV treatment) Boiler feed water – requirements – disadvantages of using hard water in boilers Internal conditioning (Calgon Conditioning method) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

UNIT II POLYMERS 9

Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization– Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III ELECTRO CHEMISTRY 9

Introduction CELLS: types of Electrochemical cells , Electrolytic cells – Reversible and irreversible cells EMF – measurement of EMF– Single electrode potential – Nernst equation Reference electrodes : Standard Hydrogen electrode -Calomel electrode Ion selective electrode :Glass electrode and measurement of pH using Glass electrode Electrochemical series – significance Titrations :Potentiometer titrations (redox - Fe^{2+}vs dichromate titrations) Conduct metric titrations (acid-base – HCI vs, NaOH titrations)

UNIT IV CORROSION AND CORROSION CONTROL 9

Introduction: Chemical corrosion Definition - Chemical Corrosion - Electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion control – sacrificial anode and impressed cathodic current methods – Protective coatings :Paints– constituents of the paint and their functions Metallic coatings – electroplating of Gold and electro less plating of Nickel.

UNIT V NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Introduction : Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor Solar energy conversion – solar cells – wind energy Fuel cells – hydrogen – oxygen fuel cell Batteries :Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries :Lead–acid storage battery –working –uses Nickel–cadmium battery - working –uses Solid – state battery : Lithium battery

TEXT BOOKS:

1. P.C.Jain and Monica Jain, “Engineering Chemistry” Dhanpat Rai Pub, Co., New Delhi (2002).

2. S.S. Dara “A text book of engineering chemistry” S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, “Engineering Chemistry, Volume 1”, Crystal Publications, Chennai, (2007).

REFERENCES :

1. B.K.Sharma “Engineering chemistry” Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar “Engineering Chemistry” Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Electrochemistry

BCS101	FUNDAMENTALS OF COMPUTING AND PROGRAMMING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES

Students will understand the basics of computers and solve computer oriented problems using various computing tools.

COURSE OUTCOMES (COs)

CO1	Learn the fundamental principles in computing.
CO2	Learn to write simple programs using computer language
CO3	To enable the student to learn the major components of a computer system.
CO4	Computing problems
CO5	To learn to use office automation tools.
CO6	To interpret and relate programs

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)

			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO COMPUTER 9

Introduction- Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers- Basic Computer Organization-Number system. Computer Software: Types of Software—System software-Application software-Software Development Steps

UNIT II PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program – Purpose – Algorithm – Flowcharts– Pseudo code Introduction to Office Packages: MS Word, Spread Sheet, Power Point, MS Access, Outlook.

UNIT III INTRODUCTION TO C 9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions. Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV ARRAYS AND STRUCTURES 9

Arrays - Handling of Character Strings - Pointers – Structures-Union -Functions – Recursion-Call by value and Call by reference.

UNIT V INTRODUCTION TO C++ 9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TEXT BOOKS:

1. Ashok, N.Kamthane,"Computer Programming", Pearson Education (2012).
2. Anita Goel and Ajay Mittal,"Computer Fundamentals and Programming in C", Dorling V Kindersley (India Pvt Ltd).,Pearson Education in South Asia,(2011).
3. Yashavant P. Kanetkar, "Let us C",13th Edition,BPB Publications(2013).
4. Yashavant P. Kanetkar,"Let us C++"10th Edition, BPB Publications (2013**).**

REFERENCES:

1. Pradeep K.Sinha, Priti Sinha "Foundations of Computing", BPB Publications (2013).
2. Byron Gottfried, "Programming with C", 2nd edition, (Indian Adapted Edition), TMH Publication.
3. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in 'C' First Edition, Oxford University Press(2009).
4. The C++ Programming Language , 4th Edition, Bjarne Stroustrop, Addison-Wesley Publishing Company (2013).

BSS101	**PERSONALITY DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	1	1	0	2
	Prerequisite – +2 Level Knowledge				

	Course Designed by – Department of Management Studies

OBJECTIVES

To make students groom their personality and prove themselves as good Samaritans of the society.

COURSE OUTCOMES (COs)	
CO1	Individual or in-group class presentations pertaining to the applications of conce theories or issues in human development..
CO2	Scores obtained from essay and or objective tests.
CO3	Attendance, classroom participation, small group interactions.
CO4	Research and write about relevant topics.
CO5	Design and complete a research project that can take the form of a developme interview, an observation or assessment through service learning.
CO6	Develop and maintain a Reflection

		Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low											
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	L		H				M					
	CO2		H	H				M					
	CO3							M	H				
	CO4									H	H		
	CO5							M			H	H	
	CO6							M					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 9

The concept personality- Dimensions of theories of Freud & Erickson- personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analyses.

UNIT II ATTITUDE & MOTIVATION 6

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III SELF-ESTEEM 9

Term self-esteem - Symptoms - Advantages - Do's and Don'ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV OTHER ASPECTS OF PERSONALITY DEVELOPMENT 9

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics –Good manners and etiquette.

UNIT V EMPLOYABILITY QUOTIENT 9

Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TEXT BOOKS:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition, Prentice Hall.

REFERENCE BOOKS:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

BBT102	**BIOLOGY FOR ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – Basic Science				
	Course Designed by – Department of Industrial Bio Technology				

OBJECTIVES

Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system**.**

COURSE OUTCOMES (COs)

CO1	Graduates within the first five years will be able to grasp and apply biological engineering principles, procedures needed to solve real-world problems.
CO2	To understand the fundamentals of living things, their classification, cell structure and biochemical constituents
CO3	To apply the concept of plant, animal and microbial systems and growth in real life situations
CO4	To comprehend genetics and the immune system

CO5	To know the cause, symptoms, diagnosis and treatment of common diseases												
CO6	To give a basic knowledge of the applications of biological systems in relevant industries												
	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M					
	CO2		H							H			
	CO3			H							M		
	CO4										H		
	CO5												
	CO6						H						M
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)				
			√										
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION TO LIFE 9

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic and eukaryotic cell-Introduction to biomolecules: definition-general classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome.

UNIT II BIODIVERSITY 9

Plant System: basic concepts of plant growth-nutrition-photosynthesis and nitrogen fixation-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions-Microbial System: history-types of microbes-economic importance and control of microbes.

UNIT III GENETICS AND IMMUNE SYSTEM 9

Evolution: theories of evolution-**Mendel's** cell division–mitosis and meiosis-evidence of e **laws of inheritance**-variation and speciation- nucleic acids as a genetic material-central dogma immunity-antigens-antibody-immune response.

UNIT IV HUMAN DISEASES 9

Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis

UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION 9

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-

recombinant vaccines-cloning-drug discovery-biological neural networks-bioremediation-biofertilizer-biocontrol-biofilters-biosensors-biopolymers-bioenergy-biomaterials-biochips-basic biomedical instrumentation.

TEXT BOOKS:

1. A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

REFERENCE BOOKS

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr, Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008
3. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

BCE 101	**BASIC CIVIL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Civil Engineering				

OBJECTIVES: Understand the basic concepts of civil engineering.

COURSE OUTCOMES (COs)

CO1	Will gain knowledge in Design, concept preparation
CO2	Loading calculation
CO3	Structural component design
CO4	Drawing and chart preparation
CO5	Will understand the components of buildings.
CO6	Will learn the engineering aspects to dams , water supply and sewage disposal.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			H		L					
	CO2					H	H						
	CO3							H	L				
	CO4									L			
	CO5										H	L	
	CO6												

3	Category	Humanities & Social	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Professional Elective	Non-Major Elective	Open Elective (OE)	Project/ Seminar/ Internship (PR)

				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I CIVIL ENGINEERING MATERIALS 8

Introduction – Civil Engineering – Materials – Stones – Bricks – Sand – Cement – Plain Concrete – Reinforced Cement Concrete – Steel Sections – Timber – Plywood – Paints – Varnishes (simple examples only)

UNIT II SURVEYING 5

Surveying – objectives – classification – principles of survey-Measurement of distances – Chain survey – Determination of areas – Use of compass – Use of leveling Instrument – (simple examples only)

UNIT III FOUNDATION FOR BUILDING 5

Bearing Capacity of Soil – Foundation – Functions – Requirement of good foundations – Types of foundations – Merits & Demerits.

UNIT IV SUPERSTRUCTURE 7

Stone Masonry – Brick Masonry – Columns – Lintels – Beams – Roofing – Flooring – Plastering– White Washing (Simple examples only)

UNIT V MISCELLANEOUS TOPICS 5

Types of Bridges –Dam- purpose – selection of site - Types of Dams – Water Treatment & Supply sources – standards of drinking- distribution system. – Sewage Treatment (simple examples only)

TEXT BOOKS:

1. Raju.K.V.B, Ravichandran .P.T, "Basics of Civil Engineering", Ayyappa Publications, Chennai, 2012.
2. SeetharamanS., "Basic Civil Engineering", Anuradha Agencies, (1st ed. 2005).
3. Dr.M.SPalanisamy, "Basic Civil Engineering" (3rded. 2000), TUG Publishers, New Delhi/Tata McGrawHill Publication Co., New Delhi

REFERENCE BOOKS:

1. Rangwala.S.C, "Engineering Materials", Charotar Publishing House, Anand, 41st Edition: 2014.
2. National Building Code of India, Part V, "Building Materials", 2005
3. Ramesh Babu"A Textbook on Basic Civil Engineering" (1998). Anuradha Agencies, Kumbakonam.
4. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co. (P) Ltd. (1999).

BME 101	**ENGINEERING GRAPHICS- E**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	2	3	0	4

	Prerequisite – +2 Level Maths & Physical Science
	Course Designed by – Department of Mechanical Engineering

OBJECTIVES

To understand techniques of drawings in various fields of engineering

COURSE OUTCOMES (COs)

CO1	To know about different types of lines & use of different types of pencils in an Engineering Drawing
CO2	To know how to represents letters & numbers in drawing sheet
CO3	To know about different types of projection
CO4	To know projection of points ,straight lines, solids etc.
CO5	To know development of different types of surfaces.
CO6	To know about isometric projection.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H											H
	CO2	M	H										M
	CO3			L									M
	CO4						L		H	H			L
	CO5			L						H			L
	CO6			L							H		L

3	Category	Humanities & Social	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Professional Elective	Non-Major Elective	Open Elective (OE)	Project/ Seminar/ Internshi -(PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I BASIC CURVES, PROJECTION OF POINTS AND STRAIGHT LINES6+6

Conics-construction of ellipse, parabola and hyperbola by eccentricity method-construction of cycloids- construction of involutes of square and circle-Drawing of tangent and normal to the above curves-Scales-Basic drawing conventions and standards-Orthographic projection principles- Principal planes-First angle projection- Projection of points. Projection of straight lines (only first angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces.

UNIT II PROJECTIONS OF PLANES AND SOLIDS 6+6

Projection of planes (Polygonal and circular surfaces) inclined to both the principal planes. Projection of simple solids like prisms, pyramids, cylinder, cone, tetrahedron and truncated solids when the axis is inclined to one of the principal planes/ both principal planes by rotating object method and auxiliary plane method.

UNITIII ORTHOGRAPHIC PROJECTIONS, ISOMETRIC PROJECTIONS & FREEHANDSKETCHING 6+6

Orthographic projection of Simple parts from 3D diagram-Principles of isometric projection and isometric view-isometric scale- Isometric projections of simple solids and truncated solids- Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems Free hand sketching of orthographic & Isometric projection

UNITIVPROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+6

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other-obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids- Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

.

UNIT VPERSPECTIVE PROJECTION, BUILDING DRAWING AND COMPUTER AIDED DRAFTING 6+6

Perspective projection of simple solids-Prisms, Pyramids and cylinders by visual ray method. Introduction- components of simple residential or office building-specifications-plan and elevation of different types of Residential buildings and office buildings. Introduction to drafting packages and basic commands used in AUTO CAD. Demonstration of drafting packages.

TEXT BOOKS:

1. N.D.Bhatt and V.M.Panchal, "Engineering Drawing", Charotar Publishing House, 50th Edition, 2010.
2. K.V.Natarajan "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.

REFERENCES:

1. K.R.Gopalakrishna, "Engineering drawing",(Vol-I & II combined) Subhas stores, Bangalore,2007.
2. K.Venugopal and V. Prabhu Raja, "Engineering Graphics", New Age International Private limited,2008.
3. Luzzader, Warren.J., and Duff, John.M.,, "Fundamentals of Engineering Drawing with an introduction to Interactive computer graphics for design and production", Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi,2005.

Special points applicable to University Examinations on Engineering Graphics

1) There will be five questions, each of either or type covering all units of the syllabus.
2) All questions will carry equal marks of 20 each making a total of 100.

BCM1L1	**BASIC CIVIL & MECHANICALENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Department of Mechanical Engineering& Civil Engineering				

OBJECTIVES

To provide exposure to the students with hands on experience on various basic Civil &

Mechanical Engineering practices.													
COURSE OUTCOMES (COs)													
CO1	Learn Basic concepts												
CO2	Students will get exposure regarding pipe connection for pumps & turbines and to study the joint used in roofs, doors, windows and furniture's.												
CO3	Students will get exposure regarding smithy, foundry operations and in latest welding operations such as TIG, MIG, CO2, spot welding etc.,												
CO4	Students will get hands on experience on basic welding techniques, machining and sheet metal works.												
CO5	Students will get hands on experience on basic machining techniques												
CO6	Students will get hands on experience on basic sheet metal techniques												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H	L										
	CO2				H								
	CO3					H	L	L					
	CO4		H				M		L			H	
	CO5		H				M		L			H	
	CO6		H				M		L			H	
3	Category	Human	Basic Sc	Engg Sc	Profession	Profession	Non-	Open	Project				
				√									
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS

I. CIVILENGINEERINGPRACTICE

Buildings:

a) Studyofplumbingandcarpentrycomponentsofresidentialandindustrialbuildings.Safetyaspe cts.

PlumbingWorks:

a) Studyofpipelinejoints,itslocationandfunctions:valves,taps,couplings,unions,reducers,elbo wsin householdfittings.

b) Studyofpipeconnectionsrequirementsforpumpsandturbines.

c) Preparationofplumbinglinesketchesforwatersupplyandsewageworks.

d) Hands-on-exercise:Basicpipeconnection ofPVCpipes&G.I.Pipes– Mixedpipematerialconnection–Pipe connectionswithdifferentjoiningcomponents.

e) Demonstrationofplumbingrequirementsofhigh-risebuildings.

CarpentryusingHandtoolsandPowertools:

a) Studyofthejointsinroofs,doors,windowsandfurniture.

b) Hands-on-exercise:Woodwork,jointsbysawing,planningandcutting.

c) Preparationofhalfjoints,MortiseandTenonjoints.

II MECHANICALENGINEERINGPRACTICE

Welding:

a) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

BasicMachining:

a) Simple Turning and Taper turning

b) Drilling Practice

SheetMetalWork:

a) Forming&Bending:
b) Modelmaking–Trays,funnels, etc.
c) Differenttypeofjoints
d) Preparationofair-conditioningducts
e) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

Machineassemblypractice:

a) Assembling,dismantlingand Studyofcentrifugalpump
b) Assembling,dismantlingand Studyofairconditioner
c) Assembling,dismantlingandStudyoflathe

Moulding:

a) Mouldingoperationslikemouldpreparationfor gearandstepconepulleyetc

Fitting:

a) Fitting Exercises–Preparationofsquarefittingandvee–fittingmodels.

Demonstration:

a) Smithyoperations,upsetting,swaging,settingdownandbending.Example–Exercise–Productionofhexagonalheaded bolt.
b) Gaswelding.

REFERENCES:

1. K. Jeyachandran, S. Nararajan& S, Balasubramanian, "A Primer on Engineering Practices Laboratory" ,Anuradha Publications, (2007).
2. T.Jeyapoovan, M. Saravanapandian& S. Pranitha, "Engineering Practices Lab Manual",Vikas Publishing House Pvt. Ltd. (2006)
3. H. S. Bawa, "Workshop Practice", Tata McGraw–Hill Publishing Company Limited, (2007).
4. A. Rajendra Prasad & P. M. M. S Sarma, "Workshop Practice", SreeSai Publication, (2002).
5. P. Kannaiah& K.L. Narayana, "Manual on Workshop Practice", Scitech Publication, (1999).

	PHYSICS AND CHEMISTRY LABORATORY	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
BPC 1L1/2 L1	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				
OBJECTIVES: To impart knowledge to the students in practical physics and chemistry					
COURSE OUTCOMES (COs)					
CO1	Students will understand the concept of hall effect				
CO2	Students will understand the concept of semiconductors. .				

CO3	Student will understand the working of spectrometer.
CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample

6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS 1L5 /2L5 NSS PRACTICAL L T P C

0 1 2 1

OBJECTIVES

1. Understand the community in which they work and their relation
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop capacity to meet emergencies and natural disasters
4. Practice national integration and social harmony and
5. Utilize their knowledge in finding practical solutions to individual and community problems.

1. Regular Activities Programme

1) Traffic regulation
2) Working with Police Commissioner's Office
3) Working with Corporation of Chennai
4) Working with Health Department
5) Blind assistance
6) Garments collection
7) Non-formal education
8)Environmental Education, Awareness and Training (EEAT)
9) Blood donation

2.Special camp Programme

A) Legal awareness
B) Health awareness
C) First-aid
D) Career guidance
E) Leadership training - cum - Cultural Programme
F) Globalization and its Economic Social Political and Cultural impacts.

REFERENCE BOOKS:

1. National Service Scheme Manual, Government of India.
2. Training Programme on National Programme scheme, TISS.
3. Orientation Courses for N.S.S. Programme officers, TISS.
4. Case material as Training Aid for field workers, Gurmeet Hans.
5. Social service opportunities in Hospitals, Kapil K.Krishan,TISS.
6. Social Problems in India, Ram Ahuja.

	ENGLISH II	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3

BEN 201	Prerequisite – English I
	Course Designed by – Department of English

OBJECTIVES

Students will be able to actively participate in group discussions. Students will have Telepho Skills, Giving Directions and Information Transfer

COURSE OUTCOMES (COs)

CO1	To make the students aware to different kinds of Learner-friendly modes of language variety of self- instructional learning (Computer based)
CO2	To make students comprehend the habit of intelligent Reading as well as Computer- ba competitive exams glob
CO3	To achieve a reasonably good level of competency in Report Writing.
CO4	To make the students aware to different kinds of Learner-friendly modes of language variety of self- instructional learning (Computer based)
CO5	To achieve a reasonably good level of competency in group discussions
CO6	To achieve a reasonably good level of competency in public speaking

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	M	L	H	L	M			H		M	L	
	CO2			H	L				H		M	L	
	CO3			H	L	M			H		H	L	
	CO4			H	L	M			H		M	L	
	CO5			H	L	M			H		M	L	
	CO6			H	L	M			H		M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ORIENTATION 12

Numerical adjectives - Meanings in context - Same words used as different parts of speech -Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II ORAL SKILL 12

Listening to audio cassettes - C.Ds , News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - and Giving Instructions - Reading Comprehension answering questions. Inferring meaning.

UNIT III THINKING SKILL 12

Self- introduction describing –Group Discussion – Debate –Role play- Telephone- Things- etiquette-

Recommendation and Sequencing jumbled sentences to make a suggestions-paragraph-advertisement and notice, Designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV WRITING SKILL 12

Definitions - Compound nouns - Abbreviations and acronyms – (a) business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) Letters to the editor (giving suggestions on an issue) .

UNIT V FORMAL INFORMATION 12

Editing **–** Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

TEXT BOOK:

1. Meenakshi Raman, Sangeetha Sharma , Technical English for Communication: Principle and Practice, OUP, 2009.

REFERENCE BOOKS:

1. Sumanth , English for Engineers, Vijay Nicole , Imprints pvt ltd.2013.
2. Meenakshi Raman and SangeethaSharma , Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binodmishra , Communication skills for engineers and scientists , PHI Learning Pvt Ltd, New Delhi, 2010.

BMA 201	**MATHEMATICS – II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – Mathematics I				
	Course Designed by – Department of Mathematics				

OBJECTIVES

Ability to apply these principles of mathematics in projects and research works.

COURSE OUTCOMES (COs)

CO1	Student shall be able to Solve differential equations, simultaneous linear equations, and so special types of linear equations related to engineering.
CO2	Relate the use of mathematics in applications of various fields namely fluid flow, heat fl solid mechanics, electrostatics, etc.
CO3	Ability to test hypothesis
CO4	Find intensity of degree of relationship between two variables and also bring out regress equations.
CO5	Understand to solve matrix problems related to real life problems.
CO6	Formulate mathematical models

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		L									

	CO2		H				H		L		L		M	
	CO3		H				H		L		L		M	
	CO4					M							M	
	CO5											M	M	
	CO6											M		

3	Category	Humanities & Social	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Professional Elective	Non-Major Elective	Open Elective (OE)	Project/ Seminar/ Internshi (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I ORDINARY DIFFERENTIAL EQUATION 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters **– Cauchy's** and L**egendre's linear equations** - simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient, divergence and curl –Directional derivatives –Irrotational and solenoidal vector fields – vector integration**– Green's theorem in a plane , Gauss divergence theorem and** S**toke's theorem (**without proofs) **–** simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) – Harmonic and orthogonal properties of analytic functions – Harmonic conjugate – construction of analytic functions – conformal mapping: W= Z+C, CZ, 1/Z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration **– Statement and application of Cauchy's integral theorem and Cauchy's integral formula –**Taylor and Laurent expansions – Singular points – Residues – Residue theorem – Application of Residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V STATISTICS 12

Mean, Median, Mode – Moments –Skewness and Kurtosis – Correlation – Rank Correlation – Regression –Chi square test for contingency tables.

TEXT BOOK:

1. R.M.Kannan and B.Vijayakumar" Engineering Mathematics–II "2nd Edition, SRB Publication, Chennai 2007.
2. Bali.N.P and Manish Goyal , "Engineering Mathematics", 3rd Edition, Laxmi Publications (P) Lltd, 2008 .
3. Grewal .B/S "Higher Engineering Mathematics", 40th Editon, Khanna Publications, Delhi, 2007

REFERENCES :

1. Ramana.B.V, "Higher Engineering Mathematic", Tata McGraw Hill Publishing Company, New

Delhi, 2007.
2. Gupta SC, and VK.Kapoor, "Fundamentals Mathematical Statistics", 11th edition, Sultan Chand Sons, New Delhi, 2014.

BPH201	ENGINEERING PHYSICS -II	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING PHYSICS -I				
	Course Designed by – Department of Physics				

OBJECTIVES

- To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications
- To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

COURSE OUTCOMES (COs)

CO1	Understand about properties and advancements of conducting materials.
CO2	Understand the principle and properties semiconducting materials.
CO3	Acquire Knowledge on Magnetic and dielectric Materials.
CO4	To Know about the creation of new materials with novel properties
CO5	To Understand the impact of modern materials in technical uses.
CO6	Learn new engineering materials and its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L								
	CO5		L	L									
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory – Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications.

TEXT BOOKS:

1. Jayaraman D Engineering Physics II. Global Publishing House, 2014.
2. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
3. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

REFERENCES:

1.Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4 http://ocw.mit.edu/courses/find-by-topic
5 http://nptel.ac.in/course.php?disciplineId=122
6 https://en.wikipedia.org/wiki/Engineering_physics

	ENGINEERING CHEMISTRY-II	L	T	P	C

BCH 201	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING CHEMISTRY –I				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving application orien topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Students will understand the concepts and further industrial applications of surface chemis
CO2	To impart knowledge about the Industrial importance of Phase rule and alloys
CO3	To make the students to be conversant with Analytical techniques of chemistry and t importance
CO4	To have an idea and knowledge about the Chemistry of Fuels and
CO5	Understanding of engineering materials
CO6	All about bonding and molecular structures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L		H		H				M	
	CO2		H			H		H					
	CO3	H		L		H		H				M	
	CO4			L		H		H					
	CO5			L		H		H					
	CO6			L		H		H		H		M	

3	Category	Humanities & Social	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Professional Elective	Non-Major Elective (NE)	Open Elective	Project/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I SURFACE CHEMISTRY 9

Introduction **:** Adsorption , absorption , desorption , adsorbent , adsorbate and sorption **–** (definition only) Differences between adsorption and absorption Adsorption of gases on solids **–** factors affecting adsorption of gases on solids **–** Adsorption isotherms **–**Frendlich adsorption isotherm and Langmuir adsorption isotherm Role of adsorbents in catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II PHASE RULE AND ALLOYS 9

Introduction **:**Statement of Phase Rule and explanation of terms involved **–** one component system **–** water system **–** Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) **–** eutectic temperature **–** eutectic composition **–** Pattinsons Process of desilverisation of Lead Alloys: Importance, ferrous alloys **–**nichrome and stainless steel **–** 18/8 stainless steel -heat treatment of steel **–** annealing **–** hardening **–** tempering normalizing **–** carburizing - nit riding . Non- ferrous

alloys: Brass and Bronze

UNIT III ANALYTICAL TECHNIQUES 9

Introduction: Type of Spectroscopy - Atomic spectroscopy – molecular spectroscopy - Explanation IR spectroscopy – principles – instrumentation (block diagram only) – applications - finger print region UV-visible spectroscopy –– principle – instrumentation (block diagram only) – Beer-**Lambert's law**- – estimation of iron by colorimetry– Atomic absorption spectroscopy- principle - instrumentation (block diagram only) - estimation of Nickel by Atomic absorption spectroscopy Flame photometry– principles – instrumentation (block diagram only) - estimation of sodium ion by Flame photometry

UNIT IV FUELS 9

Introduction **:** Calorific value – types of Calorific value - gross calorific value – net calorific value Analysis of Coal –- Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only) Flue gas analysis – importance - Orsat apparatus

UNIT V ENGINEERING MATERIALS 9

Introduction: Refractory's – classification – acidic, basic and neutral refractory's – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Manufacture of Refractory's: alumina bricks and Magnesite bricks, Abrasives – natural and synthetic abrasives Natural type : Siliceous - quartz ; Non –siliceous – diamond Synthetic Abrasives : silicon carbide and boron carbide. Lubricants: Liquid lubricants - Properties – viscosity index, flash and fire points, cloud and pour points, oiliness) Solid lubricants – graphite and molybdenum sulphide

TEXT BOOKS:

1. P.C.Jain and Monica Jain, "Engineering Chemistry" Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand &Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, "Engineering Chemistry, Volume 1", Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.Sivasankar "Engineering Chemistry" Tata McGraw-Hill Pub. Co.Ltd, New Delhi,(2008)
2. B.K.Sharma "Engineering Chemistry" Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Spectroscopy

BFR 201	FRENCH	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES Language gives access and insights into another culture. It is a fundamental truth that cultures de themselves through languages.	
COURSE OUTCOMES (COs)	
CO1	Introduce the basics of the language to beginners
CO2	Understand a dialogue and dialogue presentation
CO3	To develop their knowledge as well as their communicative skills so as to be able to respon simple everyday contexts.
CO4	Synchronies I includes documents which initiate the learners to another world, another culture which acclimatize them to the authentic use of the French language through the exploitatio written and iconographic documents. The Indian context has been used.
CO5	Grammatical and lexical notions as well as activities required for communication are learnt by students.
CO6	Interpreting skills and confidence in the language.
CO6	Interpreting skills and confidence in the language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective	Open Elective (OE)	Project/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 8

At the airport: Savoir– faire: exchanging greetings, self introduction, introducing another, welcoming someone, identifying someone - Grammar: verbs 'to be', 'to call oneself', subject pronouns, interrogation

UNIT II GRAMMAR 8

At the University: Savoir-faire: enquiring after one's welfare, taking leave, expressing appreciation - Grammar: definite & indefinite articles, gender of nouns, adjectives, present tense of regular 'er' verbs, 'to have', 'to learn', negation, irregular verbs

UNIT III CONVERSATION 8

At the café: Savoir –faire: speaking about one's likes, giving information, expressing admiration, asking information about someone - Grammar: Interrogative adjectives, irregular verbs, possessive

and interrogative adjectives

UNIT IV PROPOSAL WRITING **7**

At the beach: Savoir faire: proposing an outing, accepting/ refusing the proposal - Grammar: singular & plural, indefinite pronoun, demonstrative adjectives, negation, irregular verbs

UNIT V FORMAL LETTERS **7**

A concert: Savoir –faire: inviting, accepting, expressing one's inability to accept an invitation

UNIT VI REGULAR & IRREGULAR VERBS **7**

Grammar: Present tense of more irregular verbs, contracted articles, future tense, interrogative adverbs, **At Nalli's** Savoir- faire: asking the price of an article, protesting against the price, Grammar: possessive adjectives, Exclamative adjectives, imperative tense

REFERENCES:

1. Course Material: Synchronie I –Méthode de Français
2. Madanagobalane -Samita Publications, Chennai, 2007

BGM 201	**GERMAN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

At the end of this course, students shall be able to obtain good knowledge of the language, to r write and speak German, whereby the emphasis is laid on speech.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand German lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

Course structure:

A. German Language (speaking, reading, writing, grammar and test)
B. Life in Germany (shopping, restaurant, doctor, government, bank, post)
C. The German Way (introduction, doing business, conversation, meetings, dining)
D. Germany (Culture, Climate)

UNIT IPRONOUNCIATION **9**

Welcome: Introduction to the Language, Spelling and Pronunciation (The alphabets and numbers) Greetings, ordering, requesting, saying thank you - Grammar **– the article "the", conjugation** of verbs

UNIT IISELF INTRODUCTION **9**

Shopping - Grammar **–** adjectives, endings before nouns, practice. Self introduction

UNIT IIITRAINING **9**

Addresses, Occupations, Studies - Grammar **- 'to be', the definite/indefinite** articles, individual Training

UNIT IVORAL **9**

Leisure Time, Sports, Hobbies - Grammar **–** position of a verb in a main clause , oral practice

UNIT VNARRATION **9**

At a Restaurant, Food and Drink - Grammar **–** the personal pronoun in the Nominative and Accusative, Narrating an event

RESOURCES:

1. Sprachkurs Deutsch 1 (Verlag Diesterweg), New Delhi Learning Centre

BJP 201	**JAPANESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				
OBJECTIVES To have a basic knowledge of Japanese language, Japanese culture and heritage					

To impart knowledge Japanese lifestyle. To give sufficient exposure to develop basic conversational skills.	
COURSE OUTCOMES (COs)	
CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Japanese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective	Non-Major Elective	Open Elective (OE)	Project/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT ICULTURAL HERITAGE **9**

Introduction-history and origin of Japanese language-Japan and its cultural heritage-Self introduction-counting numbers (1-100)-time-conversation with the use of audio devices, grammar– usage of particles wa, no, mo and ka

UNIT IIUSAGE **9**

Greetings, seasons, days of the week and months of the year-numbers (up to 99,999)-grammar– usage of kore, sore, are, kono, sono, ano, koko and kochira, arimasu and imasu-i-ending and na-ending adjectives-use of audio and drills for practice

UNIT IIIORAL **9**

Asking the price–associated vocabulary-usage of particles ni, ga and ne- use of audio and drills for practice-Introduction to basic Kanji characters- use of audio and drills for practice

UNIT IVART AND CULTURE **9**

Family relationships- colours-Kanji (numbers) and festivals of Japan-religion-Japanese art and culture-ikebana, origami-introduction to hiragana- use of audio and drills for practice

UNIT VDRILLS AND PRACTICE **9**

Vocobulary associated with directions-asking way-particles – e, de, mo, koko, soko, asoko, doko, nani, mae, ushiro, ue, shita- use of audio and drills for practice-introduction to katakana

TEXT BOOKS

1. Japanese Hiragana and Katakana for beginners, Timothy G. Stout, 2011
2. Genki I: An integrated course in elementary Japanese, Eri Banno and Yuko Ikeda, 2011

REFERENCE BOOKS

1. Japanese Reader collection Volume I, Yumi Boutwell and Clay Boutwell, Kotoba books, 2013
2. Living Language Japanese Complete Edition beginners through advanced course, Living Language, 2012

BKR 201	**KOREAN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Korean language, Korean culture and heritage
To impart knowledge on Korean lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Korean lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Professional Elective	Non-Major Elective	Open Elective (OE)	Project/ Seminar/ Internship (PR)
		√							

4	Approval	37th Meeting of Academic Council, May 2015

UNIT IPLANNING **9**

Asking/giving reasons for studying Korean, making plans for the holiday, writing letters, describing past travel experiences and future travel plans, shopping in a grocery store, shopping in electronics store, storytelling Grammar: would like to (do), want to (do), construct future tense.

UNIT IIMODIFIERS **9**

Asking about feelings, asking about problems and giving advice, brief introductions - Grammar: Noun modifier, please try doing (something), irregular adjective/verb

UNIT IIIPLACING ORDERS **9**

Asking about hobbies, asking about abilities (sports), job requirements, Ordering things for delivery, ordering a meal at a restaurant - Grammar: Sentence ending for the honorific form, please do something for me, have tried (something),

UNIT IVDESCRIPTIONS **9**

Asking about evening plans, making plans with others, making preparations - Asking about rooms, describing your room to your classmates, describing your house. Grammar: to know/not know how to do something, must (do), have to (do), should,

UNIT VGRAMMAR **9**

Describing your plans and giving reasons, cancelling appointments. Grammar: Shall we~? / Should we~?, with, and, irregular verbs/adjective, so, because, cannot, intend to, plan to, or hope to, (more) than, the most, tag question/is n't it? ,will (do)

COURSE MATERIAL:

Korean for Non-Native Speakers (Student Book 1B) Korean Language Education Center, Sogang University

BCN 201	**CHINESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Chinese language, Chinese culture and heritage

To impart knowledge on Chinese lifestyle and heritage.

COURSE OUTCOMES (COs)	
CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Chinese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture

		Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low											
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Professional Elective (PE)		Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
		√											
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I RISE OF DIALECTS **9**

History, Origins, Old and middle Chinese, Rise of northern dialects

UNIT IIVARIETIES **9**

Influences 3 Varieties of Chinese. 1.Classification 2.Standard Chinese and 3.Nomenclature

UNIT III CHARACTERS **9**

Chinese characters, Homophones, Phonology

UNIT IVTRANSCRIPTIONS **9**

Tones, Phonetic transcriptions, Romanization, Other phonetic transcriptions

UNIT VGRAMMAR **9**

Grammar and morphology, Vocabulary, Loanwords, Modern borrowings and loanwords

REFERENCES:

1. Hannas, William C. (1997), Asia's Orthographic Dilemma, University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-1892-0" 978-0-8248- 1892-0.
2. Qiu, Xigui (2000), Chinese Writing, trans. Gilbert Louis Mattos and Jerry Norman, Society for the Study of Early China and Institute of East Asian Studies, University of California, Berkeley, ISBN HYPERLINK http://en.wikipedia.org/wiki/Special:BookSources/978-1-55729-071-7,978-1-55729-071-7.
3. Ramsey, S. Robert (1987), The Languages of China, Princeton University Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-691-01468-5" 978-0-691-01468-5.

4. Schuessler, Axel (2007), ABC Etymological Dictionary of Old Chinese, Honolulu: University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-2975-9"978-0-8248-2975-9.
5. R. L. G. " Language borrowing Why so little Chinese in English?" The Economist. June 6, 201

BME 202	ENGINEERING MECHANICS	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – Engineering Mathematics I , II, Engg. Physics				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES: To understand the concept of basic engineering mechanism

COURSE OUTCOMES (COs)

CO1	Students will understand the concepts of engineering mechanics
CO2	Students will understand the vectorial representation of forces and moments
CO3	Students will gain knowledge regarding center of gravity and moment of inertia and apply them for practical problems.
CO4	Students will gain knowledge regarding various types of forces and reactions and tom draw free body diagram to quicker solutions for complicated problems.
CO5	Student will gain knowledge in solving problems involving work and energy
CO6	Student will gain knowledge on friction on equilibrium and its application.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	H		H		L		H	H	
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Professional Elective	Non-Major Elective	Open Elective (OE)	Project/ Seminar/ Internshi (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BASICS AND STATICS OF PARTICLES 12

Introduction - Units and Dimensions - Laws of Mechanics – **Lame's theorem, Parallelogram and triangular Law** of forces – Vectors –Vectorial representation of forces and moments – Vector operations on forces - Coplanar Forces – Resolution and Composition of forces – Resultant of several concurrent forces - Equilibrium of a forces – Forces in space - Equilibrium of particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples– Scalar components of a moment – **Varignon's theorem** - Equilibrium of Rigid bodies in two dimensions -Equilibrium of Rigid bodies in three dimensions.

UNITIII PROPERTIES OF SURFACES AND SOLIDS 12

Determination of areas – First moment of area and the Centroid of standard sections – T section, I section, Composite figures, Hollow section – second moments of plane area – Rectangle, triangle, circle - T section, I section, Hollow section – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Basic concept of Mass moment of inertia.

UNITIV FRICTION 12

Frictional force – Laws of Coloumb friction – Cone of friction – Angle of repose – Simple contact friction – Sliding of blocks – Wedge friction - Ladder friction – Screw Jack – Belt friction - Rolling resistance.

UNIT V DYNAMICS OF PARTICLES 12

Displacements, Velocity and acceleration, their relationship – Relative motion – Relative acceleration – Curvilinear motion of particles – **Newton's law** – work energy equation – impulse and Momentum – Impact of
elastic bodies.

TEXT BOOK:

1. Beer, F.P and Johnson Jr. E.R, "Vector Mechanics for Engineers: Vol. 1 Statics and vol. 2 Dynamics", McGraw-Hill International Edition, 2013.
2. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2011.

REFERENCES :

1. Kumar, K. L Kumar, V., Engineering Mechanics, Tata McGraw – Hill, New Delhi, 2010
2. Palanichamy, M.S., Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw - Hill, 2013.
3. Timoshenko, and Young, Engineering Mechanics, Tata McGraw-Hill, New Delhi, 2013.
4. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition – Pearson Education Asia Pvt., Ltd., 2006.

BEE 201	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Engineering Mathematics, Engineering Physics-I & II				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To understand the laws of electrical engineering.	
COURSE OUTCOMES (COs)	
CO1	Students will gain knowledge regarding the various laws and principles associated with electrical systems.
CO2	Students will gain knowledge regarding electrical machines and apply them for practical problems.
CO3	Students will gain knowledge regarding various types semiconductors.
CO4	Student will gain knowledge digital electronics.
CO5	Student will gain knowledge on electronic systems.
CO6	Students will acquire knowledge in using the concepts in the field of electrical engg. projects and research.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L			
	CO2		H	M			L		L	L			
	CO3		H	M			L		L				
	CO4	M	H	M			L		L	L			
	CO5	M	H	M			L		L				
	CO6		H				L		L	H			

3	Category	Humanities & Social	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Professional Elective	Non-Major Elective	Open Elective (OE)	Project/ Seminar/ Internship (PR)
				√					

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I ELECTRIC CIRCUITS 6

Ohm's law – Kirchoff's Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem –Thevenin's and Norton's Theorem -Problems.

UNIT II ELECTRICAL MACHINES 6

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT III BASIC MEASUREMENT SYSTEMS 6

Introduction to Measurement Systems, Construction and Operating principles of PMMC, Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method **–** and Energy meter.

UNIT IV SEMICONDUCTOR DEVICES 6

Basic Concepts of semiconductor devices **–** PN Junction Diode Characteristics and its

Applications – HWR, FWR –Zener Diode – BJT (CB, CE, CC) configuration & Characteristics.

UNIT V DIGITAL ELECTRONICS 6

Number system – Logic Gates – Boolean Algebra– De-**Morgan's Theorem** – Half Adder & Full Adder – Flip Flops.

TEXT BOOKS:

1. N.Mittal "Basic Electrical Engineering". Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
3. Jacob Millman and Christos C-Halkias, "Electronic Devices and Circuits", Tata McGraw Hill

REFERENCE BOOKS:

1. Edminister J.A. "Theory and Problems of Electric Circuits" Schaum's Outline Series. McGrawHill Book Compay, 2nd Edition, 1983.
2. Hyatt W.H and Kemmerlay J.E. "Engineering Circuit Analysis", McGraw Hill International Editions, 1993.
3. D. P. Kothari and I. J. Nagrath" Electric Machines"Tata McGraw-Hill Education, 2004
4. Millman and Halkias, "Integrated Electronics", Tata McGraw Hill Edition, 2004.

BCS 2L2	**COMPUTER PRACTICE LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	1
	Prerequisite – Fundamentals of Computer				
	Course Designed by – Department of Computer Science &Engineering				

OBJECTIVES: To impart basic computer knowledge

COURSE OUTCOMES (COs)

CO1	Demonstrate major algorithms and data
CO2	Implementation of array operations
CO3	Implementation of binary tree.
CO4	Implementation of linked list
CO5	Students will able to do analyse data using spread sheet
CO6	Student will able to understand the basics of C programming.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	H		H		L		H	H	H
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

A) WORD PROCESSING **6**

Document creation, Text manipulation with Scientific Notations. Table creation, able formatting and Conversion. Mail merge and Letter Preparation. Drawing-Flow Chart

B) SPREAD SHEET **9**

Chart-Line Xy Bar and Pie – Formula-Formula Editor-Spread sheet-Inclusion of Object, Picture and Graphics Protecting the document and sheet-Sorting and Import/Export features.

C) SIMPLE C PROGRAMMING* **15**

Data types, Expression Evaluation, Condition Statement. Arrays structures and Unions – Functions

D) SIMPLE C++PROGRAMMING **15**

-Classes and Objects

-Constructor and Destructor

***For Programming exercises Flow chart and Pseudo code are essential.**

BEE2L1	**BASIC ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Basic Electrical and Electronics Engineering				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To enhance the student with knowledge on electrical and electronic equipments.

COURSE OUTCOMES (COs)

CO1	Students will able to handle basic electrical equipments.
CO2	Students will able to do staircase wiring.
CO3	Students will able to understand domestic wiring procedures practically.
CO4	Student will able to assemble electronic systems.
CO5	Students will understand all the fundamental concepts involving electrical engineering

CO6	Students will understand all the fundamental concepts involving electronics engineering												
	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	
	CO5	M	H	M			L		L		M	H	
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Professional Elective (PE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
				√					
4	Approval	37th Meeting of Academic Council, May 2015							

I LIST OF EXPERIMENTS FOR ELECTRICAL ENGINEERING LAB

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

II LIST OF EXPERIMENTS FOR ELECTRONICS ENGINEERING LAB

1. Study of electronic components and equipments.
   a. Resistor colour coding using digital multi-meter.
   b. Assembling electronic components on bread board.
2. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

	PHYSICS AND CHEMISTRY LABORATORY	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
BPC	Prerequisite – Physics and Chemistry				

1L1/2 L1	Course Designed by – Department of Physics & Chemistry

OBJECTIVES: To impart knowledge to the students in practical physics and chemistry

COURSE OUTCOMES (COs)

CO1	Students will understand the concept of hall effect
CO2	Students will understand the concept of semiconductors. .
CO3	Student will understand the working of spectrometer.
CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√						

4	Approval	37th Meeting of Academic Council, May 2015

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer

12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler'smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS1L7/BSS2L7 YOGA FOREMPOWERMENT

L	T	P	C
0	1	2	1

OBJECTIVE:

Providing Value Education to improve the Students' character - understanding yogic life and physical health - maintaining youthfulness - Measure and method in five aspects of life

UNIT I PHYSICAL HEALTH 6

Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment.

Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.

Yogasanas 1: Pranamasana - Hastha Uttanasana - Pada Hasthasana - Aswa Sanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana.

Pranayama: Naddi suddi - Clearance Practice - Benefits.

Simplified Physical Exercise - Kayakalpa Practices - Meditation Practices.

UNIT II LIFE FORCE 6

Reasons for Diseases: Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)

Philosophy of Kaya kalpa: Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind.

Maintaining youthfulness: Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid - Measure and method in five aspects of life - Controlling undue Passion.

Kayakalpa practice: Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

UNIT III MENTAL HEALTH 6

Mental Frequencies: Beta, Apha, Theta and Delta wave - Agna Meditation explanation-benefits.

Shanti meditation: Shanthi Meditation explanation-benefits

Thuriya Meditation: Thuriya Meditation explanation-benefits

Benefits of Blessing: Self blessing(Auto suggestion) - Family blessing - Blessing the others - World blessing - Divineprotection

UNIT IV VALUES 6

Human Values: Self control - Self confidence - Honesty Contentment - Humility - Modesty Tolerance – Adjustment - Sacrifice - Forgiveness

Purity(Body,Dress,Environment) - Physicalpurity-Mentalpurity - Spiritual purity

Social Values :

Non violence - Service Patriotism - Equality

Respectforparentsandelders - careandprotection - Respectforteacher Punctuality - TimeManagement

UNIT V MORALITY (virtues) 6

Importance of Introspection: I - Mine (Ego, Possessiveness)

SixEvilTemperaments-Greed-Anger - Miserliness-Immoralsexualpassion - InferiorityandsuperiorityComplex - Vengeance

Maneuvering of Six Temperaments: Contentment - Tolerance - Charity - Chastity – Equality - Pardon (Forgiveness)

FiveessentialQualitiesacquiredthroughMeditation:Perspicacity – Magnanimity – Receptivity - Adaptability - Creativity(ImprovedMemoryPower)

Total periods: 30

REFERENCE BOOKS:

1. Yoga for modern age - ThathuvagnaniVethathiri Maharishi
2. Simplified Physical Exercises - ThathuvagnaniVethathiri Maharishi
3. Kayakalpam - Thathuvagnani VethathiriMaharishi
4. Thirukkural -Rev.Dr.G.U.pope
5. Mind-ThathuvagnaniVethathiriMaharishi
6. SoundHealththroughyoga-Dr.Chandrasekaran
7. Light on yoga -BKS.lyenger
8. உணவுமுறை – தத்துவஞானிவேதாத்திரிமகரிஷி

BMA 301	MATHEMATICS - III	L	T	P	C
	Total Contact Hours – 75	3	2	0	4
	Prerequisite – Engineering Mathematics I & II				
	Course Designed by – Dept. of Mathematics				

OBJECTIVES	
• To introduce Fourier series analysis which is central to many applications in engineering apart • From its use in solving boundary value problems systems. • To acquaint the student with Fourier transform techniques used in wide variety of situations. • To introduce the effective mathematical tools for the solutions of partial differential equations • that model several physical processes and to develop Z transform techniques for discrete time	
COURSE OUTCOMES (COs)	
CO1	Solve a set of algebraic equations representing steady state models formed in engineering problems
CO2	Fit smooth curves for the discrete data connected to each other or to use interpolation methods over these data tables
CO3	Find the trend information from discrete data set through numerical differentiation
CO4	To summary information through numerical integration
CO5	Solve PDE models representing spatial and temporal variations in physical systems through numerical method
CO6	Have the necessary proficiency of using MATLAB for obtaining the above solution

UNIT-I PARTIAL DIFFERENTIAL EQUATIONS 9+6

Formation - Solutions of standard types of first order equations - Lagrange's Linear equation - Linear partial differential equations of second and higher order with constant coefficients.

UNIT-II FOURIER SERIES 9+6

Dirichlet's conditions - General Fourier series - Half-range Sine and Cosine series - Parseval's identity - Harmonic Analysis.

UNIT-III BOUNDARY VALUE PROBLEMS 9+6

Classification of second order linear partial differential equations - Solutions of one - dimensional wave equation, one-dimensional heat equation - Steady state solution of two-dimensional heat equation - Fourier series solutions in Cartesian coordinates

UNIT-IV LAPLACE TRANSFORMS 9+6

Transforms of simple functions - Basic operational properties - Transforms of derivatives and integrals - Initial and final value theorems - Inverse transforms - Convolution theorem - Periodic functions - Applications of Laplace transforms for solving linear ordinary differential equations up to second order with constant coefficients and simultaneous equations of first order with constant coefficients.

UNIT-V FOURIER TRANSFORMS 9+6

Statement of Fourier integral theorem - Fourier transform pairs - Fourier Sine and Cosine transforms - Properties - Transforms of simple functions - Convolution theorem - Parseval's identity.

TEXT BOOKS:

1. Kreyszig, E.,"Advanced Engineering Mathematics"8th Edition, John Wiley and Sons, (Asia)

Pvt., Ltd, Singapore, 2000.
2. Grewal, B.S.,"Higher Engineering Mathematics" (35thEdition), Khanna Publishers, Delhi2000.

REFERENCES:

1. Kandasamy, P., Thilakavathy, K., and Gunavathy,K. "Engineering Mathematics",Volumes 1 and 3(4th Edition) S Chand and Co., New.
2. Narayanan, S.Manicavachangam Pillai, T.K.Ramanaiah, E.,"Advanced mathematics for Engineering Students", Volume2 and 3(2nd Edition), S.Viswanathan (printers & publishers Pvt, Ltd.,) 1992.
3. Venkataraman, M.K,"Engineering Mathematics"Volumes3-A&B, 13th Edition National Publishing Company, Chennai, 1998.
4. Shanmugam,T.N.:http:.www.annauniv.edu/shan/trans.h

BME301	KINEMATICS OF MACHINES	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite –Engineering Mechanics				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To understand the concept of machines, mechanisms and related terminologies.
- To analyse a mechanism for displacement, velocity and acceleration at any point in a moving link.

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students can understand mechanism and its applications in various field of work
CO2	Students will be able to draw velocity and acceleration diagrams graphically and analytically.
CO3	Understand the analysis method for optimum design.
CO4	Understand the importance of friction in machine elements.
CO5	Understand control mechanism
CO6	Study of gears and its applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H			H		L	H		M	M
	CO2						H		L			M	
	CO3						H		L			M	M
	CO4						H		L			M	M
	CO5						H		L			M	M
	CO6						H		L			M	

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval		37th Meeting of Academic Council, May 2015						

UNIT I INTRODUCTION TO MECHANISMS 12

Introduction-Science of mechanisms-Terms and definitions-Planar, Spherical and spatial mechanisms, Mobility-Classification of mechanisms-Indexing mechanisms, reciprocating mechanism etc. Straight line generators- kinematic inversion- Slider crank chain inversions- Four bar chain inversions- Grashof's law.

Determination of velocities and acceleration in mechanisms- Relative motion method (Graphical) for Mechanisms having turning, sliding and rolling pair.

UNIT II SYNTHESIS OF MECHANISMS 16

Classification of kinematics- Synthesis problems- Chebyshev's spacing, Two point synthesis-Freudenstein method- Four bar mechanism and slider crank mechanism.Types of cams and followers- Follower motions- Uniform, parabolic, SHM, Cycloidal and polynomial-Synthesis of cam profiles for different followers. Cams with specified contours

UNIT III FRICTION 10

Friction-Types-Application-Inclined plane, Screw jack, Clutch, Brakes Bearings, Journal bearing, Flat pivot bearing, multi collar bearings, Belt & Rope drives.

UNIT IV THEORY OF GEARING 12

Classification of gears, Law of gearing, nomenclature-Forms of teeth, Cycloidal teeth, Involute teeth-Length of path of contact-Length of arc of contact-Contact ratio-Interference and undercutting- Minimum number of teeth to avoid interference- Internal gears- Extended center distance system- Long and short addendum system- Gear trains-Types-Epicyclical gear trains-Automobile differential unit.

UNIT V CONTROL MECHANISMS 10

Governors- Gravity controlled governors-Spring control governors, Hartnell governor, and Hartung governor-Governor characteristics- Governor effort and power.

Gyroscopes-Gyroscopic forces and couple- Forces on bearing due to gyroscopic action-Gyroscopic effects on the movement of aero plans and ships, stability of two wheel drive and four wheel drive.

TEXT BOOKS:

1. S.S.Rattan-Theory of Machines- Tata McGraw Hill, 2005.
2. Rao J.S. & Dukkipatti R.V.Mechanisms and Machine Theory, 2nd Edition-Wiley Estern Ltd-1992.

REFERENCES:

1. Bansal- Theory of Machines, 2006.
2. Shigley.J.E-Theory of Machines and Mechanisms, 2nd Edition- McGraw Hill Inc,1995
3. V.P.Singh-Theory of Machines ,2001
4. royalmechanicalbuzz.blogspot.com/.../theory-of-**machines**-by-rs-khurmi..

BME302	**THERMODYNAMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – MATHEMATICS –I &II				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To achieve an understanding of principles of thermodynamics and to be able to use it in accounting for the bulk behaviour of the simple physical systems.

COURSE OUTCOMES (COs)

CO1	Solve first law thermodynamics based types of problems.
CO2	Solve second law thermodynamics based types of problems.
CO3	Compare the various types of steam power cycles.
CO4	Analyze the various psychrometry processes.
CO5	Extend the ideas in implementation of mini/major project
CO6	Critical analysis of pumps and turbines

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H			H		L	H		M	M
	CO2						H		L			M	
	CO3						H		L			M	M
	CO4						H		L			M	M
	CO5						H		L			M	M
	CO6						H		L			M	

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT-I BASIC CONCEPTS AND FIRST LAW OF THERMODYNAMICS 12

Concept of continuum, Thermodynamic systems-closed, open and control volume, Thermodynamic properties, path, point functions, process - Quasistatic processes, cycle, work, modes of work, heat, temperature, Zeroth law of thermodynamics, First law of Thermodynamics-applications to open and closed systems, internal energy, Specific heats Cp, Cv, enthalpy,steady and unsteady flow conditions.

UNIT-II SECOND LAW OF THERMODYNAMICS 12

Kelvin's and Clausius statements, Reversibility, Applications - Carnot cycle, Reversed Carnot cycle, heat engines,Refrigerators, heat pumps, Concept of Entropy, Clausius Inequality, Principle of increase of entropy, Carnot theorem, Entropy and irreversibility, Available energy, Availability,Gibbs and Helmholtz functions

UNIT III THERMODYNAMIC PROPERTIES OF PURE SUBSTANCES 12

Thermodynamic Properties Of Pure Substances in solid, liquid and vapour phases, P-V, P-T,T-V,T-S,H-S diagrams, PVT surfaces, steam table of thermodynamic properties, Calculations of properties, Work done and heat transferred in non flow and flow processes.

UNIT IV THERMODYNAMIC RELATIONS & GAS LAWS 12

Exact differential,Tds relations, Maxwell, Clausius-Clapeyron equation, Joule Thomson Co-efficient, Avagadro's Law, Vanderwaal's equation of state, mole concept, molar volume, equivalent weight, properties of mixture, Dalton's law of partial pressure, Amagat law, Enthalpy and specific heat, Molecular weight of gas mixture.

UNIT V COMBUSTION OF FUELS 12

Heating value of fuels, Combustion equations, Theoretical and excess air, Air-fuel ratio, Exhaust gas analysis, adiabatic flame temperature.

TEXT BOOKS:

1. P.K.Nag-Basic and Applied Thermodynamics-Tata McGraw Hill Publishing Company, 2002
2. R.K.Rajput-Engineering Thermodynamics-Laxmi Publications

REFERENCES:

1. S.C.Somasundaram-Thermal Engineering-New Age International (P) Ltd,1996
2. Y.V.C.Rao-An Introduction to Thermodynamics-New Age International (P) Ltd, 2004
3. Yunus A.Cengel-Thermodynamics-International Edition, 2006
4.bookboon.com/en/engineering-**thermodynamics-ebook**

BME303	**MECHANICS OF SOLIDS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engineering Mechanics				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To gain knowledge of simple stresses, strains and deformation in components due to external loads.
- To assess stresses and deformations through mathematical models of beams twisting bars or combinations of both.

COURSE OUTCOMES (COs)	
CO1	Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.
CO2	Critically analyse problem and solve the problems related to mechanical machine elements and analyse the deformation behavior for different types of loads.
CO3	Understand and analyze stress behavior.
CO4	analyze the behavior of different structure under loading.
CO5	Understand failure theories
CO6	Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	G	h	i	j	k	l
2	CO1	H	H	L					M	M		H	H
	CO2	H	H	L					M	M		H	H
	CO3	H	H	L					M	M		H	H
	CO4	H	H	L					M	M		H	H
	CO5	H	H	L					M	M		H	H
	CO6	H	H	L					M	M		H	H
3	Category						√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I TRUSSES, SHEAR FORCE AND BENDING MOMENT DIAGRAM 12

Analysis of trusses – Method of joints – Method of section – Shear force and Bending moment diagram – cantilever – simply supported – overhanging beams, Relation between load, shear force and bending moments.

UNITII STRESS AND STRAIN BEHAVIOUR OF SOLIDS 12

Tension, Compression and shear, Normal stress and strain, Statically indeterminate problems – temperature effects – stress and strain diagram – Elasticity – Plasticity, strain energy in tension – Impact loads – Shear stress and strain – Allowable stress – Poisson's ratio – Relation between elastic constants.

PRINCIPAL STRESSES Principal stresses and maximum shear stress – importance of zero principal stress in a three dimensional state of stress – Solution to problems by analytical method, Calculation of principal stress and maximum shear stress for a pressure vessel and shaft.

UNIT III BENDING & TORSION 12

Normal and shear stresses in beams – Torsion of circular shafts – Statically indeterminate torsional members – Torque diagrams, Strain energy in torsion.

UNIT IV DEFLECTION OF BEAMS 12

Slope and deflection of beams – Double integration method – Macaulay's method – Strain energy method for cantilever, simply supported and overhanging beams.

UNIT V THIN AND THICK CYLINDERS 12

Thin cylinder and shells – Volumetric strain – rotational stress in thin cylinders and discs, Thick cylinders – Shrink fit – Compounding of cylinders.

COLUMN AND STRUTS Columns and struts – Eccentric loading of short struts – Euler's Formula – Limitations of Euler's formula – Rankine – Gordon formula – Johnson's Parabolic formula.

TEXT BOOKS:

1. Prabhu T.J. – Mechanics of Solids, 2009

REFERENCES:

1. Gere Timoshenko – Mechanics of materials – CBS, 1997.
2. Beer & Johnson – Mechanics of materials , SI Metric Edition – McGraw Hill, ISE, 2006.
3. Timoshenko & young, Engineering Mechanics – McGraw Hill, 2007.
4. Popov E.P. Engineering Mechanics of solids – PHI, New Delhi,2006.
5. Shames Irvin. H – Introduction to Solid Mechanics – PHI,2002
6. www.freeengineeringbooks.com/Civil/**Mechanics-of-Solids**-Books.php

BME304	**FLUID MECHANICS AND MACHINERY**	L	T	P	C
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – MATHEMATICS I & II				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To achieve a understanding of the properties of the fluids. The dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
- The applications of the conservation laws to flow though pipes and hydraulics.

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid
CO2	Can critically analyse the performance of pumps and turbines
CO3	Can understand different types of flow.
CO4	Learn Fluid Dynamics
CO5	Learn fluid kinematics
CO6	Understand dimensional analysis

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L					M	M		H	H
	CO2	H	H	L					M	M		H	H
	CO3	H	H	L					M	M		H	H
	CO4	H	H	L					M	M		H	H
	CO5	H	H	L					M	M		H	H
	CO6	H	H	L					M	M		H	H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I FLUID PROPERTIES AND FLUID STATICS 12

Fluid properties –continuity equation-Hydrostatic law-pressure variation in static fluid-hydrostatic force on a submerged plane and curved surface-location of hydrostatic force, manometry, single tube and differential manometers, Buoyancy-Metacentric height.

UNIT II FLUID KINEMATICS AND FLUID DYNAMICS 12

Classification of fluid flow, fluid flow lines, stream lines, streak line and path line, vortex flow, Euler's momentum equation, Bernoulli's equation-application of Bernoulli's equation-Flow measurement, pitot tube, venturimeter

UNIT III FLOW OF A REAL FLUID &FLOW THROUGH PIPES 12

Laminar and turbulent flow, Laminar boundary conditions, Boundary layer thickness, Navier-Stokes equation(statement only),Flow through pipes, Reynolds experiments, Darcy Weisbach equation, pipes in series ,pipes in parallel, siphon losses-Power transmission, Water hammer

UNIT IV DIMENSIONAL ANALYSIS &PUMPS 12

Principle of dimensional Analysis-Buckingham's Π theorem-Important dimensionless numbers applicable to fluid mechanics-Centrifugal pumps, Pump outlet and efficiencies-Cavitations, pump characteristics, multistage pumps, axial flowpumps-characteristics, construction details,Non-dimesnsional parameters-Efficiencies-reciprocating pumps, Indicator diagram-Rotary pumps –Classifications, Working

UNIT V HYDRAULIC TURBINES 12

Classification of hydraulic turbines-pelton turbines, velocity triangle-Efficiency, working, Principle of Pelton wheel, Francis and Kaplan turbines-velocity triangles-Hydraulic turbine characteristics.

TEXT BOOKS:

1. Modi and Seth-Fluid Mechanics and Hydraulic Machines, 2005.
2. R.K.Bansal- Fluid Mechanics and Hydraulic Machines-Laxmi Publications.

REFERENCES:

1. Agarwal.S.K.Fluid Mechanics and Machinery-McGraw Hill, 1999
2. Jain.A.K. Fluid Mechanics-Khanna Publishers, 2000
3. D.S.Kumar-Fluid Mechanics and Fluid power Engineering, S.K.Kataria&Sons, 1998
4. Mohanty, Fluid Mechanics, PHI, 2000
5.https://books.google.co.in/.../**Fluid_Mechanics_and_Machinery**.html?id.

BME305	MANUFACTURING TECHNOLOGY-I	L	T	P	C
	Total Contact Hours - 60	4	0	0	3
	Prerequisite – Basic Mechanical Engineering				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students can able to learn different manufacturing process.
CO2	Understand means of component production
CO3	Students will be able to have handsonexperience on machineries
CO4	Understandmetal working concepts
CO5	Learn the theory of metal operationscutting
CO6	Will know how to perform simple lathe

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L					M	M		H	H
	CO2	H	H	L					M	M		H	H
	CO3	H	H						M	M		H	H
	CO4	H	M	L					M	M		H	H
	CO5	M	H	L					M	M		M	M
	CO6	M	H	L					M	M		M	M

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I METAL WORKING PROCESS 9

Mechanical working of metals-hot and cold working-rolling, extrusion, spinning, wire-drawing, press working. Welding - different types of gas and arc welding process, soldering and brazing. Casting-different types, furnaces, casting defects and inspection.

UNIT II THEORY OF METAL CUTTING 8

Introduction, mechanics of metal cutting- chip formation, Merchant's circle theory, cutting force calculations, tool materials, Influence of tool angles, tool life, cutting fluids, machining time calculations, Metal cutting economics, problem in merchant circle, tool life, machining time and economics.

UNIT III MACHINING PROCESSES 10

Lathe- introduction, types, construction, mechanisms and attachments for various operations, nomenclature of single point cutting tool. Capstan and turret lathes: various mechanisms, tool and loading arrangement. Automatic lathes- single spindle and multi spindle mechanisms.

UNIT IV SHAPER, PLANER AND MILLING PROCESS 10

Shaper, planer and slotter : types, specification, mechanisms, holding devices, difference between shaper and planer. Milling machine - types and specification, mechanisms, holding devices, milling operations.Milling tool nomenclature, indexing types-simple, compound and differential.

UNIT V DRILLING, BORING AND BROACHING 8

Drilling, Boring- Specification. Nomenclature of drilling and reaming tool and its specification.Broaching: Specification, types, mechanisms, nomenclature of broaching tool.

Total: 45Periods

Text Books:

1. P.C. Sharma, A text book of production technology, S.Chand & company ltd., New Delhi, 2007.
2. Hajra Chowdary S K The fundamentals of work shop technology Vol. I &II, Media publishers,1997
3. P.N.Rao. Manufacturing Technology-foundry forging &welding TMH publishing co., New Delhi -2009.

References:

1. W.A.J.chapman-work shop technology, vol I,II& III, 1975, ELBS.
2. Roy A Llindberg, Process and material manufacture, PHI, 1995
3. Kalpakjian, manufacturing engineering and technology, Addison Wesley, 2005

BME3L1	MACHINE DRAWING	L	T	P	C
	Total Contact Hours - 60	2	0	2	3
	Prerequisite – ENGINEERING GRAPHICS				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To make the students understand and interpret drawings of machine Componentsso as to prepare assembly drawings.

To familiarize the students with Indian Standards on drawing practices and standard components.

COURSE OUTCOMES (COs)

CO1	Students will get good interpretation of machine components
CO2	Students will understand standardization of drawings .
CO3	Student will understand the Indian and International standard components.
CO4	Student will able create drawings to industrial standard.
CO5	Learn what tolerance and fits and assembly
CO6	Learn the difference between free sketching and machine drawing

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	Cos /POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H			L	L	L	L	L	L	
	CO2	H	M	H			L	L	L	L			
	CO3	H	M	H			L	L	L	L			
	CO4	H	M	H			L	L	L	L			
	CO5	H	M	H			L	L	L	L			
	CO6	H	M	H			L	L	L	L			

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

Indian standard code (BIS) of practice for engineering drawing-General principle of presentation, Conventional representation of threaded parts, Springs, Gear and common features, Abbreviations and symbols use in technical drawings.

Tolerance- Types-Symbols used and representation on the drawing - Fit types, Selection for different application- Allowance, Interchangeability. Surface finish- Relation to the manufacturing processes- Types of representation on the drawing- Welding symbols.

Preparation of working drawing for given machine components:
Bolts, Screws, Studs, Nuts, Keys and Key-ways.

Preparation of simple assembly drawings:
Different types of cotter and knuckle joints.

Preparation of simple assembly drawing for following machine with part drawings given:
Screw jack, Plummer block, Connecting rod, Machine vice, Tail stock of lathe, Tool head of shaper, fuel injection pump for single cylinder engine, Stop valve.

TEXT BOOKS:
1. Gopala Krishnan, Machine Drawing- Subash publishers, 2001.
2. Bhatt, N.D. Machine Drawing- Charotar publishing House, 2000.

REFERENCES:
1. Narayana.K.L. Machine Drawing- New age publisher, 2006.

BCE3L3	**FLUID MECHANICS, MACHINERY& STRENGTH OFMATERIALS**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	0	0	3	2
	Prerequisite – FMM				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To supplement the theoretical knowledge gained in Mechanics of Solids with practical testing for determining the strength of materials under externally applied loads. This would enable the student to have a clear understanding of the design for strength and stiffness

COURSE OUTCOMES (COs)

CO1	Students will understand flow through pipes
CO2	Students will practically understand different flow measuring equipment .
CO3	Student will understand the strength of components and testing methods.
CO4	Student will understand the characteristics of pumps.
CO5	students study the importance of flow analysis
CO6	students learn deflection and stresses

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H			L	L	L	L	L	L	H
	CO2	H	M	H			L	L	L	L			H
	CO3	H	M	H			L	L	L	L			H
	CO4	H	M	H			L	L	L	L			H
	CO5	H	M	H			L	L	L	L			H
	CO6	H	M	H			L	L	L	L			H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS

FLUID MECHANICS LAB

1. Determination of flow through pipes, losses in pipes.
2. Calibration of orificemeter and venture meter
3. Flow through notches and weir
4. Flow through open orifice
5. Buoyancy experiment-Metacentric height
6. Impact of jet on vanes-inclined and curved vanes
7. Verification of Bernoulli's equation

FLUID MACHINERY LAB

1. Performance characteristics of Jet pump
2. Performance characteristics of Vane pump
3. Performance characteristics of Centrifugal pump
4. Performance characteristics of Reciprocating pump
5. Performance characteristics of Gear pump
6. Characteristics of Impulse turbine
7. Characteristics of Reaction turbine

STRENGTH OF MATERIALS LAB

1. Tension test of a mild steel rod
2. Double shear test on mild steel and Aluminum rods
3. Torsion test on mild steel rod
4. Hardness test on metals- Brinell and Rockwell hardness
5. Deflection test on helical springs
6. Deflection test on beams
7. Compression test – bricks
8. Double shear test in U.T.M

BMA 401	NUMERICAL METHODS	L	T	P	C
	Total Contact Hours –75	3	2	0	4
	Prerequisite – Mathematics I, II & III				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To train the students with Mathematical techniques to solve problems in Engineering

COURSE OUTCOMES (COs)

CO1	solves a single equation and a system of linear equations by different methods and get exact solution and iterative solution.
CO2	Interpolate a dependent variable based on a given set of values by a suitable method.
CO3	Find integral value and differential coefficient based on a given set of values.
CO4	Solve initial value problem of ODE and boundary value problems of PDE.
CO5	Will be able to solve eigen value problems

CO6	Understand the application of differentiation and integration in various fields of engineering.

		Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low											
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H			L	L	L	L	L	L	H
	CO2	H	M	H			L	L	L	L			H
	CO3	H	M	M									
	CO4	H	M	H			L	L	L	L			
	CO5	H	M	H									H
	CO6	H	M	H			L	L	L	L			H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT-1 : SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS 9+6

Iterative method, Newton–Raphson methods for single variable- Solutions of linear system by Gaussian, Gauss-Jordan, Jacobian and Gauss-Siedel methods, Inverse of Matrix by Gauss Jordan method, Eigen value of a Matrix power and Jacobian methods.

UNIT-II: INTERPOLATION(FINITE DIFFERENCES) 9+6

Newton's Divided Difference Formula, Lagrange's Interpolation-Forward and Backward Difference Formula-Stirling's and Bessel's Central Difference Formula.

UNIT-III : NUMERICAL DIFFERENTIATION AND INTEGRATION 9+6

Numerical Differentiation with interpolation polynomials, Numerical Integration by Trapezoidal Simpson's(both 1/3 and 3/8)rule, Double integrals using Trapezoidal and Simpson's rule.

UNIT-IV: INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+6

Single Step methods, Taylors Series, Euler and Modified Euler, Runge-Kutta methods of first and second order Differential equations, Multi Step methods, Milne and Adam's-Bashforth predictor and corrector method.

UNIT-V: BOUNDARY VALUE PROBLEMS FOR ODE AND PDE 9+6

Finite difference for the second order Ordinary Differential Equations, Finite Difference solutions for one dimensional heat equations(both Implicit and Explicit), One Dimensional wave equation, Two Dimensional, Laplace and Poisson Equation.

TEXT BOOKS:

1. Sastry.SS "Introductory Numerical Methods" PHI, 2010
2. Jain K.K. Iyengar, S.R.K and Jain, R.K. "Numerical Methods for Scientific and Engineering Computation" 3rd edition, New Age International Publications and Co. 1993.

REFERENCES:

1. Grewal, B.S. "Higher Engineering Mathematics (36th edition)" Khanna Publication Delhi 2001.
2. M.K. Venkatraman, " Numerical Methods", NPC, Chennai.
3. Curtis F.Gerald. "Applied Numerical Analysis" 7th Edn. Pearson Education, Chennai-600113. 2007
4. Dennis G.Zill and Warren S.Wright. "Advanced Engineering Mathematics". 3rd Edn. Jones & Bartlett Publishers, UK. 1992.

BME401	**DYNAMICS OF MACHINES**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Mathematics I & II				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To understand the method of static force analysis and dynamic force analysis of mechanisms
- To study the undesirable effects of unbalances in rotors and engines.

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the Students can able to predict the force analysis in Mechanisms
CO2	Learn about the mechanical system and related vibration issues.
CO3	Can be able to solve mechanical system problem.
CO4	Understand static and dynamic balancing
CO5	Understand the application of degrees of freedom and vibrations
CO6	Understand critical speed of shafts

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H			L	L	L	L	L	L	H
	CO2	H	M	H			L	L	L	L			H
	CO3	H	M	M									
	CO4	H	M	H			L	L	L	L			
	CO5	H	M	H									H
	CO6	H	M	H			L	L	L	L			H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I FORCE ANALYSIS OF MECHANISMS 12

Static, Inertia and combined force analysis- Graphical and analytical method- Slider crank mechanism and four bar mechanism. Turning moment diagram and flywheel-Applications in engine, Punching presses.

UNIT II BALANCING 12

Static and dynamic balancing-Balancing of rotating masses- Balancing of several masses in different planes.Primary and secondary unbalanced forces of reciprocating parts-Balancing of in line engines- Firing order- Balancing of 'V' and 'W' engines.

UNIT III FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS 12

Fundamentals of vibrations-Undamped free vibrations of single d.o.f systems–Derivation & solution of differential equation-Torsional Vibrations-single rotor- Equivalent stiffness of spring combinations-Bifilar, Trifilar suspensions-Compound pendulum-Types of damping-Damped free vibrations of single d.o.f-over, critical, under damped- Damping coefficient - Critical damping coefficient-Logarithmic decrement

UNIT IV FORCED VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS12

Forced vibrations with-Constant harmonic excitation-Rotating & Reciprocating unbalance-Excitation of the support-Energy dissipated by damping-Forced vibrations with coulomb, viscous damping-Vibration Isolation and Transmissibility- Vibration Absorbers

UNIT V CRITICAL SPEEDS AND SHAFTS WITH ROTORS 12

Lateral vibration of beams - Whirling speed of shaft - Shafts with two & three rotors-Geared system. Dunkerly's method for different types of beams & shaft with several loads.

TEXT BOOKS:

1. R.S.Khurmi-Theory of Machines-S.Chand Publications.
2. S.S.Rattan-Theory of Machines- Tata McGraw Hill, 2005.

REFERENCES:

1. Rao.J.S. and Dukkipatti, Mechanism and Machines Theory, 2nd Edition-Wiley Eastern Ltd, 1992.
2. Groover.G.K. Mechanical Vibrations- Nemchand & Bros., 2001.
3. Singh.V.P. Mechanical Vibrations-Dhanpatrai & co (p) Ltd, 2005.
4. royalmechanicalbuzz.blogspot.com/.../theory-of-**machines**-by-rs-khurmi...

BME402	THERMAL ENGINEERING - I	L	T	P	C
	Total Contact Hours - 60	4	0	0	4
	Prerequisite : Thermodynamics				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To integrate the concepts, laws and methodologies from the first course in thermo dynamics into analysis of cyclic processes
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam Turbines, Compressors and Refrigeration and Air conditioning systems

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students can able to apply the different gas power cycles
CO2	Use of them in IC and R&AC applications.
CO3	Study of steam nozzles
CO4	Study of vapour power cycles
CO5	Study of rankine power cycles and its application
CO6	Understand the concept of refrigeration and its application

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H			L	L	L	L	L	L	H
	CO2	H	M	H			L	L	L	L			H
	CO3	H	M	M									
	CO4	H	M	H			L	L	L	L			
	CO5	H	M	H									H
	CO6	H	M	H			L	L	L	L			H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I STEAM NOZZLES 12

Flow of steam through nozzles, Shape of nozzles, Effect of friction, Critical pressure ratio, Super saturated flow

UNIT II STEAM TURBINES 12

Working principles, Simple impulse(De laval) turbine, Reaction turbine, velocity and pressure

compounded turbines, Height of blades of turbines, multi stage turbine, Radial flow turbines, Governing of steam turbines(Derivations not included)

UNIT III AIR POWER CYCLES 12

Construction & working of 2 stroke and 4 stroke engines, Otto, Diesel and dual cycles-air standard efficiency, Mean effective pressure and power, Brayton with reheat, intercooling and regeneration, Erricson, Stirling, Atkinson cycles.

UNIT IV VAPOUR POWER AND COMBINED CYCLES 12

Rankine, Modified Rankine, Reheat, Regeneration cycles, Binary vapour power cycles, Cogeneration principles & Applications.

UNIT V REFRIGERATION CYCLES 12

Air refrigeration cycles, Vapour compression refrigeration cycle, sub cooling and superheating cycles, vapour absorption cycles.

TEXT BOOKS:

1. R.K.Rajput, Thermal Engineering, Dhanpat Rai publishers, 2008
2. S.Domkundwar-Thermal Engineering-Dhanpat Rai publishers,2000

REFERENCES:

1. P.K.Nag, Basic & Applied Thermodynamics-Tata McGraw Hill, 2002
2. Yunus A.Cengel-Thermodynamics-International Edition, 2006.
3. engg-ebook.blogspot.in › ... › r k rajput › sem 4 › thermal engineering

BME403	**INDUSTRIAL METALLURGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Manufacturing Technology				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students will be able to differentiate materials, their processing, heat treatments in suitable application of mechanical engineering field.
CO2	Student gain knowledge in selecting materials
CO3	Understand mechanical properties of materials
CO4	Understand crystallography techniques
CO5	Learn surface engineering techniques
CO6	Understand fracture and learn to get rid of it.

	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L					M	M		H	H
	CO2	H	H	L					M	M		H	H
	CO3	H	H						M	M		H	H
	CO4	H	M	L					M	M		H	H
	CO5	M	H	L					M	M		M	M
	CO6	M	H	L					M	M		M	M

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I CRYSTALLOGRAPHY 9

Structure of metals and alloys – Molecules and bonding – Crystal structure inter atomic distance and ionic radii, polymorphism, Miller indices of atomic planes, Bragg's law, crystal defects – point, line and plane defects – Effect of crystal imperfection on mechanical properties- strengthening mechanism for improvement of mechanical properties – Allotropy, grain and grain boundaries – problems.

UNIT II MECHANICAL PROPERTIES AND ELASTIC DEFORMATION 9

Mechanical properties: Stress strain curve- elastic deformation – characteristics of elastic deformation – Atomic mechanism of elastic deformation – elastic deformation of an isotropic material – Modulus of elastic resilience. **Elastic deformation:** strain time curves – Damping capacity – viscous deformation – Plastic deformation – Dislocation and stress – strain curves, Schmid's law. Critical resolved shear stress, Work hardening, Grain boundary hardening, solution hardening, Dispersion hardening.

UNIT III FRACTURE AND ITS PREVENTION 9

Mechanism of brittle fracture – ideal fracture stress (Griffith's theory) – Ductile fracture- Difference between brittle and ductile fracture – fracture toughness – Cup and cone type of fracture – fatigue failure and its prevention – Creep – various stages in creep curve – factors affecting creep resistant materials – Mechanism of creep fracture.

UNIT IV METALLURGY, FERROUS AND NON FERROUS ALLOYS 9

Metallurgy: Solid solution – Intermetallic compound – Cooling curves – Non equilibrium – Phase rule – Interpretation of equilibrium diagram of Cu-Ni, Cu –Zn, Cu – Sn, Cu –Al.

Ferrous alloys: Phase diagram and its significance – Allotropy and phase change of pure iron – steel and cast iron classifications – Equilibrium diagram for iron –Carbon, Microstructure representation for iron and steel – Application of ferrous alloys – Factors affecting mechanical properties. **Heat treatment:** Definition – annealing and normalizing. Types of annealing.TTT

diagram – cooling curves superimposed on I.T. diagram. Hardenability, Jominy end quench test, Austempering, mar tempering.

UNIT V SURFACE ENGINEERING 9

Surface heat treatment – Diffusion methods – Carburizing – Nitriding – Cyaniding and carbonitriding – Applications – Thermal methods – flame hardening – induction hardening and their applications – Laser surface hardening–Vickers's Hardness test.

TEXT BOOKS:

1. G.E.Dieter, Mechanical Metallurgy, McGraw Hill ISE, 1999.
2. Raghavan, Material Science and Engineering, Prentice Hall of India Pvt. Ltd., 2004.

REFERENCES:

1. D.Callister-Material Science And Engineering.
2. Arumugam, M.Material Science, Anuradha Publishers, 1997.
3. R.A.Flinn & P.K.Trojan, Engineering Materials and their Applications
4. Rajan, T.V. Sharma and Ashok Sharma, Heat Treatment – Principles and their techniques, Prentice Hall of India Pvt. Ltd., 2004.
5. www.studynama.com/.../315-Engineering-materials-**metallurgy**-lecture-n...

BME 404	**ENGINEERING METROLOGY ANDINSTRUMENTATION**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	3	0	0	3
	Prerequisite – Manufacturing Technology I				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the Students can demonstrate different measurement techniques
CO2	Learn form measurement
CO3	Use of different measuring methods in Industrial environment.
CO4	Understand the application of LASER in measurement
CO5	Student will know the advance measuring methods
CO6	Understand principles of Laser

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1						L						
	CO2		H							L			L

	CO3				H								
	CO4						H			M		M	
	CO5									H		M	
	CO6									M		H	
3	Category	Humanities and Social studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)		Open Elective (OE)	Project/ Seminar/ Internship (PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I INTRODUCTION TO MEASUREMENTS – LINEAR, ANGULAR 9

Basic concepts of measurement–need of measurement–precision and accuracy –Reliability–Errors in measurement–causes–types, Engineering component measurements – comparators – mechanical & pneumatic–Limit gauges – slip gauges – Sine bar – dial gauge – Rollers – Design – Applications – Angle dekkor – Auto collimator – Alignment telescope.

UNIT II FORM MEASUREMENT AND LASER IN METROLOGY 9

Form measurement – Measurement of tooth thickness – gear tooth vernier – Surface finish measurement – radius measurement – flatness and roundness measurement – Screw thread and gear Measurement.

Laser Metrology: Precision instrument based on laser – Principle – Application of laser –Laser interferometer – Applications in linear measurement and angular measurement – Application in testing of machine tools by Laser interferometer.

UNIT III RECENT ADVANCEMENT AND DEVELOPMENT METROLOGY 9

Coordinate Measuring Machine – constructional features – types – Applications of CMM – CNC. CMM applications – Inspection by computer aided – machine vision – Applications in Metrology.

UNIT IV MECHANICAL INSTRUMENTATION AND INSTRUMENTS 9

Generalized measurement system and its functional elements, primary, secondary and working standards. Instrument characteristics, static and dynamic characteristics classification – zero, first and second order instruments and responses, problems. Sensors and transducers – mechanical detector – transducer elements, electrical transducers – Thermoelectric transducer – variable inductance transducers – capacitor transducers – preamplifiers – charge amplifiers – Piezo electric transducers – strain gauges – bridge circuits (quarter, half and full activated), sensitivity – filters – attenuators – D'arsonval – CRO – Oscillographs – recorders – microprocessor based data logging.

UNIT V MEASUREMENT SYSTEMS 9

Force measurement – Torque measurement – Pressure measurement – Flow measurement – Temperature measurement – Vibration Measurement.

TEXT BOOKS:

1. R.K.Jain Engineering Metrology , Khanna Publishers, 2005
2. Kumar D.S Mechanical Measurement and Control – Metropolitan Book company Pvt. Ltd. – 1989

REFERENCES:

1. T.G.Beckwith and N.Lewis Buck, Mechanical Measurements, Addison Wesley, 2001
2. Sirohi, R.S. and Radhakrishnan, H.C.Mechanical Measurements, New Age, 1994.

BCE406	**ENVIRONMENTAL STUDIES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – Physical Sciences				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To study the nature and facts about environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context
CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		H									
	CO2			H									
	CO3			H									
	CO4								L				
	CO5							M					
	CO6									L			

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015 And 38th meeting of Jan 2016							

UNIT I THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance, Need for public awareness.

Natural Resources : Renewable And Non – Renewable Resources

Natural resources and associated problems

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.
c) Mineral resources : Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing , effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.
f) Land resources : Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 8

Concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-

Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III BIODIVERSITY AND ITS CONSERVATION 7

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega-diversity nation, Hot-spots of biodiversity -Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-

situ and Ex-situ conservation of biodiversity.

Environmental Pollution **7**

Definition, Causes, effects and control measures of ;- Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management : floods earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **8**

From Unsustainable to Sustainable development, Urban problems related to energy, nuclear accident and holocaust, case studies, wasteland reclamation, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection Act, Forest Conservation Act, Issues involved in enforcement of environmental Legislation, public awareness –

Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel –oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes – Noise produced by fire crackers – Noise pollution – Noise level standards for fire crackers – Intensity of sound – Impact on hearing – Safety measures.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **6**

Population growth, variation among nations, population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXTBOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, 1989.
4. Benny Joseph, "Environmental Studies"., TATA McGraw Hill, 2010

REFERENCES

1. Trivedi R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol.I and II, EnviroMedia 2009
2. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Wager K.D. "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.
4. Trivedi R.K. and P.K. Goel, "Introduction to Air Pollution", Techno Science Publications 2013
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB),2001.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p

8. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
9. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publish Co. Pvt. Ltd. 345p.
12. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut.
13. http://eng.mft.info/uploadedfiles/gfiles/c8e31c9e52d84c3.pdf

BEI4L1	CONTROL SYSTEM LABORATORY	L	T	P	C
	Total Contact Hours – 45	0	0	3	2
	Prerequisite – Engg Mathematics-I, Engg Mathematics -III, Circuit Theory and Network Analysis and Synthesis				
	Course Designed by – Dept. of Electronics & Instrumentation Engineering				

OBJECTIVES

- To understand the use of transfer function models for analysis physical systems and introduce the control system components.
- To provide adequate knowledge in the time response of systems and steady state error analysis.
- To accord basic knowledge in obtaining the open loop and closed–loop frequency responses ofSystems.
- To introduce stability analysis and design of compensators
- To introduce state variable representation of physical systems and study the effect of stateFeedback

BME4L1	METROLOGY & METALLURGY LAB	L	T	P	C
	Total Contact Hours –45	0	0	3	2
	Prerequisite – Metrology				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To make the students understand the concept of standardization and interchangeability
To familiarize the students with metallographion structures of different materials .

COURSE OUTCOMES (COs)

CO1	Students will understand the difference between accuracy and precision
CO2	Students will be aware of different measuring equipments .
CO3	Student will have hands on experience in handling a metallurgical microscope .
CO4	Student will understand metallographic structures of different materials.
CO5	Student will understand crystallographic structures of different materials.

CO6	Students will learn to measure the profile of a gear.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H								M			
	CO2											H	L
	CO3									M			
	CO4												L
	CO5												
	CO6					H				M			

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS:

METROLOGY LABORATORY

1. Estimation of accuracy of instruments-vernier and micrometer.
2. Calibration of dial gauge, micrometer and vernier.
3. Measurement of angles using sine bar, bevel protractors, spirit level.
4. Measurement of gear tooth thickness by various methods including profile projector.
5. Measurement of effective diameter, pitch and helix angle of screw threads by profile projector.

METALLURGY LABORATORY

1. Study of metallurgical microscope
2. Preparation of specimen for metallographic observation of white Cast Iron, Grey Cast Iron, Malleable Iron.
3. Preparation of specimen for metallographic observation of Mild Steel, Low CarbonSteel, Medium Carbon Steel, Tool Steel, High speed Steel, and Stainless steel.
4. Preparation of specimen for metallographic observation of Copper-bronze, Copper brass.

	MANUFACTURING TECHNOLOGY LAB – I	**L**	**T**	**P**	**C**
	Total Contact Hours –45	0	0	3	2
BME4L2	Prerequisite – MANUFACTURING TECHNOLOGY				

	Course Designed by – Department of Mechanical Engineering

OBJECTIVES

To make the students understand the concept of standardization and interchangeability
To familiarize the students with metallographion structures of different .

COURSE OUTCOMES (COs)

CO1	Students will understand lathe and its working
CO2	Students will get aware about different tools used in manufacturing .
CO3	Student will understand the concept of tool wear..
CO4	Learn the use of machineries.
CO5	Learn the different methods of manufacturing
CO6	Learn to do force calculations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H								M			
	CO2											H	L
	CO3									M			
	CO4												L
	CO5												
	CO6					H				M			

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS:

1. Study of Centre, Capstan and Automatic lathes and their accessories.
2. Exercise on Plane turning and Step turning
3. Exercise on taper turning and knurling
4. Exercise on Eccentric turning
5. Exercise on thread cutting and grooving
6. Exercise on drilling and reaming
7. Exercise on drilling and boring
8. Determination of cutting forces in turning using tool dynamometer.
9. Determination of tool wear using tool makers microscope.

BME4L3	TECHNICALSEMINAR I	L	T	P	C
	Total Contact Hours –30	0	0	2	1
	Prerequisite – ENGLISH I & II				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To make them master the techniques of professional communication so that they becomeemployable after completing the course.

COURSE OUTCOMES (COs)

CO1	After the completion of the course the students communicate effectively
CO2	Answer interview peer members
CO3	Students can travel abroad
CO4	Adopt good interpersonal skills
CO5	Overcome stage fear
CO6	Develop personality skills

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1								H				
	CO2	H				M			H				
	CO3	H								H	L		L
	CO4					H			H				L
	CO5					M							L
	CO6								H				

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
									√
4	Approval	37th Meeting of Academic Council, May 2015							

During the Seminar session each student is expected to prepare and present a topic on engineering/ technology for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

*Practice for writing of Technical article.

	MACHINE DESIGN - I	L	T	P	C
BME501	Total Contact Hours - 75	3	2	0	4
	Prerequisite – ENGINEERING MECHANICS AND DYNAMICS OF MACHINES				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn & use standard practices and standard data of design parameters.

COURSE OUTCOMES (COs)

CO1	Students will learn to design components
CO2	Students will understand how to select a material
CO3	Students will learn to use the design data book
CO4	Students will learn to obtain an optimum design procedure
CO5	Students will understand various concepts in design
CO6	Students will learn to fabricate/do research using their knowledge attained

UNIT I FUNDAMENTALS 9+6

Design process – Engineering Materials and Mechanical properties – Eccentric loading – Principal stresses – Design criteria – Calculation of permissible stress – Failure theories – Stress Concentration – Design for variable loading –Soderberg, Goodman and Gerberg relations - Introduction to Fracture Mechanics. Introduction to Optimum Design

UNIT II DESIGN OF SHAFTS 9+6

Design of Shafts using fatigue factors – Shafts carrying pulleys gears – overhanging and simply Supported Shafts - Hollow shafts - Design of Axles.

UNIT III DESIGN OF SPRINGS 9+6

Design of tension and compression Helical springs – Springs for Buffers – Springs for impact loads – Concentric springs - Springs in series and parallel connection –Design of Leaf springs – Semi elliptical cantilever type.

UNIT IV DESIGN OF RIVETED & WELDED JOINTS 9+6

Design of riveted joint for a Boiler – Lozenge joint – Design of eccentrically loaded riveted joints – Design of Welded joints.

UNIT V DESIGN OF BOLTED JOINTS & COUPLINGS 9+6

Design of eccentrically loaded bolted joints – Screw fastenings – Gasket joints for cylinders – Design of Rigid couplings, Pin and Bush type flexible couplings, Muff coupling and Clamp coupling.

TEXT BOOKS :

1. Prabhu T.J. – Fundamentals of Machine Design, 2009.

REFERENCES :

1. Bhandari V.B – Design of Machine Elements - TataMcGraw Hill, 2007.
2. Shigley J.E. & Misheka – Mechanical Engineering Design2004 – McGraw Hill,2007.
3. Dobrovolosky, Machine Elements – Mir Publications, 1978.
4. Pandya & Shah – Elements of Machine Design, 2000.
5. Design Data, PSG College of Technology, 2007.
6. www.allexamresults.net/.../download-pdf-textbook-of-**thermal-engineeri**...

BME502	**THERMAL ENGINEERING-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – THERMAL ENGG. I				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To apply the thermodynamic concepts into various thermal application like IC engines, Steam Turbines, Compressors and Refrigeration and Air conditioning systems

COURSE OUTCOMES (COs)

CO1	Learn the fundamental and concepts in IC engines
CO2	Learn refrigeration principles
CO3	Learn to use the steam table and related charts
CO4	Will be able to draw enthalpy diagrams
CO5	Learn various cycles
CO6	Apply their learnt ideas in their field of work

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		M										
	CO3												
	CO4										H	M	
	CO5						L				H		M
	CO6							H			H		

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I I.C. ENGINES 9

S.I.Engines-Simple carburetor- Idling, cruising and power range-MPFI system, Principles of Turbo charging, Ignition systems-Battery ignition and magneto ignition systems-Combustion-detonation factors and remedy – Pollution control norms. C.I Engines-Fuel injection systems, Combustion knocking factors and remedies Rating of fuels, Cooling and lubrication of I.C Engines.

UNIT TESTING OF I.C. ENGINES 9

Indicated power and Brake power, Mean effective pressure, Efficiencies, Morse test, Determination of torque, Brake power and Brake mean effective pressure, Specific fuel consumption, Brake thermal efficiency and different efficiencies, Performance curves and effect of various parameters on the performance of the engine.

UNIT III AIR COMPRESSORS 9

Reciprocating compressor-Multistage compression-Effect of clearance, volumetric efficiency, Rotary compressors, vane type, Root blowers, Screw compressors, Centrifugal compressors.

UNIT IV PRINCIPLES OF GAS DYNAMICS 9

Types of Jet engines, turbojet, ramjet, pulsejet. Aircraft propulsion theories, Parameters affecting flight performance, Thrust Augmentation, Types of Rocket engines.

UNIT V AIR CONDITIONING 9

Introduction to Psychrometry-Psychrometric chart-Psychrometric processes-summer and winter air conditioning, SHF, RSHF, GSHF, ESHF, Simple calculations used in psychrometry, Components used in air conditioners.

TEXT BOOKS:

1. S.C.Somasundaram-Thermal Engineering-New Age International (P) Ltd, 1999.
2. C.P.Arora-Refrigeration & Air conditioning, 2000
3. R.K.Rajput-Engineering Thermodynamics-Laxmi Publications

REFERENCES:

1. Mathur and Mehta, Thermal Engineering-Jain brothers, 1998
2. Ramalingam-Internal combustion engines-SciTech publications, 2003
3. YahyaS.M-Fundamantals of Compressible flow,New Age International(P)NewDelhi, 2008
4. Cohen H, Rogers GFC, Saravanamuttoo HIH, Gas Turbine Theory, Addison Wesley Longman Ltd, 2007
5. www.allexamresults.net/.../download-pdf-textbook-of-**thermal-engineeri**...

BME503	**FLUID POWER SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	3	0	0	3
	Prerequisite – FMM				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To know the advantages and applications of Fluid Power Engineering and Power

Transmission System.

- To learn the Applications of Fluid Power System in automation of Machine Tools and others Equipments.

COURSE OUTCOMES (COs)

CO1	Identify hydraulic and pneumatics components.
CO2	Ability to design hydraulic and pneumatic circuits
CO3	Design hydraulic circuits
CO4	Learn the concepts of pneumatic power and design
CO5	Learn to select materials
CO6	Students will learn to design

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L					M	M		H	H
	CO2	H	H	L					M	M		H	H
	CO3	H	H						M	M		H	H
	CO4	H	M	L					M	M		H	H
	CO5	M	H	L					M	M		M	M
	CO6	M	H	L					M	M		M	M

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT 1: GENERAL INTRODUCTION AND CONTROL SYSTEM COMPONENTS 9

Introduction to Fluid Power, Advantages, Applications –Fluids – Properties of Fluids - Basic Principle of Fluid Power. Hydraulic pumps, Classification Performance, characteristics, pump selection, - Hydraulic Actuators-Linear, Rotary, Selection, and Characteristics. Control system components-Hydraulic valves – Pressure, Flow, and Direction control - Applications

UNIT II :HYDRAULIC CIRCUITS 9

Fluid power symbols - Hydraulic circuits - Location of Flow control valves Regenerative, Synchronizing, Sequencing, Intensifier- Accumulator– Types, Applications

UNIT III: HYDRAULIC CIRCUIT DESIGN 8

Design of Hydraulic circuits - selection of components - Hydraulic circuit for shapers, Surface Grinding machine Vertical milling machine, Forklift ,Hydraulic press, Safety circuits -Automatic reciprocating system, Robot Arm – Hydrostatic Transmission – Power Pack.

UNIT 1V: PNEUMATIC SYSTEMS **10**

Basic concepts and principles of pneumatic circuits, Relative merits and demerits over hydraulic Systems, Pneumatic conditioners – filters, regulators, lubricators, mufflers, Air dryers. Pneumatic actuators, pneumatic circuits, Hydro Pneumatics- Pneumatic logic controls, Electro hydraulic systems – Servo Systems

UNIT V: DESIGN & SELECTION **9**

Design of pneumatic circuits – classic – cascade – step counter – selection criteria for pneumatic components – PLC applications in fluid power control. Installation and Maintenance of Hydraulic and Pneumatic power packs – fault finding – principles of low cost automation, case studies.

TEXT BOOKS:

1. Andrew Parr, Hydraulics And Pneumatics (HB), Jaico Publishing House, 2005
2. R.Srinivasan, Hydraulic and Pneumatic Controls, Second Edition, Vijay Nicole Imprints PVT, 2006.

REFERENCES:

1. Anthony Esposito, Fluid Power with applications – Prentice Hall, 2006
2. Dudleyt A. Pease and John j. Pippenger, Basic Fluid Power, Prentice Hall, 1987.
3. Jamco L.Johnson, Introduction to fluid Power, Eswar Press, 2003.
4. Majumdar S.R,"Pneumatic systems-Principles and Maintenance", Tata McGraw Hill, 1995.
5. www.engineeringstudymaterial.net/**ebook/fluid-power**-with-applications/

BME504	**AUTOMOBILE ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	3	0	0	3
	Prerequisite – MANUFACTURING TECHNOLOGY, MACHINE DESIGN				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

COURSE OUTCOMES (COs)

CO1	Learn vehicle structures
CO2	Students will learn the different types of engines
CO3	Transmission systems will be learnt
CO4	The students will learn about the engine auxiliary systems
CO5	Students will learn to interpret and analyse forces on vehicle structure
CO6	Students learn about suspension systems and steering wheels

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L					M	M		H	H
	CO2	H	H	L					M	M		H	

	CO3								M			H	H
	CO4	H	M	L						M			H
	CO5	M	H						M	M		M	M
	CO6	M	H	L					M	M		M	M

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I VEHICLE STRUCTURE AND ENGINES 9

Vehicle construction – Chassis, frame and body- Engine types-Construction-Operation-Turbo and Supercharger engine. Cylinder arrangements-Performance& balancing-engine locations-engine trouble shooting-Pollution norms-Catalytic converter-Indian &Euro emission standards.

UNIT II TRANSMISSION SYSTEMS 9

Clutches-types & Construction- fluid coupling-types-torque converter-Advantages-gear box-types-advantages-gear ratios-automatic transmissions-propeller shaft-universal joint-slip joint-Differential-rear axle. Brakes -Types-Mechanical, Hydraulic, Pneumatic, Power brake. Details of components.

UNIT III STEERING AND SUSPENSION SYSTEMS 9

Principle of steering-Steering geometry and wheel alignment-Steering linkages- Power steering-Wheel and tyres-Construction-Types and specification-Tyre wear and causes-Front and rear axle, Suspension Systems – Needs and Types-Springs-Torsion bar-Shock Absorber.

UNIT IV ENGINE AUXILLARY SYSTEMS 9

Carburetors-Electronic fuel injection systems-Single and multi points types-Principles of modern electrical systems-battery-Dynamo-Alternator-Starting motor-Lighting and ignition(Battery and Electric systems)-Automobile air conditioning.

UNIT V ALTERNATIVE FUELS 9

Alternative fuels-Hydrogen-Compressed natural gas(CNG)-Liquefied petroleum gas (LPG), Fuel cells, Electric hybrid vehicle.

TEXT BOOKS:

1. Kirpal Singh, Automobile Engineering, Vol 1 and 2 –Standard Publications, 2004.

REFERENCES:

1. R.B.Gupta, Automobile Engineering, Satya Prakashan, 2007.
2. Ganesan. V.”Internal Combustion Engines”,TMH,2003
3. K.K.Ramlingam,”Automobile Engineering”, 2002.
4. https://books.google.co.in/.../A_Text_Book_of_**Automobile_Engineerin**..

BME505	MANUFACTURING TECHNOLOGY-II	L	T	P	C
	Total Contact Hours –45	3	0	0	3
	Prerequisite- MANUFACTURING TECHNOLOGY -I				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching
- To understand the basic concepts of non-traditional machining processes.

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students will be able to understand and compare the functions and applications of different metal cutting tools.
CO2	Learn programming languages using G-Codes and M-codes
CO3	To demonstrate the programming in CNC machining
CO4	Upon completion of this course, the students can able to apply the different metal removing ,finishing and super finishing and for component production
CO5	Learn the basic concepts of NTM.
CO6	Learn surface finishing techniques.

	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M	H			L	L	L	L	L	L	H
	CO2	H	M	H			L	L	L	L			H
	CO3	H	M	M									
	CO4	H	M	H			L	L	L	L			
	CO5	H	M	H									H
	CO6	H	M	H			L	L	L	L			H
3	Category	Humanities and Social studies (HS)		Basic Sciences & Maths (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Seminar/ Internship (PR)	
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

UNIT I SURFACE FINISHING PROCESS 9

Surface finishing processes: grinding process, types of grinding machine, work holding devices, grinding wheels and specification. Mounting and balancing of grinding wheel. Fine finishing processes: honing, super finishing, polishing, buffing, metal spraying, galvanizing and electroplating.

UNIT II GEAR AND GEAR MANUFACTURING 9

Gear milling, gear shaping, gear planning, gear hobbing. Gear broaching for various types of gears. gear stamping process, cold drawing process, rolling process, sintering process, gear finishing-gear shaving, gear grinding, gear lapping, gear honing**.**

UNIT III NON-TRADITIONAL MACHINING PROCESSES 9

Non-traditional machining techniques, classification. Abrasive jet machining, Electrical Discharge machining, E.D wire cutting, Electro chemical machining, Electron Beam Machining, Laser Beam Machining, Ultrasonic Machining – process parameters, process capabilities, application.

UNIT IV HIGH ENERGY RATE FORMING PROCESS (HERF) 9

Explosive forming, Electro hydraulic, Electro magnetic forming, Dynapack machine – process parameters, process capabilities, application**.**

UNIT V PLASTIC MATERIALS AND PROCESSES 9

Types of plastics, types of Moulding, compression Moulding, transfer Moulding, injection Moulding, blow Moulding, film and sheet forming, thermo forming, reinforced plastic, laminated plastics.

TEXT BOOKS:

1. P.C. Sharma, A Text Book of Production Technology, S.Chand & Company Ltd, New Delhi, 2007
2. Hajra Chowdary S.K. The Fundamentals of Work Shop Technology. Vol. I & II, Media Publishers, 1997

REFERENCES:

1. W.A.J.Chapman - Work shop technology, vol I,II& III, 1975, ELBS.
2. Roy.A.Lindberg, Processes and Material Manufacture, PHI, 1995
3. Kalpakjian, Manufacturing Engineering and Technology, Addison Wesley, 2005
3. P.N.Rao. Manufacturing Technology - Foundry Forging & Welding, TMH., New Delhi – 2009.
4. www.studynama.com/.../301-**Manufacturing-Technology**-1-lecture-notes..

BME5L1	**THERMAL LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Thermal Engineering, Thermodynamics				
	Course Designed by – Department of Mechanical Engineering				
OBJECTIVES To practically understand the concepts and working of various thermal application like IC					

engines, Steam Turbines, Compressors and Refrigeration and Air conditioning systems	
COURSE OUTCOMES (COs)	
CO1	Upon completion of this course, the students can able to understand the fundamentals in every area of thermal engineering.
CO2	Will understand the concepts in thermal engineering lab
CO3	Will understand the working principle of airconditioning
CO4	Will understand the wam turbinesorking of ste
CO5	Will understand the concept and working of compressors
CO6	Will understand the working principle of IC Engines

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		H										
	CO3									H			
	CO4										L		
	CO5				M							L	
	CO6							M					L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS:

1. Flash and Fire point of liquid fuel
2. Determination of viscosity using Saybolt and Redwood viscometer
3. Flue gas analysis using Orsat apparatus
4. Performance characteristics of a Air blower
5. Valve timing diagram of a four stroke engine, Port timing diagram of a two stroke engine
6. Determination of mechanical efficiency of four stroke diesel engine
7. Determination of mechanical efficiency of two stroke petrol engine
8. Heat balance test on a four stroke diesel engine
9. Heat balance test on a four stroke petrol engine
10. Determination of optimum cooling water rate on a single cylinder diesel engine
11. Performance test on a multi cylinder petrol engine- Morse test
12. Test on Air compressor
13. Performance test on a Refrigeration plant
14. Performance test on A/C plant
15. Performance test of Cooling tower

BME5L2	MANUFACTURING TECHNOLOGY LAB-II	L	T	P	C
	Total Contact Hours –45	0	0	3	2
	Prerequisite – Manufacturing technology I & II				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To expose students in understanding various metal cutting operations and commonly used machine tools.

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students can able to understand and compare the functions and applications of different metal cutting tools
CO2	Learn operations in metal cutting processes.
CO3	To demonstrate the programming in CNC machining
CO4	Upon completion of this course, the students can able to apply the different metal removing ,finishing and super finishing and for component production
CO5	Learn various cutting tool operations using CNC machines.
CO6	Upon completion of this course, the students can able to understand and compare the

		Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low											
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		H										
	CO3									H			
	CO4										L		
	CO5				M							L	
	CO6							M					L
3	Category	Humanities and Social studies (HS)		Basic Sciences & Maths (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/ Seminar/ Internship (PR)
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS:

1. Shaper Exercise : Making a square from a round rod

2. Exercise on dovetail cutting
3. Exercise on Plane milling.
4. Exercise on Spur Gear Milling
5. Exercise on Helical Gear Milling
6. Grinding a single point cutting tool in tool and cutter grinder.
7. Slotting and key way cutting in vertical slotting machine.
8. Determination of cutting forces in Milling and drilling using dynamometers

BME5L3	**INSTRUMENTATION AND DYNAMICS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	0	0	3	2
	Prerequisite – Metrology and Instrumentation				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To supplement the principles learnt in kinematics and Dynamics of Machinery
- To understand how certain measuring devices are used for dynamic testing.

COURSE OUTCOMES (COs)

CO1	Students will gain knowledge in kinematics and Dynamics of Machinery
CO2	Students will understand how certain measuring devices are used for dynamic testing.
CO3	Students will gain knowledge regarding various types of forces and reactions.
CO4	Students will understand the concepts of vibration
CO5	Students will learn balancing of rotors students learn how to use a tachometer
CO6	Students gain hands on experience in the use of instruments

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		H										
	CO3									H			
	CO4										L		
	CO5				M							L	
	CO6							M					L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

LIST OF EXPERIMENTS:

INSTRUMENTATION LAB

1. Pressure measuring device calibrations
2. Force measurement load cell, providing ring
3. Temperature measuring devices: Thermocouple, Platinum resistance thermometer.
4. Speed measurement: Tachometer & Stroboscope
5. Torque measurement
6. Flow measurement: Orifice meter, Rotometer.
7. Vibration measurement.

DYNAMICS LAB

1. Kinematics of four bar mechanism – Slider crank chain, Quick return mechanism.
2. Kinematics of gear trains – Simple, Compound, Epicyclic
3. Determination of M.O.I by using connecting rod and flywheel
4. Governors – Watt, Porter
5. Study of cam profile
6. Motorized gyroscope and verification of losses
7. To determine the stiffness and natural frequency of spring-mass-system- single
8. D.O.F and verification of spring laws.
9. Determination of M.O.I using compound pendulum.
10. Determination of stiffness and natural frequency of single rotor and two rotor shafts.
11. Determination of critical speed of shaft with concentrated loads- Whirling of shafts.
12. Balancing of rotors.

	COMPREHENSION I	**L**	**T**	**P**	**C**
BME8C1	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses up to fifth semester				
	Course Designed by – Dept. Mechanical Engineering				

OBJECTIVES

- To provide a complete review of Mechanical Engineering topics covered up to fifth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to fifth semester.

In comprehension, the knowledge acquired by the students in the earlier semesters, is tested. The student is prepared to face competitive examinations. There will be tests involving objective type and oral viva Voce at the end of V semester..

BME601	MACHINE DESIGN II	L	T	P	C
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Machine design I				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To gain knowledge on the principles and procedure for the design of power Transmission components.
- To understand the standard procedure available for Design of Transmission sip terms

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students can able to successfully design components for a system
CO2	Design gears
CO3	Understand bearings and design
CO4	Understand belt drives and chain drives
CO5	Understand the principle behind design
CO6	Learn calculation of speed reduction , kinematic and ray diagrams

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L					M	M		H	H
	CO2	H	H	L					M	M		H	H
	CO3	H	H						M	M		H	H
	CO4	H	M	L					M	M		H	H
	CO5	M	H	L					M	M		M	M
	CO6	M	H	L					M	M		M	M

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I BEARINGS 12

Design of sliding contact bearings using Somerfield number - Selection of rolling contact bearings for radial and axial load combination and for varying load cycles.

UNIT II BELTS AND CHAINS 12

Design of flat belts and V – belts using manufacturer's data – Design of chain drives using manufacturer's data –PSG.

UNIT III SPUR AND HELICAL GEARS 12

Design of spur and helical gears – Russian Design Procedure (PSG Design Data Book / Design of Transmission Elements – T.J. Prabhu)

UNIT IV BEVEL, WORM GEARS, POWER SCREW 12

Design of bevel and worm gears – Design of Power screws for machine tool application. Russian Design Procedure (PSG Design Data Book / Design of Transmission Elements – T.J. Prabhu)

UNIT V MULTI SPEED GEAR BOXES 12

Design of speed reducers. (Not for Examination)

Design of Multispeed Gear boxes for machine tools - Ray Diagrams, Kinematic diagram and Number of teeth calculation for gears.

TEXT BOOKS :

1. Prabhu T.J. Design of Transmission Elements, 2008.

REFERENCES :

1. Shigley, Mechanical Engineering Design – Tata McGrawHill,2004.
2. Dobrovolosky, Machine Elements – Mir Publications, 1978.
3. Pandya & Shah – Elements of Machine Design, 2000.
4. www.faadooengineers.com/.../26687-**Machine-design**-by-shigley-**ebook**-

BME602	**FINITE ELEMENT ANALYSIS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Numerical Methods				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To introduce the concepts of Mathematical Modeling of Engineering Problems.
To appreciate the use of FEM to a range of Engineering Problems

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students can able to understand different mathematical Techniques used in FEM analysis and
CO2	Understand the concepts of Nodes and elements
CO3	Understand use of FEA in Structural and thermal problem
CO4	Understand the application of FEA in heat transfer problem
CO5	Learn how to do analysis learn the various concepts and types of analysis
CO6	Learn finite element modeling techniques.

	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M					M			M		
	CO2	H							L		M		
	CO3	H							L		M		L
	CO4											L	
	CO5							M					
	CO6					M							L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I AN INTRODUCTION TO FINITE ELEMENT METHODS 12

Field problems – Elementary treatments – Elements and types – Steady state problems – Propagation problems – Eigen value problems – Differential formulation – Weighted residual Method- Galarkin Approach – Variational methods – Convergence criteria.

UNIT II BAR ELEMENTS 12

Bar element – Mechanical and Thermal loads – Shape functions – Lagrange's Interpolation – Temperature effects and strain distributions.

UNIT III HEAT TRANSFER IN FE 12

Heat Transfer-Conduction, Convection, Radiation, Elasticity concepts – Plane stress and Plane strain - Euler - Bernoulli Beam Elements – Trusses and Frames.

UNIT IV GAUSS QUADRATURE METHODS 12

Node numbering – Natural co-ordinates – Isoparametric formulation – Gauss quadrature – Choice of quadrature rule – Gauss Point.

UNIT V COMPUTERIZED FEA 12

Computerized FEA – Preprocessing –Element types - Mesh generation – Solution – Post processing – Procedures of Case studies.

TEXT BOOKS:

1. J.N.Reddy – An introduction to Finite Element Method – McGraw Hill, 2007.
2. S.Senthil- An introduction to Finite Element Analysis – Laxmi Publications.

REFERENCES :

1. K.J.Bathe – Finite Element Procedure – Prentice Hall of India, 1996.
2. O.C.Zienkiewicz–The Finite Element Method in Engineering Science, McGrawHill, 2000.

5. T.R.Chandraputla , A.D.Belegundu – Introduction to Finite Elements in Engineering – Prentice Hall of India, 2002.
6. S.S.Bhavikati – Finite Element Analysis, New Age International Publishers.
7. https://www.amazon.in/...**FINITE-ELEMENT-ANALYSIS**...**ebook**/.../B0

BME603	**HEAT AND MASS TRANSFER**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Thermal Engineering-II				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To understand the mechanisms of heat transfer under steady and transient conditions.
- To understand the concepts of heat transfer through extended surfaces.
- To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer. (Use of standard HMT data book permitted)

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students can able to understand different heat and mass transfer principles
CO2	Understand the principles of conduction
CO3	Understand the principles of convection
CO4	Understand the applications for the welfare of the people
CO5	Learn the design concepts in heat and mass transfer
CO6	Learn steady state and unsteady state of systems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M					M			M		
	CO2	H							L		M		
	CO3	H							L		M		L
	CO4											L	
	CO5							M					
	CO6					M							L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I STEADY STATE HEAT CONDUCTION 12

Fourier law of conduction, general equation in Cartesian, cylindrical and spherical co-ordinates, One dimensional steady state conduction across plane wall-Composite wall-composite cylinder-composite sphere with convection boundaries, Overall heat transfer co-efficients, critical thickness of insulation, conduction with generation, conduction and convection systems-fins with direct boundary conditions(Derivations not included)

UNIT II UNSTEADY STATE HEAT CONDUCTION 12

Unsteady state conduction-Lumped capacity systems, semi-infinite solids, infinite solids and multi dimensional systems, Numerical solution of 2-dimensional steady and unsteady condition

UNIT III CONVECTION 12

Principles and governing equations, Natural convection from vertical, inclined and horizontal surface, Forced convection-Heat transfer from a flat plate, flow through pipes, condensation and boiling processes-Heat exchangers-Type of heat exchangers-Overall heat transfer co-efficient, LMTD & NTU methods, Fouling factor

UNIT IV RADIATION 12

Black body concept, Grey body, Radiation shape factor, relation between shape factors, radiation heat transfer between two surfaces, Radiation shields, Gas radiation,Solar radiation

UNIT V MASS TRANSFER 12

Fick's law of diffusion, Stefan's law, Mass transfer co-efficient, Non-dimensional number used in mass transfer, evaporation process in the atmosphere.

TEXT BOOKS:

1. Sachdeva.R.C-Fundamentals of Heat&Mass Transfer-NewAgeInternational(P)Ltd, 2003

REFERENCES:

1. OzisikN.M-heat transfer-McGraw hill Book Company, 1985
2. Holman.J.P-heat transfer –McGraw hill Book Company, 2002
3. Dr.D.S.Kumar,Heat and Mass Transfer,S.K.Kataria& sons,2003
4. P.K.Nag, Heat transfer, McGraw Hill Book Company,2002.
5. **book**boon.com/en/momentum-**heat-and-mass-transfer-ebook**

BME604	**CAD/CAM**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Manufacturing Technology-I				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

This course will enable the student To gain knowledge about the basic fundamentals of CAD.

COURSE OUTCOMES (COs)

CO1	To gain knowledge on how computers are integrated at various levels of planning and manufacturing understand computer aided planning and control and computer monitoring.

CO2	Understand the concepts of CAD/CAM
CO3	Understand writing programs
CO4	Understand to give command
CO5	Learn to draw 2D drawings
CO6	Learn to do 3D modeling

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H							M			L
	CO2												
	CO3			H			H	M	M				L
	CO4				H						M	M	L
	CO5												
	CO6												L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION TO CAD AND ITS ELEMENTS 9

Principles of Computer hardware, Software and Operating System, application Programs, Data Handling and File Structures, Computer aid in Phases of design- Development of Design Database using CAD Systems- Conceptual Design Process Analysis Optimization- Detailed Design and Documentation.

UNIT II ELEMENTS OF CAD SYSTEMS AND DESIGN USING COMPUTERS9

Elements of CAD Systems, Introduction to Graphic Hardware, Software, Details of 2D Software Packages-Layering, Drawing Primitives, Display Techniques, Editing, utilities, Scaling, Dimensioning, 3D Visualization,Geometric Modeling-Wireframe and Solid models.

UNIT III DESIGN USING COMPUTERS 9

Design of Gears, Couplings, Flywheels, Shafts Connecting Rods etc. Software for Vibration Problems- Stress Analysis, Kinematic Analysis, Dynamic Analysis.

UNIT IV COMPUTER AIDED MANUFACTURING 9

Numerical Control- Modes- NC Elements- NC Machine Tools- CNC Machines- CNC Hardware Basics- CNC Tooling- CNC Machine Tools and Control System- Part Programming- Manual and Computer Aided- Turning Center Programming- Advanced Part Programming- Direct Numerical Control- Adaptive Control- Computer Aided Part Programming, APT. Introduction to

Robotics, Group Technology, Computer Aided Process Planning, FMS.

UNIT V COMPUTER INTEGRATED MANUFACTURING 9

CIM as a Concept and a Technology- CASA/SME Model of CIM-Benefits- Communication Matrix in CIM- Fundamentals of Computer Communication n CIM, CIM Data Transmission Method, Serial , parallel, asynchronous, modulation, Demodulation, Simplex and Duplex- Types of Communications in CIM- Point to Point, Star and Multiplexing- CIM for Batch Production- Group Technology – FMS- Process Control in CIM- Characteristics of Manufacturing Process Data- Continuous, Analog, Discrete Binary and Pulse Data- ADC/DC Multiplexers, Process Monitoring Through Computer- Types of Computer Process Control- Preplanned, Direct Digital Control (DDC)- Regular Control and Feed Forward Control, Requirements of Control Programming Interrupt, Real Time Clock Input.

TEXT BOOKS:

1. Radhakrishnan P. CAD/CAM/CIM, I Edition, New central Book Agency, 2006.

REFERENCES:

1. Rao P.N. CAD/CAM, Principles and Application, Tata McGraw Hill, 2005.
2. Mikell P.Groover, Automation, Production Systems and CIM, II Edition, Prentice Hall of India,2001.
3. Chris McMahon and Jimmy Browne, CAD/CAM, Pearson Education, 2001.
4. sbmpme.blogspot.com/2011/01/**cad-cam**-cim-p-radhakrishnan.html

BSS601	**VALUE EDUCATION AND PROFESSIONAL ETHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
- To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)

CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing
CO4	To learn more of Engineer as Responsible Experimenter.
CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To learn more of Responsibilities and Rights as Professional and facing Global Challenges

	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (GOE	Project/ Seminar/ Internship (PR)
		√							
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I : PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II : SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE) 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People's Responsibility / duties of the community, World peace.

UNIT III: MIND CULTURE & TENDING PERSONAL HEALTH 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelising the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV: ENGINEERING AS SOCIAL EXPERIMENTATION ANDENGINEERS'S RESPONSIBILITIES FOR SAFETY 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Challenger, case study. Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies.

UNIT V: ENGINEERS'S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership

TEXT BOOKS:

1. Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata McGraw Hill, Newyork 2005 (Units IV & V)

REFERENCES:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004 (for Units IV-V).
5. ww.apjce.org/files/APJCE_12_3_205_216.**pdf**

BME6L1	**HEAT TRANSFER LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	0	0	3	2
	Prerequisite – Thermal lab				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES: To make the students to understand heat transfer characteristics materials and equipment.

COURSE OUTCOMES (COs)

CO1	To understand the mechanisms of heat transfer under steady and transient conditions.
CO2	To understand the concepts of heat transfer through extended surfaces.
CO3	To learn the thermal analysis and sizing of heat exchangers and to understand the basic
CO4	**T**he students can able to understand different heat transfer equipments
CO5	Apply different heat and mass transfer principles of different applications.
CO6	Will practically know about wind tunnel

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H							M			L	
	CO2	H							M			L	
	CO3			H	H	H						L	
	CO4					M						L	L
	CO5					M							L
	CO6						M	M	M				L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS:

1. Thermal conductivity of insulating materials
2. Thermal conductivity of guarded hot plate method
3. Heat transfer through composite wall
4. Heat transfer by free and forced convection
5. Test on heat exchangers- parallel and counter flow
6. Emissivity measurement apparatus
7. Heat transfer from fins-natural and forced convection
8. Stefan-Boltzman apparatus
9. Test on Pinfin apparatus
10. Study on Wind tunnel- Drag and lift measurement

BME6L2	**CAD/CAM Laboratory**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	0	0	3	2
	Prerequisite – CAD /CAM/CIM				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

This course will enable the student To gain knowledge about the basic fundamental of CAD and CAM

COURSE OUTCOMES (COs)

CO1	Understand the benefits of computer aided design
CO2	Knowledge of CNC.
CO3	Understand the computer aided manufacturing of machine elements.
CO4	**Students learn 2D modeling**
CO5	Students learn modeling 3d Drawings
CO6	Students learn writing commands

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H							M			L	

	CO2	H							M			L	
	CO3			H	H	H						L	
	CO4					M						L	L
	CO5					M							L
	CO6						M	M	M				L
3	Category	Humanities and Social studies (HS)		Basic Sciences & Maths (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/ Seminar/ Internship (PR)	
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

CAD Introduction to Computer Aided Drawing

2-D DRAWING Orthographic Views, Isometric Views, 2D Sectional Views, Part Drawing, Assembly Drawing, Detailed Drawing. Dimensioning, Annotations, Symbols, Welding, Surface finish, Threads, Text, Bill of Materials. Exercise- Knuckle Joint, Gib and Jotter Joint, Screw Jack, Foot Step Bearing.

3-D DRAWING Part Modeling- Protrusion, Cut, Sweep, Draft and Loft- Modify/Edit-Pattern-Transformation, Boolean operation. Assembly- Creating Assembly from Parts, Modify/Edit-Pattern Conversion of 3D Solid Model to 2D Model. Surface Modeling- Tabulated, Revolve, Ruled and Edge Surfaces. Exercise- Piston, Connecting Rod, Knuckle Joint, Universal Joint, Couplings.

CAM LAB

1. Manual Part programming for CNC machines Using standard G – Codes and M- codes. Simulation of Tool path – Machining Practices on Trainer type CNC Machines – Straight cut, Taper turning, Profile, Parting, Thread cutting.
2. CNC Milling Machine: Production of Various Contour shapes
3. Computer assisted part programming – APT programming Language – Part programming using APT and other NC programming Languages.
4. Introduction to Component Modeling
5. NC code generation using CAD / CAM software – Post processing for standard CNC controls like FANUC, SINUMERIC etc.,

	TECHNICAL SEMINAR – II	**L**	**T**	**P**	**C**
ME6L3	Total Contact Hours –30	0	0	2	1
	Prerequisite – Technical seminar I				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To make them master the techniques of professional communication so that they becomeemployable after completing the course.

COURSE OUTCOMES (COs)

CO1	After the completion of the course the students can communicate without any inferior complex
CO2	They can answer the questions asked in the campus interview without any difficulty
CO3	They very well can manage the abroad job situations.
CO4	They will become effective communicators once the course is completed.
CO5	They learn to overcome stage fear
CO6	Students learn to develop their personality skills

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H							M			L	
	CO2	H						H	M			L	H
	CO3			H	H	H		H				L	
	CO4					M		H				L	H
	CO5					M							H
	CO6						M	H	M				H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

During the Seminar session each student is expected to prepare and present a topic on engineering/ technology, for a duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

Need to Present paper.

	INDUSTRIAL ENGINEERING	**L**	**T**	**P**	**C**

BME701	Total Contact Hours –45	3	0	0	3
	Prerequisite – Manufacturing Engg.,				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES: To impart knowledge in undertaking market research, demand forecasting and costing for designing plant, operation, production, maintaining standards of professional ethics.

COURSE OUTCOMES (COs)

CO1	Market research, demand forecasting and costing.
CO2	Demonstrate the knowledge of designing plants and controlling Production.
CO3	Optimize the resources of an organization and improve productivity.
CO4	A systematic understanding of design, improvement and installation of integrated systems of people, materials, money, equipment and energy.
CO5	Learn types of production
CO6	Maintain high standards of professional and ethical responsibility

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1			H	H								
	CO2				H					H			H
	CO3	L						H					H
	CO4		L					H		M			H
	CO5												H
	CO6									M			H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I PRODUCTION AND PRODUCTIVITY 9

Definitions-Productivity, Effectiveness, and Types-Factors Influencing Productivity-Techniques To Improve Productivity, Technology Based Techniques and material Based Productivity Improvement-Inventory Control-M.R.P-Quality Circles-Brainstorming-Pareto Analysis-Cause And Effect Analysis-TQM-Zero Defects-Flextime-Just In Time-Ergonomics-Reliability Improvement-Modular Design-Maintainability**.**

UNIT II PLANT LAYOUT /LOADING AND SCHEDULING 9

Types of Layout, Its Advantages and Disadvantages-Preference of Different Types of Layout, Plant Location and Decision-Definitions: Group Technology-Principles of Material Handling. Loading- Master Scheduling- Perpetual Loading-Order Scheduling-Loading By Scheduled

Method-Index Method Of Scheduling-Factors Influencing Scheduling-Production Planning And Control-Routing And Dispatching-Job Card-Job Order-Order Control And Machine Load Chart.

UNIT III WORKSTUDY 9

Techniques of Work Study-Procedure-Method Study, Types of Process Charts and Diagrams-Multiple Activity Chart-Utility-Time Study-Micro Motion Time Study-PMTS-Work Sampling-Job Analysis-Job Evaluation and Merit Rating-Wage and Wage Incentive.

UNIT IV INDUSTRIAL PSYCHOLOGY 9

Introduction-Nature And Scope-Objectives-Hawthorne Studies And Its Conclusion-Individual Behaviour-Group Behaviour,Types Of Groups-Formal And Informal Organizations-Fatigue – Accident,Major Factors,Prevention-Importance And Methods Of Training To The Employees, Methods And Aids-Leadership And Leadership Styles-Communication And Its Importance.

UNIT V STATISTICAL QUALITY CONTROL 9

Introduction to Quality Control-Statistical Measures-Control Chart-Types –Control Chart for Attributes-Control Chart for Number of Defects per Unit-Acceptance Sampling-Basic Probability-Normal Distribution-Acceptable Quality Level-Lot Tolerance Percent Defective-Average Outgoing Quality

TEXT BOOKS:

1. Khanna.O.P. Industrial Engineering and Management, Khanna Publishers, New Delhi, 2000.
2. B.Kumar, Industrial Engineering, Hanna Publishers,2004
3. S.Ramachandran and K.Pandian Principles Of Management And Industrial Psychology, Air Walk Publishers, 2007.

REFERENCES:

1. Gupta And Petal, Work Study- Khanna Publishers, 1998.
2. onlinevideolecture.com/**ebooks**/?subject=**Industrial**%20**Engineering**...

BME 702	**OPERATIONS RESEARCH FOR ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Mathematics I, II & III				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To impart knowledge about various tools in Operations Research to apply and solve real life problems in Engineering.

COURSE OUTCOMES (COs)

CO1	Formulate a raw problem into LPP or TP or AP and solve them by using relevant method.
CO2	Solve network problems by applying PERT or CPM concept.
CO3	Find optimum stock level in an inventory system with many products.
CO4	Solv**e** queuing problems with single and multiple channels.
CO5	Make decisions for replacement of equipments under stochastic situations.

CO6	Learn industrial concepts of inspection and output

		Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low											
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1		H						H				
	CO2	H						L					H
	CO3	H							M				H
	CO4				M		M			H			
	CO5												
	CO6												H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
			√						
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT – I LINEAR PROGRAMMING 12

Introduction to phases of Operations Research – Linear programming – formulation of the problem – graphical method – simplex method – two phase method – Assignment problems – Transportation models – Vogel's approximation method – Modi method – unbalanced transportation problem – degeneracy in transportation models.

UNIT – II RESOURCE SCHEDULING AND NETWORKS 12

Resource scheduling – Sequencing n jobs through 2 machines and 3 machines. Networks – PERT and CPM – Network diagrams – shortest route – minimum spanning tree – probability of achieving completion date – crash time – cost analysis – resource smoothing and resource levelling.

UNIT – III INVENTORY AND REPLACEMENT MODELS 12

Inventory models- Types of Inventory and variables in the Inventory problem – deterministic models- Replacement models – Replacement of items that deteriorate with time – equipment that fails completely and their analysis – factors for evaluation of proposals of capital expenditures and comparison and alternatives – present value average investment – rate of return pay off period – individual and group replacement policy.

UNIT – IV QUEUEING MODELS 12

Queuing theory – queuing system and structure – Kendalls's notation– Poisson arrival and exponential service time – characteristic of queuing models – single channel and multiple models – simulation.

UNIT –V DECISION MODELS **12**

Game theory –Saddle point-Maximin-Minimax principle-Two person zero sum games(mixed Strategies)-Graphical method for 2×n or m×2 games-Dominance Property-Oddment method.

TEXT BOOKS :

1. Kanti Swarup, Gupta, P.K and Manmohan, "Operations Research", Sultan Chand & Sons, New Delhi. 1997

REFERENCES:

1. Handy A. Taha, "Operations Research", 7th Edn. Prentice Hall of India. 2007.
2. Gupta and Hira DS " Operations Research", S. Chand & Co, New Delhi, 2006
3. Paneerselvam.R. "Operations Research", PHI, New Delhi. 2009 .
4. www.**study**nama.com/.../312-**Operations-Research**-lecture-notes-**ebook-p**...

BMT7L1	**FLUID POWER AUTOMATION LAB & MICROPROCESSOR LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	0	0	3	2
	Prerequisite – FMM				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To enable the student to understand different hydraulic and pneumatic components and their design.

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the student can able to understand the use of hydraulic and pneumatic systems
CO2	Learning different mechanisms
CO3	Able to design logical circuits.
CO4	Will gain knowledge CMM based instruments.
CO5	Apply different FMM principles of different applications.
CO6	Will practically gain knowledge in FMM analysis

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H							M			L	
	CO2	H							M			L	
	CO3			H	H	H						L	
	CO4					M						L	L
	CO5					M							L
	CO6						M	M	M				L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

LIST OF EXPERIMENTS:

1. Design and testing of the circuits such as i) Pressure, ii) Flow and iii) Direction control valves
2. Design of circuits with logic sequence using electro pneumatic trainer kits
3. Simulation of basic hydraulic, pneumatic and electric circuits using soft ware
4. Circuits with multiple cylinder sequences in electro pneumatic using PLC
5. Servo controller interfacing i) open loop ii) closed loop
6. Stepper motor interfacing with 8051 microcontroller (i) Full step resolution ii) Half step resolution
7. Computer controlled relays, solenoids and DC motors
8. Study of CMM based instrumentation
9. Modeling and analysis of basic electrical, hydraulic and pneumatic systems using LABVIEW software.

BME6L2	**COMPUTER AIDED ANALYSIS & SIMULATION LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	0	0	3	2
	Prerequisite – CAD /CAM Laboratory				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

This course will enable the student To gain knowledge about the basic fundamental of CAD and CAM

COURSE OUTCOMES (COs)

CO1	Understand the benefits of computer aided design
CO2	Knowledge of SIMULATION.
CO3	Understand the computer aided manufacturing of machine elements.
CO4	Students learn 2D design and modeling in MATLAB
CO5	Students learn modeling 3d Drawings
CO6	Students learn writing commands

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	H							M			L	
	CO2	H							M			L	
	CO3			H	H	H						L	
	CO4					M						L	L
	CO5					M							L
	CO6						M	M		M			L
3	Category	Humanities and Social studies (HS)		Basic Sciences & Maths (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/ Seminar/ Internship (PR)	
							√						
4	Approval	37th Meeting of Academic Council, May 2015											

LIST OF EXPERIMENTS:

A. PROGRAMMING IN MATLAB

1. Simple Applications in Arithmetic, Linear Algebra, Matrix operations.
2. Basic 2-D plots like i) Creating the circle ii) Creating the sine curve
3. Simulation of Mechanical Systems

B. MESHING AND ANALYSIS

1. Simple Meshes using a Meshing Software
2. Stress analysis of a plate with circular hole
3. Stress analysis of beams (Cantilever, Simply supported and fixed beams)
4. Thermal analysis of hot fluids in a pipe line
5. Mass flow of flue gases in an exhaust pipe
6. Harmonic analysis of a thin plate under axial loading
7. Mode frequency of a 2D component

	TERM PAPER	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	0	0	4	2
BME7P1	Prerequisite – Professional Courses				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to practical problems.

COURSE OUTCOMES (COs)

CO1	the student can able to design the components they required
CO2	Understand the different fabrication processes.
CO3	will gain confidence to face industrial environment

CO4	able to apply the knowledge attain to real life problems which he / she may have to face in future as an engineer.
CO5	The students work in groups and solve a variety of problems given to them.
CO6	The problems given to the students should be of real like industrial problems selected by a group of faculty members of the concerned department

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to undergo learning in research oriented areas, collecting survey and documents on the growing fields in technology
The students as an individual will choose onetopic which will be the topic of his project work in the final semester. Every project work shall have a guide who will be the faculty of the institution.

The topic chosen may be related to small machine elements (Example- screw jack, coupling, machine vice, cam and follower, governor etc) attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic/pneumatic devices etc.

The student is required to collect literature survey regarding the selected topic to be extended in the next semester. He has to demonstrate its working apart from submitting the project report. The report should contain study material, literature and whatever further deemed important related to his work.

BME8C1	**COMPREHENSION-II**	**L**	**T**	**P**	**C**
		0	0	0	1
	Prerequisite – All the courses upto VIII Semester				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- The objective of comprehension is to provide opportunity for the student to apply the knowledge acquired during the earlier semesters to real life problems which he / she may have to face in future as an engineer.

COURSE OUTCOMES (COs)

CO1	Understanding of the fundamentals of all the courses upto the VIII semester

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H							M			L	
	CO2	H						H	M			L	H
	CO3			H	H	H		H				L	
	CO4					M		H				L	H
	CO5					M							H
	CO6						M	H	M				H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
									√
4	Approval		37th Meeting of Academic Council, May 2015						

In comprehension, the knowledge acquired by the students in the earlier semesters, is tested. The student is prepared to face competitive examinations. There will be tests involving objective type and Viva Voce questions at the end of VIII for the starting from I to VIII semesters..

BME8P1	**PROJECT WORK**	**L**	**T**	**P**	**C**
	Total Contact Hours –18 periods per week	0	0	18	9
	Prerequisite – Professional Courses				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

Every project work shall have a guide who is the member of the faculty of the institution. The aim of the project work is to deepen comprehension of principles by applying them to a new problem which may be the design and manufacture of a device, a research investigation, a computer or management project or a design problem.

COURSE OUTCOMES (COs)

CO1	Each student shall finally produce a comprehensive report covering background information, literature survey, problem statement, project work details and conclusion.
CO2	This final report shall be typewritten form as specified in the guidelines.
CO3	The continuous assessment shall be made as prescribed in the regulations.
CO4	The student can able to design the components they required
CO5	Understand the different fabrication processes.
CO6	Will gain confidence to face industrial environment.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H							M			L	
	CO2	H						H	M	H		L	H
	CO3			H	H	H		H				L	
	CO4					M		H		M		L	H
	CO5					M							H
	CO6						M	H	M				H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Science s (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
									√
4	Approval		37th Meeting of Academic Council, May 2015						

The objective of this project is to provide opportunity for the students to implement their skills acquired in the previous semesters to undergo learning in research oriented areas, collecting survey and documents on the growing fields in technology

The students as an individual will choose onetopic which will be the topic of his project work in the final semester. Every project work shall have a guide who will be the faculty of the institution.

The topic chosen may be related to small machine elements (Example- screw jack, coupling, machine vice, cam and follower, governor etc) attachment to machine tools, tooling (jigs, fixtures etc), small gear box, automotive appliances, agricultural implements, simple heat exchangers, small pumps, hydraulic/pneumatic devices etc.

The student is required to collect literature survey regarding the selected topic to be extended in the next semester. He has to demonstrate its working apart from submitting the project report. The report should contain study material, literature and whatever further deemed important related to his work.

CORE ELECTIVE – I

BME001	**ADVANCED INTERNAL COMBUSTION ENGINES**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	3	0	0	3
	Prerequisite – BASIC MECHANICAL ENGG.				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

update the knowledge in engine exhaust emission control and alternate fuels and enable the students to understand the recent developments in IC Engines **.**

COURSE OUTCOMES (COs)

CO1	Will update the knowledge in engine exhaust emission control. and
CO2	Will understand the concept of alternate fuels .
CO3	Will understand the recent developments in IC Engines.
CO4	Will update the knowledge in engine exhaust emission control. and
CO5	Understand the different fabrication processes.
CO6	Will gain confidence to face industrial environment.

	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1								M			L	
	CO2			H				M	H	H		L	L
	CO3			H	H	M		M			L	L	
	CO4					M		M		M		L	H
	CO5					M							H
	CO6						M	H	M				L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I SPARK IGNITION ENGINES 9

Spark ignition engine mixture requirements - Feedback control carburetors - Fuel-Injection systems - Monopoint and Multipoint injection - Stages of combustion - Normal and Abnormal combustion - Factors affecting knock - Combustion chambers -Introduction to Thermodynamic Analysis of S.I.Engine combustion.

UNIT II COMPRESSION IGNITION ENGINES 9

Direct and Indirect systems - combustion chamber - Fuel spray behaviour - Spray structure, Spray Penetration and Evaporation - air motion - Turbocharging - Introduction to Thermodynamic analysis of C.I.Engine combustion.

UNIT III POLLUTANT FORMATION CONTROL 9

Pollutants - Sources and types - Formation of Nox, Hydrocarbon Emission Mechanism - Carbon monoxide formation - Particulate emissions - Methods of Controlling Emissions - Catalytic converters and particulate Traps - Methods of Measurement and driving cycles.

UNIT IV ALTERNATE FUELS 9

Alcohol, Hydrogen, Natural gas and Liquefied petroleum gas - Properties, Suitability, Engine Modifications, Merits and Demerits on fuels.

UNIT V RECENT TRENDS 9

Lean Burn Engines - Stratified charge Engines - Gasoline Direct Injection Engine - homogeneous charge compression ignition - Plasma ignition - Measurement techniques.

TEXT BOOKS:

1. R.B.Mathur and R.P.Sharma- Internal Combustion Engines, Dhanpat Rai & Sons, 1994.
2. V. Ganesan-Internal Combustion Engines - Tata McGraw Hill, 2003.
3. K.K.Ramalingam-Internal Combustion engines, Scitech Publications India(P) Ltd. 2000.

REFERENCES:

1. John B. Heywood, Internal Combustion Engine Fundamentals, McGraw Hill International Editions, 1998.
2. https://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/28890yy.pdf

BME002	SPECIAL CASTING PROCESSES	L	T	P	C
	Total Contact Hours –45	3	0	0	3
	Prerequisite – MANUFACTURING TECHNOLOGY				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

Understand the concepts of molding and casting

COURSE OUTCOMES (COs)

CO1	understand and perform basic casting processes .
CO2	effectively use casting industry tools (real and virtual).
CO3	use technical methodology in analyzing a casting design in terms of casting parameters and cost estimates.
CO4	Will update the knowledge in industrial field
CO5	Understand the different fabrication processes.
CO6	Will gain confidence to face industrial environment.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1								M			L	
	CO2			H				M	H	H		L	L
	CO3			H	H	M		M			L	L	
	CO4					M		M		M		L	H
	CO5					M							H
	CO6						M	H	M				L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 7

Sand casting-Conventional mould-Core making-Need for special casting process-Applications

UNIT II SHELL MOULDING 8

Process-Machines-Pattern-Sand , resin and other materials – Process parameters – Characteristics of shell mould casting-'D' Process – Applications

UNIT III INVESTMENT CASTING 9

Process- Pattern and mold materials – Black mold and ceramic shell mold - Mere Cast and Shaw process – Applications.

UNIT IV CETRIFUGAL AND DIE CASTING 9

Types of centrifugal process – calculation of rotating speed of mold – Equipment – Applications.

UNIT V CONTINUOUS CASTING, CO_2 MOULD PROCESS AND FULL MOULD PROCESSES 12

Reciprocating continuous mould process – Direct chill process – Use of steel, Aluminum, brass material in continuous casting. CO_2 Mould / Core hardening process – Principle of full Mould process – Applications , Special processes like Squeeze casting and eletroslag casting processes.

REFERENCES :

1. P.L. Jain, Foundry Technology, 1992.
2. R.A.Higgins, Engineering Metallurgy – Vol. II, 1998.
3. phindia.com/.../**casting**-technology-and-**cast**-alloys-chakrabarti-a-k--isbn.

BME003	**MECHANICAL VIBRATIONS**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	3	0	0	3
	Prerequisite – KINEMATICS OF MACHINES, DYNAMICS OF MACHINES				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

The student will be able to understand the sources of vibration and noise in automobiles and make design modifications to reduce the vibration and noise and improve the life of the components

COURSE OUTCOMES (COs)

CO1	Understand the sources of vibration and noise in various appliances.
CO2	Will able to make design modification to reduce vibration.
CO3	Will produce life improved components.
CO4	Will update the knowledge in mechanical vibrations field
CO5	Understand the different derivations necessary
CO6	Will find solutions technically involving noise, frequency and vibrations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L

2	CO1	H							M			L	
	CO2	H		H				M	H	H		L	L
	CO3	H		H	H	M		M			L	L	
	CO4	H				M		M		M		L	L
	CO5	H				M							L
	CO6	H					M	H	M				L
3	Category	Humanities and Social studies (HS)		Basic Sciences & Maths (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)	
							√						
4	Approval		37th Meeting of Academic Council, May 2015										

UNIT I PRINCIPLES OF VIBRATION 9

Vibration principle- Equilibrium & Energy methods- Free vibrations-Viscous & coulomb damping- Forced vibration EXCITATION- Transmissibility –Resonance -Characteristics.

UNIT II TWO DEGREES OF FREEDOM 9

Two degrees of freedom –Matrix form – Undamped free vibration – Principal modes – Co-ordinate coupling – Principal co-ordinates – Torsional vibrations – Holzer method – Work &Energy approach.

UNIT III TRANSIENT VIBRATION 9

Transient vibration – Time dependency – Laplace transforms – Step inputs – Pulse inputs – Duhamel's integral – Phase plane method – Shock spectrum.

UNIT IV MULTI DEGREES OF FREEDOM 9

Multi degrees of freedom – Equations of motion – Solution –Orthogonality of normal modes – Continuous system – Free & forced vibrations – Vibration analysis by FEM.

UNIT V VIBRATION INSTRUMENTS 9

Vibration instruments – Vibration absorber –Elastically supported dampers – Seismic instruments –Vibrometers – Pickups – Accelerometers – Mounting instruments – Amplitude & phase distortions.

TEXTBOOKS

1. G.K.Grover – Mechanical Vibrations – Namchand & Bros. 2001.
2. V.P.Singh - Mechanical Vibrations –Dhanpat Rai & Co, 2005.

REFERENCES:

1.W.T.Thomson – Theory of vibrations,Uniwin Hyman Ltd/CBS Publishers,1998.
2.Francis S.Tse, Iran E. Morse, Rolland T. Hinkle- Mechanical vibrations - CBS Publishers,

1983.
3. S.P.Timoshenko – Vibration Problems in Engineering – CBS Publishers, 1985.
4. booksformech.blogspot.com/.../**mechanical-vibrations**-by-vpsingh-pdf.ht..

BME004	**PLANT LAYOUT AND MATERIAL HANDLING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite –MANUFACTURING TECH I & II				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To equip students with adequate knowledge for running an organization and to understand the integration of material handling systems.

COURSE OUTCOMES (COs)

CO1	Understand the procedures for systematic integration of organization.
CO2	Will understand various techniques and tools of layout planning.
CO3	Students will be able to get knowledge on industrial layouts.
CO4	Understand material handling systems
CO5	Learn the concepts of industrial building
CO6	Learn the concepts of industrial utilities

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H											
	CO2	H		H				L					
	CO3	H		H		M	M			L		L	
	CO4	H		H									L
	CO5	H					M		M				
	CO6	H		H									L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
						√			

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I PLANT LOCATION AND FACILITIES 8

Factors to be considered – influence of location on plant layout, selection of plant site, Consideration in facilities planning and layout. Equipments required for plant operation,

Capacity, serviceability and flexibility and analysis in selection of equipments, space requirements, and man power requirements.

UNIT II PLANT LAYOUT 8

Need for layout, types of layout, factors influencing product, process. Fixed and combination layout: tools and techniques for developing layout, process chart, flow diagram, string diagram, template and scale models – machine data. Layout planning procedure. Visualization of layout, revision and improving existing layout, balancing of fabrication and assembly lines.

UNIT III MATERIAL HANDLING 10

Importance and scope. Principles of material handling. Planning, operating and costing Principles, types of material handling systems, factors influencing their choice.

UNIT IV INDUSTRIAL BUILDING AND UTILITIES 12

Centralized electrical, pneumatic water line systems. Types of buildings, lighting, heating, air conditioning and ventilation utilities - planning and maintenance, waste handling, statutory requirements. Packing and storage materials: Importance of Packaging, layout for Packaging – Packaging machinery – wrapping and Packing materials, cushion materials.

UNIT V ANALYSIS OF MATERIAL HANDLING 7

Motion analysis, flow analysis, graphic analysis, safety analysis, equipment cost analysis, palletization analysis, analysis of operation, material handling surveys.

TEXT BOOKS :

1. S. C. sharma, Plant layout and material handling, Khanna publishers.
2. Agarwal, Plant layout and material handling, Jain brothers publication.

REFERENCES :

1. Shubin J A, Plant layout, P H I publications.1965
2. Oberman. Ya, Material handling, Mir publishers.1980
3. S.C. Sharma, Material Management And Material Handling, Khanna Publishers.1995.
4. https://books.google.com/.../**Plant_Layout_and_Material_Handling**.html?...

CORE ELECTIVE – II

BME005	**DESIGN OF HEAT EXCHANGERS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – HEAT AND MASS TRANSFER				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To learn the sizing of heat exchangers, thermal and mechanical stress analysis for various heat exchange applications.

COURSE OUTCOMES (COs)

CO1	Will understand concepts and working principle of heat exchangers.
CO2	Will understand heatexchanger design.
CO3	Will able to do compact heatexchanger design.

CO4	Will understand the concept of cooling tower.
CO5	Student learns the SHELL TYPE heat exchangers
CO6	Student understands the use of other types of heat exchangers,advantages and disadvantages

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2			H		L				H		L	
	CO3	H					M						
	CO4			H		L		M					L
	CO5									H			
	CO6	H				L							L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
						√			

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I DOUBLE PIPE HEAT EXCHANGERS & HEAT PIPES 9

Thermal And Hydraulic design – Inner pipe – Annulus, Hairpin heat exchanger – Basic inner tube – Finned multi tubes – Parallel and series arrangements – Pressure drop, Constructional features. Heat pipes – Structures – Applications – Basic relations – Performance characteristics – Effect of working fluid and operating temperatures, Wick – Selection of materials – bore size.

UNIT II SHELL AND TUBE HEAT EXCHANGERS 9

Basic components – shell – tube bundles – baffles – type and geometry, design procedure – preliminary estimation of size, pressure drop and Heat transfer calculations – shell and tube sides – Kenn method – Bell – Delaware methods.

UNIT III COMPACT HEAT EXCHANGERS & GASKETTED PLATE HEAT EXCHANGERS 9

Compact Heat Exchangers – types – constructional features, heat transfer and pressure drop calculations – Finned plate and tube.Gasketted plate Heat Exchangers - constructional features plate, pack and flame – Operational characteristics – Flow arrangements, Heat transfer and pressure drop calculations, Performance analysis, Comparison with other types of heat exchangers.

UNIT IV CONDENSERS & EVAPORATORS 9

Shell and tube condensers – Horizontal and vertical types – Design and operational

consideration, Plate condensers, Air cooled and direct contact type condenser for refrigeration, Evaporative condensers.Evaporators for refrigeration and air conditioning – Chillers – air coolers – thermal analysis – Shah, Kandhkar and Ghnkor and Winterom Correlations, Standard types.

UNIT V COOLING TOWERS 9

Cooling towers - Types – Basic relation – Heat balance and heat transfer characteristics and effect of packing – Geometry, Spray design, Selection of pumps, fans, testing, Maintenance, environmental effects, wind load, typical installations.

TEXTBOOK:

1.R.K.Rajput- Heat and mass Transfer- S Chand Publications, Jan 2008

REFERENCES:

1. Sadik Kakal & Homgton Lin – Heat Exchangers – CRC Press, London, 1998.
2. Arthur.P.Fraas, - Heat exchanger Design, John Willey & Sons, 1997.
3. Kenn.D, - Process heat transfer – Tata McGraw Hill, 1980.
4. Holger Martin - Heat exchangers – Hemi sphere Publishing Corporation, London.
5. https://www.crcpress.com/**Heat-Exchanger-Design**-Hand**book**/.../978142...

BME006	**COMBUSTION ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – IC ENGINES				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To understand and analyze the combustion with emphasis on engineering applications.

COURSE OUTCOMES (COs)

CO1	Understand various types of fuels and its ppts
CO2	Understand the concept of gaseous fuels
CO3	Will able to differentiate gaseous and liquid fuels
CO4	Will understand the concept of solid fuels
CO5	Student learns about fluidized bed combustion
CO6	Student understands the fundamentals in combustion of fuels.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H											
	CO2	H		H				L					
	CO3	H		H		M	M			L		L	
	CO4	H		H									L
	CO5	H					M		M				

	CO6	H		H									L
3	Category	Humanities and Social studies (HS)		Basic Sciences & Maths (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)		Project/ Seminar/ Internship (PR)
								√					
4	Approval			37th Meeting of Academic Council, May 2015									

UNIT I CHEMICAL REACTIONS 9

Fuels and combustion, Theoretical and actual combustion processes, Enthalpy of formation and enthalpy of combustion, First law analysis of Reacting systems, Adiabatic flame temperature, Entropy change of reacting systems, Second law analysis of reacting systems, problems

UNIT II COMBUSTION OF GASEOUS AND VAPORIZED FUELS 9

Review of types of fuels, Types of flames, Energy balance and furnace efficiency, Burner type, Emissions from gas-fired furnaces, Emissions control, Chamber design, Detonation

UNIT III COMBUSTION OF LIQUID FUELS 9

Spray combustion in furnace, spray formation and droplet behaviour, Gas turbine operating parameters, combustor design, ignition delay, and detonation of liquid fuel sprays

UNIT IV COMBUSTION OF SOLID FUELS 9

Drying of solid fuels, devolatilization of solid fuels, stoker-fired boilers, Refuse and biomass fired boilers, Pulverized coal-burning systems, Pulverized coal combustion, Emission from pulverized coal, Problems

UNIT V FLUIDIZED BED COMBUSTION 9

Fluidization fundamentals, combustion in bubbling bed, atmospheric fluidized bed combustion systems, circulating fluidized beds, pressurized fluidized bed combustion, problems.

TEXTBOOK:

1. Yunus.A.Cengel- A textbook of Thermodynamics

REFERENCES:

1. Gary.L.Borman, Combustion Engineering-McGraw Hill international Edition,1998
2. Roger.A.Strehlow-Combustion fundamentals- McGraw Hill international Edition,1989.
3. www.goodreads.com/book/show/3785353-**combustion-engineering**

	COMPOSITE MATERIALS AND TECHNOLOGY	**L**	**T**	**P**	**C**
BME007	Total Contact Hours –45	3	0	0	3
	Prerequisite – machine design –I,Metallurgy				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To understand the fundamentals of composite material strength and its mechanical behavior Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.

COURSE OUTCOMES (COs)

CO1	Thermo-mechanical behavior and study of residual stresses in Laminates during processing. Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.
CO2	Will understand the fundamentals of composite material strength and its mechanical behavior
CO3	Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
CO4	Thermo-mechanical behavior and study of residual stresses in Laminates during processing. Implementation of Classical Laminate Theory (CLT)
CO5	They study and analysis for residual stresses in an isotropic layered structure such as electronic chips.
CO6	Will understand the fundamentals of composite material strength and its mechanical behavior

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H							M			L	
	CO2	H						H	M			L	H
	CO3			H	H	H		H				L	
	CO4					M		H				L	H
	CO5					M							H
	CO6						M	H	M				H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
							√		

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION 9

Conventional materials–Limitations–Definition of composite materials–Difference between conventional and composite materials-Types of Characteristics (Dispersions, particulates, fibre)-Application.

UNIT II MATERIALS 9

Fibres-Materials-fibre reinforced plastics-Thermoset polymers-Coupling agents, fillers and additives-Metal matrix and ceramic composites-Particulate reinforced composite

UNIT III MANUFACTURING 9

Fundamentals-bag moulding-compression moulding- pultrusion-filament winding-other manufacturing process-MMC's Casting (Solid and liquids state processing)-quality inspection and non destructive testing

UNIT IV MECHANICS AND PERFORMANCE 9

Introduction to micro-mechanics-Unidirectional laminates-interlinear stresses-static mechanical properties-fatigue properties-impact properties-environmental effects-fracture mechanics and toughening mechanisms, damage prediction, failure modes.

UNIT V DESIGN OF COMPOSITES 9

Failure predictions-design considerations-joint design-codes-design examples. Optimization of laminated composites-Application of FEM for design and analysis of laminated composites.

TEXTBOOKS:

1. Krishnan Chawla ,Composite Materials Science and Engineering, Springer publications,2012.
2. Daniel gay, Composite Materials, CRC Press, 3rd edition.

REFERENCES:

1. Ronald Gibson, Principles of Composite Material Mechanics, Tata McGraw Hill, 1994.
2. Michael Hyer, Stress Analysis of Fiber- reinforced composite Materials, Tata McGraw Hill, 1998.

3.http://www.springer.com/in/book/9780387743646

4.https://books.google.co.in/books/about/Composite_Materials.html?id=5Q6oUTFO0RgC

BME008	**MECHANICS OF FRACTURE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – MACHINE DESIGN I & II				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

The purpose is to give an introduction about fundamental theory in facture mechanics. Knowledge of failure mechanisms and the fracture mechanics is important in many fields of research and industrial applications..

COURSE OUTCOMES (COs)

CO1	The student will develop skills in deriving stress field and energy release rate around the crack tip and crack propagation under cyclic loading.
CO2	Learn about crack failures
CO3	Understanding of fracture mechanics and its application.
CO4	Learn about fatigue growth
CO5	Will learn about fracture failure modes

CO6	Learn fracture repair and analysis

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H											
	CO2			H									
	CO3							M				L	
	CO4	H		H	H	M	M						L
	CO5												L
	CO6	H											L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION &ELASTIC CRACK 9

Introduction-Crack in a structure-Griffith criterion cleavage fracture, ductile fracture, fatigue cracking- Service failure analysis. Elastic crack-Elastic crack tip stress field- Solution to crack problems, Effect of finite size stress intensity factor-Special cases- Irwin plastic zone correction – Actual shape of plastic zone- plane stress- plane strain

UNIT II ENERGY PRINCIPLE 9

Energy release rate- criterion for crack growth- Crack resistance curve-Principles of crack arrest-Crack arrest in practice.

UNIT III FATIGUE CRACK GROWTH 9

Fatigue crack growth test, stress intensity factor, factors affecting stress intensity factor-variable amplitude service loading, retardation model.

UNIT IV ELASTIC PLASTIC FRACTURE MECHANICS 9

Elastic plastic fracture concepts- crack tip opening displacement- J using FEM.

UNIT V APPLICATIONS OF FRACTURE MECHANICS 9

Fracture design- selection of materials-Fatigue crack growth rate curve- stress intensity factor range- Use of crack growth law.

TEXTBOOKS:

1. Jean lemative and Jean Louis chboche “Mechanics of solid Materials,” Cambridge university press, Cambridge, 1987.

2. Prashant Kumar, Elements of fracture mechanics, wheeler publishing, 1999.

REFERENCES:

1.John M.Barsom and Stanley T Rolfe, "Fracture and fatigue control in structures", Prentice Hall, Inc, USA, 1987.
2.David Broek- "Elementary engineering fracture mechanics" Martinus Nijh off publishers, 1982.
3.https://apm.iitm.ac.in/smlab/kramesh/book_4.htm

CORE ELECTIVE – III

BME009	**DESIGN FOR MANUFACTURING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – MACHINE DESIGN, MANUFACTURING TECHNOLOGY				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- At the end of this course the student should be able to understand the design principles of casting, welding, forming, machining and assembly, by considering various manufacturing constraints.

COURSE OUTCOMES (COs)

CO1	Students will learn the principles of manufacturing
CO2	Students will learn manufacturing design
CO3	Learn design principles of welding
CO4	Learn design principles of forming
CO5	Learn design principles of casting
CO6	Learn design principles of machining and assembly

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1												
	CO2	H	H							M			
	CO3		H				M				M	H	
	CO4	H											H
	CO5		H				M						
	CO6												H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I GENERAL DESIGN **9**

General design principle for manufacturing - Process capability- Surface finish – tolerances – features of tolerance – cumulative effect of tolerance – Geometric tolerances.

UNIT II FITS AND ASSEMBLIES **9**

Fits- Selective assembly- Deciding the number of groups, control of axial play- Grouped datum systems- Types- Automated assemblies- laminated shims assemblies.

UNIT III TOLERANCING **9**

True position theory- Virtual size concept- True position tolerancing- fixed fasteners- Floating fasteners- zero true position tolerances- Functional gauging- paper layout gauging.

UNIT IV REDESIGNING **9**

Form design of castings- Redesigning- Parting line consideration- Minimizing core requirements- economic design of castings- Form design of weldments- Welding symbols- redesigning cast members using weldments- Economic weldments.

UNIT V DESIGN FOR ASSEMBLY **9**

Design for assembly- Design for inspection- Design for machining- Redimensioning based on manufacturing datums- Design of reduce value addition – Parts cut to length – Machined round holes- Blind & Through holes – Design consideration for various machining operations.

TEXTBOOK:

1. M.F.Spotts – "Dimensioning & Tolerancing for Quantity Production" – Prentice Hall

REFERENCES:

1.Harry Peck – "Designing for Manufacture" – Pitman Publications, 1973.
2.James G.Bnalla- "Hand book of Product Design for Manufacturing".
3.www.bookchums.com › Books › Free ebooks

BME010	**ADVANCED TURBO MACHINES**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	3	0	0	3
	Prerequisite – HEAT AND MASS TRANSFER				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To develop skilled manpower in the field of turbo machines with the knowledge of transport processes through the turbo machine passage, analytical, numerical and experimental tools for design, operation, performance evaluation and innovative research in the area of turbo machines"

COURSE OUTCOMES (COs)

CO1	Understand the performance evaluation, operation and maintenance of rotodynamic

	machines.
CO2	Will have knowledge on conceptual design of different components of thermal and hydroturbomachines.
CO3	Design and develop turbomachineries
CO4	Learn the principle of machineries
CO5	Learn axial and radial flow turbines
CO6	Learn the principles and application of turbines

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1												
	CO2	H	H							M			
	CO3		H				M				M	H	
	CO4	H											H
	CO5		H				M						
	CO6												H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PRINCIPLES 9

Energy transfer between fluid and rotor, classification of fluid machinery, dimensionless parameters, specific speed, applications, stage velocity triangles, work and efficiency for compressors and turbines.

UNIT II IMPELLER BLADES 9

Types, stage and design parameters, flow analysis in impeller blades, Volute and diffusers, losses, characteristics curves and selection, fan drives and fan noise.

UNIT III CENTRIFUGAL COMPRESSOR 9

Construction details, types, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

UNIT IV AXIAL FLOW COMPRESSOR 9

Stage velocity triangles, enthalpy-Entropy diagrams, stage losses and efficiency, work down factor, simple stage, design problems and performance characteristics.

UNIT V AXIAL AND RADIAL FLOW TURBINES 9

Stage velocity diagrams, reaction stages, losses and coefficients, blade design principles, testing and performance characteristics.

TEXTBOOKS:

1. S.M.Yahya – Turbines, Compressors and Fans – Tata McGraw Hill Publishing Company, 2005.
2. V.Ganesan – Gas Turbines - Tata McGraw Hill Publishing Company, New Delhi- 2003.

REFERENCES:

1. Earl Logan Jr, Ramendra Roy.,Handbook of Turbo Machinery., CRC Press.
2. https://books.google.co.in/books/about/Advanced_topics_in_turbomachinery_techno.html?id=qs9QAAAAYAAJ&redir_esc=y

BME011	**PROCESS PLANNING AND COST ESTIMATION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	1	0	3
	Prerequisite – INDUSTRIAL ENGG.				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To introduce the process planning concepts to make cost estimation for various products after process planning

COURSE OUTCOMES (COs)

CO1	Understand the various processes.
CO2	Learn to estimate labour cost
CO3	Learn to estimate material cost
CO4	Learn to estimate overhead cost
CO5	Learn to fix discounts
CO6	Learn the use of charts

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2				H							H	
	CO3	M						H		H			H
	CO4				H		M					H	
	CO5							M		H			H
	CO6	L											H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
						√			
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PROCESS PLANNING 12

Types of production, standardization, simplification, production design and selection - Process Planning, selection and analysis – Steps involved in manual and experienced based planning and computer aided process planning – Retrieval, Generative – Selection of process analysis – Break even analysis.

UNIT II ESTIMATION AND COSTING 12

Aim and objective of cost estimation – Functions of estimation – Costing – Importance and aims of costing – Difference between costing and estimation. Importance of realistic estimates – Estimation procedure.

UNIT III COST ELEMENTS 12

Material cost – Determination of material cost, Labour cost - Determination of labour cost, Expenses — Analysis of overhead expenses – Factory expenses, Administrative expenses – Selling and Distributing expenses – Allocation of over head expenses. Cost of product – Illustrative examples

Depreciation: Depreciation – Causes of Depreciation – Methods of Depreciation.

UNIT IV ESTIMATION OF PRODUCTION COST 12

Estimation in forging shop – Losses in forging – forging cost – Illustrative examples. Estimation in welding shop – Gas cutting – Electric welding - Illustrative examples. Estimation in foundry shop – Estimation of pattern cost and casting cost - Illustrative examples.

UNIT V MACHINING TIME ESTIMATION 12

Estimation of Machining Timefor Lathe operations – Estimation of Machining TimeforDrilling, Boring, Shaping, Planning, Milling and Grinding operations - Illustrative examples.

TEXTBOOKS:

1. M.Adithian and B.S. Pabla, Estimation and Costing, Konark publishers Pvt. Ltd., 1989.
2. A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, Prentice Hall Pvt. Ltd.., 2005

REFERENCES :

1. Namua Singh, System Approach to computer integrated Design and Manufacturing, John Wiley & Sons,Inc.,1996.

3. Joseph G Monks, Operation Management, Theory & Problems, McGraw Hill Book Company, 1987.
4. T.R.Banga and S.C.Sharma, Estimations and Costing, Khanna Publishers,1988.
5. G.B.S.Narang and V.Kumar, Production and Costing, Khanna Publishers, 1995.
6. https://books.google.com/books?id=A9-ZXblNrPoC

BME012	**JIGS FIXTURES AND PRESS TOOLS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – MANUFACTURING TECHNOLOGY				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To understand the functions and design principles of Jigs, fixtures and press tools To gain proficiency in the development of required views of the final design.

COURSE OUTCOMES (COs)

CO1	Will gain knowledge on standard components
CO2	Will understand the principle and use of standards
CO3	Will learn the use and design of fixtures
CO4	Will learn and design the use of tools
CO5	Learn CNC programming
CO6	Understand concept of technical design

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2	H		H	M					H			H
	CO3			H			M						H
	CO4	H		H					M			L	L
	CO5	H											L
	CO6	H		H									

3	Category	Humanities and Social studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
					√				

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I LOCATING AND CLAMPING DEVICES 12

Introduction to jigs & Fixtures - Design principles of jigs & fixtures - Locating principles and elements – Standard parts – Clamping devices, Mechanical ,Pneumatic and hydraulic actuation, Clamping force analysis.

UNIT II JIGS 12

Drill bushes - Different types of jigs- plate, latch, channel, box, post, angle plate, angular post, turnover, pot jigs - Automatic drill jigs – Rack & pinion operated and Air operated jig components - Design and development of jigs for the given components.

UNIT III FIXTURES 12

Types of fixtures - Boring, Lathe, Milling, Broaching fixtures – Grinding, Planning and Shaping fixtures – Assembly, Inspection and Welding fixtures – Modular fixtures – Design and development of fixtures for the given components.

UNIT IV PRESS TOOLS 12

Press working terminology - Types of Presses and Press Accessories – Computation of capacities and tonnage requirements – Strip layout

UNIT V DIES 12

Design and development of various types of Cutting, Forming and Drawing dies – Blank development for cylindrical and non cylindrical shells – Compound , Progressive and Combination dies.

TEXTBOOK:

1. Design of Jigs, Fixtures and Press tools, C.Elanchezhian,T.Sunderselvan, B.Vijayaramnath, Eswar Press, 2005.

REFERENCES :

1. ASTME Handbook of Fixture design,1960.
2. Fundamentals of tool Design ASTME, 1984.
3. Akgoroshkin, Jigs and Fixture Handbook, Mix Publishers, Moscow, 1983 .
4. Design Data, PSG Tech, Coimbatore, 2003.
5. https://www.overdrive.com/media/.../design-of-**jigs-fixtures-and-press-to**...

NON MAJOR ELECTIVE-I

BGE 001	**VIBRATION CONTROL AND MONITORING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	1	0	3
	Prerequisite – MECHANICAL VIBRATIONS				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To presents fundamentals to a modern treatment of vibrations, placing the emphasis on analytical developments and computational solutions. This course will provide the detail knowledge about nonlinear and random vibration with fault diagnosis of machinery using vibration signature analysis.

COURSE OUTCOMES (COs)

CO1	Understand the principles of vibration
CO2	Learn the types of vibration
CO3	Gain knowledge in vibration control
CO4	Gain knowledge in vibration monitoring
CO5	Undergo derivations related to vibrations
CO6	Learn dynamic balancing and alignment of machinery

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2	H		H	M					H			H
	CO3			H			M						H
	CO4	H		H					M			L	L
	CO5	H											L
	CO6	H											

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
						√			

4	Approval	37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION 9

Review of fundamentals of single degree of freedom systems- Two degree of freedom systems- Multi degree freedom systems- Continuous system- Determination of Natural frequencies and mode shapes. Numerical methods in vibration analysis.

UNIT II VIBRATION CONTROL 9

Introduction – Reduction of vibration at source- Control of vibration- By structural Design- Material selection- Located Additions- Artificial Damping- Resilient Isolation, Vibration Isolation- Vibration Absorbers.

UNIT III ACTIVE VIBRATION CONTROL 9

Introduction - Concepts and Applications- Review of Smart Materials- Types and Characteristics Review of Smart Structures- Characteristic Active Vibration in Smart Structures.

UNIT IV CONDITION BASED MAINTANENCE PRINCIPLES AND APPLICATION 9

Introduction- Condition Monitoring methods- The design of Information system, Selecting Methods of Monitoring, Machine Condition Monitoring and Diagnosis- Vibration Severity

Criteria Machine Maintenance Techniques- Machine Condition Monitoring Techniques- Vibration Monitoring Techniques- Instrumentation Systems- Choice of Monitoring Parameter.

UNIT V DYNAMIC BALANCING AND ALIGNMENT OF MACHINERY 9

Introduction, Dynamic Balancing of Robots, Field Balancing in one Plane, Two Planes and in Several Planes- Machinery Alignment, "Rough" Alignment methods- The face Periphery Dial Indicator Method- Reverse indicator method.

TEXTBOOKS:

1. Singiresu S.Rao. "Mechanical Vibration". Addison- Wesley Publishing Co.2004
2. Rao J.S. "Vibratory Condition Monitoring of Machines" CRC Press. 2000.

REFERENCES:

1.J.O. Den Hartog- "Mechanical Vibrations" McGraw Hill New York.1985.
2.Science Elsevier-"Hand book of Condition Monitoring" ELSEVIER SCIENCE,1996.
3.https://www.overdrive.com/media/118481/**vibration**-with-**control**

BGE002	**WIND AND SOLAR ENERGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – NEW AND RENEWABLE SOURCES OF ENERGY, BME				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To equip students with adequate knowledge on the need for alternate energy sources, Potential of solar and wind options.

COURSE OUTCOMES (COs)

CO1	Student learns About the pollutions and its types
CO2	Student learns the types of energy and energy storage system
CO3	Student learns the use of wind energy
CO4	Student learns the use of solar energy in the far future
CO5	Student learns the installation methods for solar panel
CO6	Student understands the use of other types of energy,advantages and disadvantages

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2			H		L				H		L	
	CO3	H					M						
	CO4			H		L		M					L
	CO5									H			
	CO6	H				L							L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
						√			
4	Approval		37th Meeting of Academic Council, May 2015						

UNIT I WIND ROTOR AND ITS MODELING 9

Scope of wind power, wind turbine design- Approach elementary aerodynamic models for rotors, Ranking- Fronde actuator disc theory- Wake rotation ,two dimensional air foil theory, Glauert momentum vortex theory-Optimal rotor – Modification, Experimental verification of aero dynamic model.

UNIT II WIND ROTOR DESIGN AND PERFORMANCE ESTIMATION 9

Wind model rotor sizing- Rotor specification, Rotor design – Number of blades, blade design. Performance estimation, sitting economics of wind power.

UNIT III 9

General requirements, synchronous generators, Induction generators-Squirrel cage-Variable speed-Wound rotor-Resistance controlled-with cyclone converter-practical aspects. Speed control-Stall and Pitch control-Electronic control, power control, Electrical cut-in.

UNIT IV SOLAR ENERGY 9

Principle of conversion of solar radiation into heat, types of solar thermal collectors-Flat plate and concentrating collectors(parabolic, trough, Minor ,strip, Fresnel lens and compound parabolic concentrator),compression of collectors selective absorber coating, solar thermal power plant.

UNIT V SOLAR ENERGY STORAGE AND APPLICATIONS 9

Solar energy storage systems-Thermal, Electrical, Chemical, Mechanical and Electro-magnetic, Solar pond. Applications of solar energy-Solar thermo electric conversion-Solar photo voltaic, Solar heating and cooling of buildings, Solar distillation, Solar pumping and terrestrial application. System of solar cell power plant-direct grid connection through electronic control devices.

TEXTBOOKS:

1. Rai G.D. , Non – Conventional sources of energy, Khanna Publications, 4th edition, 2004.

REFERENCES:

1. David M. Eggleston and Forrest S.Stoddard, Wind Turbine Engineering Designing – Van Noustrand 1987.
2. Le Gouries D, Wind Power Plants, Theory and Design - Permagon Press, 1982.
3. Putnam Palmer C., Power from Wind – Van Noustrand, 1984.

4. www.global-greenhouse-warming.com/**renewable-energy-eBooks**.html

BGE003	**NEW AND RENEWABLE SOURCES OF ENERGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – POWER PLANT ENGINEERING				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

To understand the importance of saving energy

COURSE OUTCOMES (COs)

CO1	the students can able to identify the new methodologies / technologies for effective utilization of renewable energy sources.
CO2	Enhance knowledge on solar and wind energy.
CO3	Get aware about different source of renewable energy.
CO4	Learn various sources of energy
CO5	Will gain knowledge on energy management
CO6	Will understand the importance of saving fuels

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

		a	b	c	d	e	f	g	h	i	j	k	l
1	COs/POs												
2	CO1	L											
	CO2	L						H			H	H	H
	CO3	L		M	M			H	L		H	H	H
	CO4				M				L		H	H	H
	CO5				M			H			H	H	H
	CO6							H			H	H	H

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
							√		
4	Approval		37th Meeting of Academic Council, May 2015						

UNIT I WIND ENERGY 9

Introduction-Location of Wind Generators-Types of Windmills-Induction and Synchronous Systems

UNIT II SOLAR ENERGY 9

Principle of Conversion of Solar Radiation into Heat, Types of Solar Thermal Collectors- Flat Plate And Concentrating Collectors(Parabolic, Trough, Minor Strip, Fresnel Lens and Compound Parabolic Concentrator), Comparison of Collectors, Selective Absorber Coatings, Solar Thermal Power Plant

UNIT III SOLAR ENERGY STORAGE AND APPLICATION 9

Solar energy storage systems- thermal, electrical, chemical, mechanical and electromagnetic, solar pond. Application of solar energy- solar thermoelectric conversion- solar photo voltaics, solar heating and cooling of buildings, solar distillation, solar pumping and solar cookers. System of solar cell power plant- direct grid connection through electronic control devices

UNIT IV BIO- MASS 9

Sources Of Bio-Mass Energy- Wood And Agricultural Waste- Municipal Waste- Animal Waste- Energy Conservation Systems- Biogas Generation From Animal Waste- Wood Gasification- Downdraft And Fluidized Bed Systems- Alcohol Fuels

UNIT V OTHERSOURCES 9

Wave Energy- Scope and Simple Systems for Power Generation, Tidal Power- Scope and Applications, Otec-Scope, Fundamental Principles and Operating System for Power Generation

TEXTBOOK:

1. 1. Rai,G.D. Non – Conventional Sources of Energy, Khanna publications, 4th edition 2004
2. Le Gouries.D, Wind Power Plants, Theory and Design –permagon press,1982.

REFERENCES:

1.David M.Eggleston and Forrest S.Stoddard,Wind Turbine Engineering Designing- Van Noustrand 1987

2.F.S.seiler, Alternate Energy Vehicle Information, Wind Book Inc.,1977

3. Barbara Keiler, Energy Alternatives,Luscentr Books,1990
4. T.Nejat Veziroygal, Alternative Energy Sources-III,Hemisphre Publishing co.,1989.
5. www.studynama.com/.../357-**Renewable-energy-sources-ebook-pdf**-lect..

BGE004	**ELECTRONICS FOR MECHANICAL SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – MECHATRONICS				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To enable the students to understand the fundamental concepts of Semi Conductors, Transistors, Rectifiers, Digital Electronics and 8085 Microprocessors

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students can able to design mechatronics system with the help of Microprocessor,
CO2	Also using PLC and other electrical and Electronics Circuits.

CO3	Learn the concepts of transistors
CO4	Learn the concepts of rectifiers
CO5	Learn the concepts of digital electronics
CO6	Learn the concepts ofresistors

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	H											
	CO211		H						H				
	CO3			H		M							H
	CO4				M		L	M		L			
	CO5										L	L	
	CO6												

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
							√		

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I DIGITAL ELECTRONICS 9

Basic logic Gates - Application of logic gates – De-Morgan's theorem-Boolean Expression-Minimization of Boolean expression-Minterm - Maxterm-Sum of Products(SOP)-Product ofSum(POS)–K-MAP- Digital Comparators – Code Converter – Adders – Sequential logic – Flip flops – SR/JK/D – Counters – Synchronous and Asynchronous – Shift registers – Memory I.C's – RAM, ROM, EPROM – Multiplexers – Demultiplexers - Decoders – Encoders.

UNIT II SIGNAL GENERATORS 9

Operational Amplifier / Inverting / Noninverting / Summing / Integrating / Differential / Logarithmic –Bridge Measurements-Maxwell,Hay,Schering,Andeson,Weinbridge,Wheat Stone Bridge - Comparison of Analog& Digital Techniques, Electronic multimeter,Function generator-Pulse and Square wave Generator-Harmonic Distortion

UNIT III 8085 ARCHITECHTURE 9

Block diagram with CPU – Input/output – Components and features of CPU – Program Instructions -Control Unit - Arithmetic logic unit – Registers – Significance of data, address and control bus – Architecture of Intel 8085A and Pin Configuration.

UNIT IV MICROPROCESSOR PROGRAMMING 9

Programming concepts – Machine code – Hex code – Basic concepts of assembly language – Instruction sets – Addressing modes – Assembly language programming examples – Addition of 8 bit numbers in two memory addresses – Subtraction, Multiplication – Division -Determination of the biggest number in the list of numbers - Counting – sorting – Delay subroutine – Delay with stepper motors.

UNIT V APPLICATIONS IN MECHANICAL SYSTEMS 9

Introduction-Generation of I/O ports-Programmable peripheral Interface(PPI)- Intel 8255 - Keyboard and Display Controller(8279) ,Traffic light control-washing Machine control –DC Motor-Stepper Motor- D/A Converters- A/D converters–Automotive applications – Antilock braking – Steering – transmission and suspension systems- Illustrative Examples.

TEXTBOOKS:

1.Goankar R.S., Microprocessor Architecture programming and Applications, New Age International.2006.

2.W.Bolton, Mechatronics, Addison Wesley Longman, 2006.

REFERENCES:

1. M.Morris Mono, Digital Design, 3rd Edition, Prentice Hall of India Pvt Ltd.,2003/Pearson Education(Singapore) Pvt Ltd.,New Delhi.,2003.
2. Malvino A.P., Digital Electronics, Principle and Applns.-TMH 1989V.K. Mehta, Principle of Electronics, S.Chand& Company, 2007.
3. Kenneth J.Ayala."The 8086 Microprocessor: Programming & Interfacing the PC"Delmar Publishers, 2007.
4. Douglas V., Hall, Microprocessors Interfacing,Programming And Hardware, TMH 2007.
5. https://www.amazon.com/**Mech**atronics-**Electronic-mechanical**...**ebook**

NON MAJOR ELECTIVE-II

BGE005	**INDUSTRIAL ROBOTICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – EMS				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVE:

- To understand the basic concepts associated with the design and Functioning and applications of Robots To study about the drives and sensors used in Robots
- To learn about analyzing robot kinematics and robot programming

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students can able to apply the basic engineering
CO2	To learn about knowledge for the design of robotics.
CO3	Will understand robot kinematics and robot programming.
CO4	Will understand application of Robots
CO5	To learn about force and torque sensing

CO6	To learn about application of robot

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	D	e	f	g	h	i	j	k	l
2	CO1	M											
	CO2					H			M				H
	CO3	M											H
	CO4					H					L		H
	CO5	M		H		H							H
	CO6	M											

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO ROBOTICS 9

Definition of Robot – Laws of Robotics – Basic concepts – Robot Configuration – Types of Robot drives – Basic Robot motions – Point to Point control – Continuous path control – Accuracy and repeatability.

UNIT II COMPONENTS OF ROBOTICS 9

Control system components-Control system analysis–Actuation and feed back– manipulators – Direct kinematic model and inverse kinematic model – Coordinate transformation – Robot dynamic modeling – Types of Robot and end effectors - Tools as end effectors

UNIT III SENSING AND MACHINE VISION 9

Range sensing – Proximity sensing – touch sensing – force and torque sensing.
Introduction to machine vision – Sensing and digitalizing – Image processing and analysis.

UNIT IV ROBOT PROGRAMMING 9

Methods online/ offline – Show and teach – Teach pendant – lead and teach – Languages Explicit – task level – capabilities and limitation – Artificial intelligence – Knowledge representation – Search techniques.

UNIT V ROBOT APPLICATIONS 9

Applications of robots in machining – Welding – Assembly – Material handling – processing –

Loading and un loading – CIM inspection – Hostile and remote environments – Non industrial applications.

TEXTBOOK:

1. Michael P.Groover, Mitchell Weiss, Industrial Robotics Technology Programming and applications, - McGraw Hill International Editions, 1989.

References:

1. K.S.Fu., R.C. Gonalez , C.S.G. Lee, Robotics, Control sensing, Vision and Intelligence, - McGraw Hill International Editions, 1987.
2. Michael – B.Histland, David. G. Aliatoce., Introduction to Mechatronics and Measurement Systems, McGraw Hill International. Edition, 1999.
3. www.e-booksdirectory.com › Engineering

BGE006	**POWER PLANT ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – NEW AND RENEWABLE SOURCES OF ENERGY, BME				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To understand the various components, operations and applications of differenttypes of power plants .

COURSE OUTCOMES (COs)

CO1	Student learns the types of power plants
CO2	Student learns the working of generators
CO3	Student learns the working of turbines
CO4	Student learns the principle of working in power plants
CO5	Student learns the installation methods
CO6	Student understands the installation of nuclear power plants and their adv and disadvantages

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2			H		L				H		L	
	CO3	H					M						
	CO4			H		L		M					L
	CO5									H			
	CO6	H				L							L

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
						√			
4	Approval		37th Meeting of Academic Council, May 2015						

UNIT I STEAM POWER PLANT 9

Various components ,types of firing systems-pulverized fuel, tilting and tangential systems, fluidized bed combustion system, coal handling systems-crushers, feeders, ash handling system-Dust collectors ID and FD fans-flue stack, Feed pumps, Economizers, Air preheaters, Super heaters, Reheaters, Condensers- Types.

UNIT II STEAM GENERATORS AND POWER CYCLES 9

Boilers-types-Boiler efficiencies, combustion calculations, equivalent evaporation, Boiler power, cooling towers-tower characteristics. Review of Rankine cycle-reheat, regeneration with open and closed type of feed water heaters and their representation in T-S diagram

UNIT III NUCLEAR, HYDEL AND GAS TURBINE POWER PLANTS 9

Nuclear energy,Fission,Fusion reaction, chain reaction, parts and types, waste disposal and safety in nuclear plants,Hydel plants-classification, selection of turbines, pumped storage system, performance evaluation of turbines. Gas turbine plants-open and closed cycles-combined cycle plants and their representation in T-S diagram

UNIT IV NON CONVENTIONAL ENERGY BASED POWER PLANTS 9

Wind energy, wind mills, wind forming, site selection and limitation, tidal power plants, solar energy-Various solar power energy systems, geothermal energy, Fuel cells, thermionic and thermo electric converters, magneto hydro dynamic plant.

UNIT V ECONOMICS OF POWER GENERATION 9

Load duration curves, power plant economics, fixed and operating costs, Load sharing and plant selection, Economical comparison of various power plants and co-generation. Environmental consideration of various power plants-CO_2, SO_2, NOx and particulate emissions and their control

TEXT BOOK:

1. P.K.Nag-Power plant Engineering-Tata McGraw Hill publishers, 2008

REFERENCES:

1. G.R.Nagpal- Power plant Engineering-Khanna publishers, Delhi, 1998
2. G.D.Rai-Non Conventional sources of Energy, 2004.
3.G.D.Rai-Power plant Engineering, Khanna publishers, 2000.
4.https://memechanical**engineering**.files.wordpress.com/.../power-plant-**eng**...

BGE007	GAS DYNAMICS AND SPACE PROPULSION	L	T	P	C
	Total Contact Hours – 45				
	Prerequisite – HEAT AND MASS TRANSFER	3	0	0	3
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVE:

- To impart knowledge to the students on compressible flow through ducts, jet propulsion and space propulsion.
- To understand the basic difference between incompressible and compressible flow.

To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.

Course Outcomes

CO1	Will get knowledge to the students on compressible flow through ducts, jet propulsion and space propulsion.
CO2	Will understand the basic difference between incompressible and compressible flow.
CO3	Will understand the phenomenon of shock waves and its effect on flow.
CO4	Will understand the jet propulsion
CO5	To learn about the rocket propulsion
CO6	To learn about the types of rocket engine

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	K	L
2	CO1	H											
	CO2		M										
	CO3			H	M		H			H			
	CO4					L			M				M
	CO5							L			L	L	
	CO6												

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
							√		

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I BASIC CONCEPTS OF COMPRESSIBLE FLOW 9

Compressible fluid flow-energy and momentum equations, stagnation stages, various regions of flow, reference velocities, effect of Mach number on compressibility. Types of waves, Mach cone, Mach angle.

UNIT II FLOW THROUGH DUCTS 9

Flow through variable area ducts-nozzles and diffusers, Mach number variation, stagnation and critical states, area ratio as a function of Mach number.
Flow through constant area ducts-with friction (Fanno flow), with heat transfer (Reyleigh flow), Variation of flow properties. Use of Gas Tables and Charts.

UNIT III NORMAL AND OBLIQUE SHOCKS 9

Governing equations, variation of flow parameters across the normal and oblique shocks. Prandtl Meyer relations. Flow in variable area ducts with normal shocks. Use of Tables and Charts.

UNIT IV JET PROPULSION 9

Types of jet engines-turboprop, turbojet, ramjet, pulsejet. Aircraft propulsion theory, performance analysis of jet engines, parameters affecting flight performance, thrust augmentation.

UNIT V ROCKET PROPULSION 9

Types of rocket engines, propellants, combustion instabilities, rocket propulsion theory, performance of rocket engine, multistage rockets, orbital and escape velocities.

TEXTBOOKS:

1. Yahya S.M. Fundamentals of Compressible Flow, New Age International (P) Ltd., New Delhi, 2003.
2. Ganesan V, Gas Turbines, Tata McGraw-Hill Publishing Company Ltd., 2003.

REFERENCES:

1. Philip G Hill and Carl R. Peterton, Mechanics and Thermodynamics of Propulsion, Addison-Wesley Publishing Company, 1999.
2. Khajuria P.R and Dubey S.P., Gas turbines and Propulsive Systems, Dhanpat RaiPublications (P) Ltd, New Delhi 2003.
3. Cohen H. Rogers GFC, Saravanamuttoo HIH, Gas Turbines Theory, Addison-Wesley Long man Ltd., 2001.
4. freecomputerbooks.com/**Total-Quality-Management**-and-Six-Sigma.htm.

BBA008	**TOTAL QUALITY MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

1. To introduce to the student about the basic terms related to quality and concepts of quality management
2. To familiarize the student about the basic principles of total quality management
3. To acquaint the student with the basic statistical tools used in process control
4. To introduce to the student about the various tools used in implementing and checking total quality management
5. To familiarize the student about the different quality systems used in auditing the quality of a company/industry/organization

COURSE OUTCOMES (COs)

CO1	By understanding about various quality terms, it will be helpful for the student to maintain quality in his/her organization
CO2	The student will be able to formulate new plans/procedures to be implemented to achieve the desired quality status by knowing about the various principles of quality management
CO3	The student will be able to analyze the periodical data in quality control using statistical tools
CO4	The total quality management tools will help the student to understand the procedures in measuring the quality of the organization/process and will also enable him/her to identify the parameters that are improving/depriving the quality
CO5	By knowing about the quality ISO systems, the student will be maintain processes/documentation properly so that the quality maintained by his/her organization gets recognized
CO6	As a whole the students will understand the importance of quality in all the fields of engineering and the social circle.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (GOE	Project/ Seminar/ Internship (PR)
							√		
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – AnalysisTechniques for Quality Costs, Basic concepts of Total Quality Management, HistoricalReview, Principles of TQM, Leadership – Concepts, Role of Senior Management,Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers toTQM Implementation

UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, ServiceQuality, Customer Retention, Employee Involvement – Motivation, Empowerment,Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership –Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development,Performance Measures – Basic Concepts,

Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendencyand Dispersion, Population and Sample, Normal Curve, Control Charts for variables andattributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality FunctionDeployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality LossFunction, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA –Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System –Elements, Implementation of Quality System, Documentation, Quality Auditing, TS16949, ISO 14000 – Concept, Requirements and Benefits

TEXT BOOKS:

1. Dale H.Besterfiled, et al., "Total Quality Management", Pearson Education, Inc.2003. (Indian reprint 2004). ISBN 81-297-0260-6.

REFERENCE BOOKS:

1. Evans. J. R. & Lindsay. W,M "The Management and Control of Quality", (5th Edition),South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991.
3. Oakland.J.S. "Total Quality Management", Butterworth Hcinemann Ltd., Oxford,1989.
4. Narayana V. and Sreenivasan, N.S. "Quality Management – Concepts and Tasks",New Age International 1996.
5. Zeiri. "Total Quality Management for Engineers", Wood Head Publishers, 1991.
6.freecomputerbooks.com/**Total-Quality-Management**-and-Six-Sigma.htm

NON MAJOR ELECTIVE-III

BGE009	**NUCLEAR ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – THERMAL ENGINEERING				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVE:

To gain some fundamental knowledge about nuclear physics, nuclear reactor, nuclear fuels, reactors and safe disposal of nuclear wastes.

COURSE OUTCOMES (COs)

CO1	Will gain some fundamental knowledge about nuclear physics.
CO2	Will acquire knowledge about nuclear reactor.
CO3	Will understand about nuclear fuels and will become capable of handling nuclear waste.
CO4	Will understand about core thermal design
CO5	Will understand about Disposal of Radio active waste

CO6	To learn about boiling water reactor

	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low												
1	COs/POs	a	b	c	D	e	f	g	h	i	j	k	l
2	CO1	M											
	CO2					H			M				H
	CO3	M											H
	CO4					H					L		H
	CO5	M		H		H							H
	CO6												

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
							√		

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I ATOMIC STRUCTURE AND NUCLEAR REACTORS & NEUTRONS AND INTERACTION 8

Atomic structure, Nuclear Equation- Energy from nuclear reactions –fusion and fission, nuclear technology, conversion and breeding –Radio activity, effect of radiation. Thermal neutrons, buckling factor, nuclear cross-section, Neutron flux, Volumetric Thermal Source strength-Fission, cross-section in reactors.

UNIT II NEUTRON FLUX DISTRIBUTION 10

Neutron life cycle, neutron conservation equation, diffusion equations, reflectors and their effect, Reactivity and reactivity period-Multiplication factor. Void and Void factor, Flow and non-flow system, simple problems-Boiling and non boiling heights, Friction drop in a two-phase channel

UNIT III REACTOR HEAT GENERATION 8

Heat conduction in reactor elements, heat flow of solid planes.Types of fuel elements. Heat flow out of spherical fuel elements, Effect of cladding and coolant absorption of core radiation, Heat removal in slab subjected to radiation, problems, Thermal shields, secondary Radiation

UNIT IV CORE THERMAL DESIGN 10

General consideration ,Arial Temperature ,Distribution of fuel element and coolant, Maximum temperature in fuel elements, Problems, coolant channel orificing, hotspot factors, Core thermal design ,selection of fuel materials, cladding, coolant, moderator, control rods- structural parts-safety considerations and site solution –Disposal of Radio active waste

UNIT V REACTORS 9

Boiling water reactor- B.W.R modified Rankine cycle, Heavy water reactors, as cooled Reactor, liquid metal cooled reactor, Compatibility of liquid metal coolant. Site layout, Shielding and containment decontamination, Hazard evaluation and likening.

TEXT BOOKS:

1. M.M.E.I Wakil, Nuclear Power Engineering, International Textbook Company.

REFERENCES:

1. R.L.Murray, Introduction to Nuclear Engineering, Prentice hall.
2. M.M.E.I Wakil, Nuclear Power Engineering ,International Textbook company
3. Gasstone, Nuclear Reactor Engineering ,CBS 1998
4. M.M.E.I Wakil, Nuclear energy conservation, International Textbook Company.
5. www.springer.com/us/book/9783642488788

BGE010	**RAPID PROTOTYPING**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	3	0	0	3
	Prerequisite – MANUFACTURING TECHNOLOGY				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To provide knowledge on different types of Rapid Prototyping systems and its applications in various fields.

COURSE OUTCOMES (COs)

CO1	Generating a good understanding of RP history, its development and applications. Expose the students to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.
CO2	Students will be exposed to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.
CO3	Students will understand steriolithography methods
CO4	Students learn processes of CAD
CO5	Students gain knowledge to develop prototypes
CO6	Students learn the concepts of rapid tool processing

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2	H		H	M					H			H
	CO3			H			M						H
	CO4	H		H					M			L	L
	CO5	H											L
	CO6												

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
							√		
4	Approval		37th Meeting of Academic Council, May 2015						

UNIT I INTRODUCTION 10

Basic operation –impact of rapid proto typing and tooling on product development- benefits-applications.

UNIT I RAPIDPROTOTYPINGPROCESSES 10

Introduction –Classification-laminated object manufacturing-fused deposition modeling-stereolithography-solid ground curing –selective laser sintering-3D printing

UNIT III CADPROCESSES 10

Introduction –data requirements-solid modeling –surface modeling .geometric processing – interface formats-model preparation-slicing, support structures and machine instructions

UNITIV MATERIALS FOR RAPID PROTOTYPING 5

Plastics- resins -metals-ceramics selection of materials for suitable processes – advantages-limitations

UNIT V RAPID TOOLING PROCESSES 10

Introduction - Classification in direct rapid tooling-silicon rubber Moulding-epoxy Moulding-electro forming-vacuum casting-vacuum forming-rapid tools for injection Moulding – direct rapid cooling processes –SLS rapid tool- shape deposition manufacturing- laser deposition lamination-rapid tooling roots

TEXTBOOKS:

1. Ibrahim Zeid, CAD/CAM theory and practice, Tata Mc Graw hill, 2005

REFERENCES :

1. Paul F. Jacobs, RapidPrototyping and Manufacture. Fundamentals of Stereolithography,1995
2. RapidPrototyping reports, CAD/CAM publishing ,1991
3. Rapid News, University of Warwick. UK 1995
4. Rapid tools for Injection Moulding (www.vmreg.com/raptia/reports/CRIF.pdf)Applications of RP techniques for sheet metal forming (www.raptia.org) Medical RP applications (http://home.att.net/-rppat /museum/mus-5.htm)

	COMPUTATIONAL FLUID DYNAMICS	L	T	P	C
	Total Contact Hours – 45	3	0	0	3

BGE011	Prerequisite – FMM
	Course Designed by – Department of Mechanical Engineering

OBJECTIVE:

- To impart the knowledge of numerical techniques to the solution of fluid dynamics and heat transfer problems.
- To introduce Governing Equations of viscous fluid flows.
- To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers
- To enable the students to understand the various discretization methods, solutionprocedures and turbulence modeling.

COURSE OUTCOMES (COs)

CO1	Will acquire knowledge of numerical techniques to the solution of fluid dynamics and heat transfer problems.
CO2	Will get introduced to Governing Equations of viscous fluid flows
CO3	students will be enabled to understand the various discretization methods, solutionprocedures and turbulence modeling.
CO4	To learn about calculation of flow field
CO5	To study about TURBULENCE AND ALGEBRAIC MODELS
CO6	To study of heat conduction of FEA

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	D	e	f	g	h	i	j	k	L
2	CO1	M											
	CO2					H			M				H
	CO3	M											H
	CO4					H					L		H
	CO5	M		H		H							H
	CO6	M											

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
							√		

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I GOVERNING DIFFERENTIAL EQUATIONS 9

Conservation of chemical species-The energy equation-Momentum equation-time averaged equations for turbulent flow-Turbulence-Kinetic energy equation-The general differential

equation-Nature of co-ordination-Independent variable-Choice of co-ordinates-one way and two way coordinates

UNIT II DISCRETIZATION METHODS 9

Nature of numerical methods-Methods of deriving of discretization equations-Taylor series formulation-Variational formulation-Methods of weighted residuals-Control volume formulation

UNIT III HEAT CONDUCTION, CONVECTION AND DIFFUSION 9

Steady One Dimensional Conduction- Two and three dimensional conduction-Steady one dimensional convection and diffusion-Discretization equations for two dimensional convection and diffusion

UNIT IV CALCULATION OF FLOW FIELD 9

Representation of pressure-gradient and continuity equation-stagged grid-momentum equations-pressure and velocity correction-pressure correction equation.Introduction to Finite Element Method-solution of steady heat conduction by FEM-incompressible flow-simulation by FEM.

UNIT V TURBULENCE AND ALGEBRAIC MODELS 9

One, two equation model-high and low Reynolds number models-Reynolds stress models-Prediction of fluid and heat transfer using standard codes.

TEXTBOOKS:

1.Yunus Cengel.,John Cimbala., Fluid Mechanics,TMG.,2014.
2.S .Malasangara., An Introduction to Computational Fluid Dynamics.,2nd edition.,TMG.,2010.

REFERENCES:

1. K.Muralidhar & T.Sundarrajan-Computational Fluid Flow and Heat Transfer-Narosa, 2003
2. P.S.Ghoshdastidar-Computer Simulation of Flow and Heat Transfer-Tata McGraw Hill Publishing Company Ltd 1998.
3. H.K.Versteeg&W.Malalasekara-An Introduction to Computational Fluid Dynamics-Longman.
4. **book**boon.com/en/**computational-fluid-dynamics-ebook**

BGE012	**MEMS AND NANOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – RAPID PROTOTYPING				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVE:

- To inspire the students to expect to the trends in development and synthesizing of nano systems and measuring systems to nano scale.
- To expose the students to the evolution of Nano systems, to the various fabrication techniques.
- Also to impart knowledge to the students about nano materials and various nano measurements techniques.

COURSE OUTCOMES (COs)

CO1	The students are expected to understand the general issues relating to nanotechnology and nanofabrication.
CO2	Methods for production of Nanoparticles.
CO3	Characteristic techniques of nanomaterials.
CO4	To expose the students to the evolution of Nano systems, to the various fabrication techniques.
CO5	Also to impart knowledge to the students about nano materials and various nano measurements techniques
CO6	Introduction of industrial application

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	L
2	CO1	M											
	CO2					H			M				H
	CO3	M											H
	CO4					H					L		H
	CO5	M		H		H							H
	CO6	M											

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
							√		

4	Approval		37th Meeting of Academic Council, May 2015

UNIT – I INTRODUCTION **9**

Historical background development of microelectronics, evolution of micro sensors, MEMS, emergence of micro machines.

Micro sensors: Introduction, thermal sensors, mechanical sensors, flow sensors and Introduction to SAW DEVICES

UNIT – II MEMS MATERIALS AND PROCESSING **9**

Overview, metals, semiconductors, ceramic, polymeric and composite materials, Microstereolithography: Introduction, Scanning Method, Projection Method, Applications. LIGA Process: Introduction, Basic Process and Application.

UNIT – III MICRO SYSTEM FABRICATION PROCESSES **9**

Photolithography, Chemical Vapor Deposition, Etching, Bulk and Surface Micro Manufacturing.

UNIT – IV NANO-TECHNOLOGY **9**

Introduction to Nanotechnology, The nanoscale. Consequences of the nanoscale for technology

and society. - Technologies for the Nanoscale, Top-down versus bottom-up assembly. Visualisation, manipulation and characterisation at the nanoscale, Proximal probe technologies. Self-assembly.

UNIT – V NANO SCALE MANUFACTURING: 9

Nanomanipulation, Nanolithography - An introduction to tribology and its industrial applications – Nanoscale Materials and Structure, Nanocomposites, Safety issues with nanoscale powders - Applications, Applications in energy, informatics, medicine, etc

TEXT BOOKS:

1. Mark Ratner & Daniel Ratner , Nano Technology, Pearson Education,2003.
2. Tai – Ran Hsu, " MEMS & MICROSYSTEMS Design and Manufacturing", TATA McGRAW- HILL, 2002
3. S.M. Sze, Semiconductor Sensors, John Wiley & Sons, INC., 1994.

REFERENCES:

1. Marc J. Madou, "Fundamentals of Microfabrication", II Edition, CRC Press, 2002.
2. Mohamed Gad-el-Hak, The MEMS Handbook, CRC Press, 2002
3. M.Elwenspoek, R.Wiegerink, Mechanical Microsensors, Springer-Verlag Berlin Heidelberg, 2001.
4. David Ferry, Transport in Nanostructures, Cambridge University Press, 2000.
5. S. Datta, Electron Transport in Mesoscopic Systems, Cambridge University Press, 1995.
6. Beenaker and Van Houten, Quantum Transport in Semiconductor Nanostructures, in Solid State Physics v. 44, eds. Ehernreich and Turnbull, Academic Press, 1991.
7. P. Rai-Choudhury, Handbook of Microlithography, Micromachining &Microfabrication, SPIE, 1997.

8.www.springer.com/us/book/9783319007793

OPEN ELECTIVE-I

BBA001	PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management Studies				

OBJECTIVES

- Familiarize the students with the fundamental concepts of Management and to highlight the approaches in organization behavior

COURSE OUTCOMES (COs)

CO1	Understanding the concepts of Management
CO2	Knowledge on Management Functions
CO3	Understanding the Organization Theory & Approach.
CO4	Knowledge on the Concepts of Motivation
CO5	Clear insight on the factors contributing to discipline
CO6	In-depth Understanding about the concepts of Group Behavior
	Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	H								
	CO2				H					H			H
	CO3	L						H					H
	CO4		L					H		M			H
	CO5												H
	CO6									M			H
3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)				
								√					
4	Approval		37th Meeting of Academic Council, May 2015										

UNIT -I NATURE OF MANAGEMENT 9

Definition – theory and practice – effective management – Management : Science of Art – Management in India. Development of Management thoughts – Taylor's – Henry Fayol – Hawthrone experiment – Barnard & Social system – Herbert Simon – Peter Drucker – Various approaches – Management thoughts.

UNIT- II MANAGEMENT PROCESS 9

Co-ordination – Functions of management – Managers and environment – External and internal Business Ethics – Planning – Fundamentals – Definitions & Features – Steps in planning – types of planning – Objectives – Concepts and features – Hierarchy of objectives – role – Process of MBO – Policy & Strategy – Decision making process – Individual Vs Group Decisions.

UNIT- III ORGANIZATION STRUCTURE 9

Organizing – Theory & Approach –Authority & Responsibility – Delegation – Centralization & Decentralization – Line & Staff Relationship – Staffing – Fundamentals – System approach – Manpower Planning – Recruitment & Selection – Training and development – Performance appraisal – Direction – Fundamentals Motivation – Theories of Motivation-Maslow's Hersberg's MaClelland's theory X,Y & Z leadership – Theories and Styles – Communication – Type – Controlling – System and Process.

UNIT- IV ORGANIZATIONAL BEHAVIOUR 9

Definition – Organization – Managerial Role and Functions – Organizational Approaches, Individual behaviour – Causes – Environmental effect – Behaviour and performance, perception – Organizational implications, Personality – Contributing factors – Dimension, Motivation – Need Theories – Process Theories – Job satisfaction, Learning and Behaviour – Learning Curves, Work Design and Approaches.

UNIT -V GROUP BEHAVIOUR 9

Groups – Contributing factors –Group Norms, types – Causes – Intergroup relations – Conflict and Resolution – Change Process –Resistance to change.

TEXT BOOKS:

1. Herald Knootz and Heinz weihrich, 'Essentials of Management', McGraw Hill Publishing Company, Singapore International Edition, 2004.
2. Ties AF, Stoner and R. Edward Freeman, "Management" Prentice Hall of India Pvt. Ltd., New Delhi -110011, 1995.

REFERENCE BOOKS :

1. Joseph I. Massie 'Essentials of Management', Prentice Hall of India Pvt. Ltd., New Delh-110011, 2004.
2. L.M. Prasad "Principles and Practice of Management", Sultan Chand & Sons.2001
3. Uma Sekaran, "Organizational Behaviour", Tata McGraw Hill, 2007
4. https://www.extension.harvard.edu

BBA002	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES:

- To learn about types of entrepreneurship.
- To study about major motivation methods.
- To study about government policies for small scale industries

COURSE OUTCOMES (COs)

CO1	To learn difference between entrepreneur and intrepreneur.
CO2	To learn about entrepreneurship development programs.
CO3	To study about economic feasibility methods.
CO4	To learn about taxation.
CO5	To study about corrective measures methods.
CO6	To learn about Steps Involved in Setting up a Business

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	G	h	i	j	k	l
2	CO1												
	CO2	M			M				M				H
	CO3							H			H		H
	CO4					L			M				H
	CO5		L								H		

	CO6	L				L								
3	Category	Humanities and Social studies (HS)		Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/ Seminar/ Internship (PR)			
									√					
4	Approval		37th Meeting of Academic Council, May 2015											

UNIT I ENTREPRENEURSHIP 8

Entrepreneur- Types of Entrepreneurs - Difference Between Entrepreneur and Interpreneur- Role of Entrepreneurship in Economic Growth- Women and Rural Entrepreneurship - Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION 8

Major Motives Influencing Entrepreneur – Achievement Motivation Training, Self Rating – Business Game – Thematic Apperception Test – Stress Management – Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9

Small Enterprise – Definition, Classification – Characteristics- Ownership Structure – Project Formulation – Steps Involved in Setting up a Business – Identifying, Selecting a Good Business Opportunity- Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports- Project Appraisal- Sources of Information- Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 10

Need – Sources of Finance- Terms Loans, Capital Structure- Financial Institutions, Management of Working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/ CPM –Taxation – Income Tax – Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 10

Sickness in Small Business- Concept, Magnitude, Causes and Consequences, Corrective Measures- Government Policy for Small Scale Enterprises- Growth Strategies in Small Industry – Expansion- Diversification, Joint Venture, Merger, Sub Contracting.

TEXT BOOKS:

1. S.S.Khanka, "Entrepreneurial Development", S. Chand & Co. Ltd., Ram Nagar, New Delhi, 1999.
2. Hisrich RD and Peters MP, "Entrepreneurship", 5th Edition, Tata McGraw Hill, 2002.

REFERENCES:

1. RabindraKanungo, "Entrepreneurship and Innovation" , Sage Publications, New Delhi, 1999
2. ED II. Faculty & External Experts-A Hand book for New Entrepreneurs Publishers: Entrepreneurial Development, Institute Of India, and Ahmedabad, 1986.

3. depintegraluniversity.in/userfiles/**Entrepreneurship**%20**Development**.**pdf.**
4. bookboon.com/en/**entrepreneurship-ebooks**

BBA003	**MARKETING MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours –45	3	0	0	3
	Prerequisite – TQM& Professional Cour4ses				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES

- To learn about consumer marketing.
- To study about demographic factors
- To study about retailing process

COURSE OUTCOMES (COs)

CO1	To learn marketing concepts between industry andconsumer.
CO2	To learn about demographic factors.
CO3	To study about pricing methods.
CO4	To learn about portfolio analysis.
CO5	To study about advertising and sales methods.
CO6	Learn to be an entrepreneur

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1												
	CO2	M			M				M				H
	CO3							H			H		H
	CO4					L			M				H
	CO5		L								H		
	CO6	L				L							

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
								√	

4	Approval		37th Meeting of Academic Council, May 2015

UNIT I INTRODUCTION 9

Definition- Marketing Process- Dynamics- Needs- Wants and demands-Marketing Concepts- Environment- Mix- Types- Philosophies- Selling Vs Marketing- Organizational- Industrial Vs Consumer Marketing- Consumer Goods- Industrial Goods- Product Hierarchy.

UNIT II BUYING BEHAVIOUR & MARKET SEGMENTATION 9

Cultural- Demographic Factors- Motives- Types- Buying Decisions- Segmentation factors- Demographic- Psychographic & Geographic Segmentation- Process- Patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives- Pricing- Decisions & Pricing Methods- Pricing Management- Introduction- Uses- Process of Marketing Research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan- Strategy formulation and marketing process- Implementation- Portfolio analysis- BCG- GEC grids.

UNIT- V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9 Characteristics- Impact- Goals- Types- Sales promotion- Point of Purchase- Unique selling proposition- Characteristics- Whole selling- Retailing- Channel Design- Logistics- Modern trends in retailing.

TEXT BOOKS:

1. Ramasamy and Namakumari, "Marketing Environment: Planning, Implementation and Control the Indian Context",2002
2. Govindarajan.M, "Industrial Marketing Management:", Vikas Publishing Pvt. Ltd, 2003

REFERENCES:

1. Philip Kotler, Marketing Management, Analysis, Planning, Implementation and Control, 1998.
2. Khanna O.P. – Industrial Engineering and Management, Khanna Publishers, New Delhi, 2000.
3. Green Paul.E and Donald Tull, "Research for Marketing Decisions", Prentice Hall of India. 1995
4. Donald S. Tull and Hawkins, "Marketing Research", Prentice Hall of India- 1997.
5. bookboon.com/en/**marketing**-media-**ebooks**

BBA009	**INTELLECTUAL PROPERTY RIGHTS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Value Education and Professional Ethics & Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

Strong intellectual property rights (IPR) protection is crucial to fostering trade, and achieving the goals and benefits of global integration. Countries with high standards of IPR protection tend to attract more investment, stimulate more innovation, thereby developing more rapidly. Countries with inadequate protection are often vulnerable to infringements of intellectual property rights that hinder trade flow and economic development.

Hence, the objective is to introduce IPR to the UG Engineering and Technology students.

COURSE OUTCOMES (COs)

CO1	Understand the principles, function and basic legal rules of IP Law.
CO2	Recognize the relevant criteria for generating and protecting intellectual works.
CO3	Recognize the intellectual property likely to be produced in the academic and professional environment.
CO4	Demonstrate appreciation and critical awareness of pertinent IP issues in the academic and professional lives.
CO5	Understand the relevance and impact of IP Law on academic/scientific works/studies.
CO6	Understand the different forms of infringement of intellectual property rights.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					H					H	
	CO2		H		M					H			
	CO3	M							M		H		
	CO4			M	H							H	
	CO5							M					
	CO6	H			H					M			L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I PROPERTIES AND TYPES 9

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i). Movable Property ii. Immovable Property and iii. Intellectual Property.

UNIT II PATENTS AND RIGHTS 9

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures..

UNIT III INTERNATIONAL TRADE 9

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV WTO 9

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V CASE STUDIES 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TEXT BOOKS:

1. Subbaram N.R. "Handbook of Indian Patent Law and Practice ", S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.

REFERENCES:

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.
4. www.ipmatters.net/features/000707_gibbs. html.
5.http://www.metastudio.org/Science%20and%20Ethics/file/readDoc/535a76367d9d331598f49e2d/34_Hb_on_IPR.pdf

OPEN ELECTIVE-II

BBA 004	ENGINEERING ECONOMICS AND FINANCIAL MANAGEMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept. of Management Studies				

OBJECTIVES

- Acquire knowledge of economics to facilitate the process of economic decision making
- Acquire knowledge on basic financial management aspects
- Develop the skills to analyze financial statements

COURSE OUTCOMES (COs)

CO1	Evaluate the economic theories, cost concepts and pricing policies
CO2	Understand the market structures and integration concepts

CO3	Understand the measures of national income, the functions of banks and concepts of globalization
CO4	Apply the concepts of financial management for project appraisal
CO5	Understand accounting systems
CO6	analyze financial statements using ratio analysis

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low**1**

1	COs/POs	a	b	c	d	e	F	g	h	i	j	K	l
2	CO1												
	CO2	M			M				M				H
	CO3							H			H		H
	CO4					L			M				H
	CO5		L								H		
	CO6	L				L							

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
								√	

4	Approval		37th Meeting of Academic Council, May 2015

UNIT- I ECONOMICS, COST AND PRICING CONCEPTS 9

Economic theories – Demand analysis – Determinants of demand – Demand forecasting – Supply – Actual cost and opportunity cost – Incremental cost and sunk cost – Fixed and variable cost – Marginal costing – Total cost – Elements of cost – Cost curves – Breakeven point and breakeven chart – Limitations of break even chart – Interpretation of break even chart – Contribution – P/V-ratio, profit-volume ratio or relationship – Price fixation – Pricing policies – Pricing methods.

UNIT –II CONCEPTS ON FIRMS AND MANUFACTURING PRACTICES 9

Firm – Industry – Market – Market structure – Diversification – Vertical integration – Merger – Horizontal integration

UNIT-III NATIONAL INCOME,MONEY AND BANKING, ECONOMIC ENVIRONMENT 9

National income concepts – GNP – NNP – Methods of measuring national income – Inflation – Deflation – Kinds of money – Value of money – Functions of bank – Types of bank – Economic liberalization – Privatization – Globalization

UNIT- IV CONCEPTS OF FINANCIAL MANAGEMENT 9

Financial management – Scope – Objectives – Time value of money – Methods of appraising project profitability – Sources of finance – Working capital and management of working capital

UNIT- V ACCOUNTING SYSTEM, STATEMENT AND FINANCIAL ANALYSIS 9

Accounting system – Systems of book-keeping – Journal – Ledger – Trail balance – Financial statements – Ratio analysis – Types of ratios – Significance – Limitations

TEXT BOOKS:

1. Prasanna Chandra, ―Financial Management‖ (Theory & Practice) TMH
2. Weston & Brigham, ―Essentials of Managerial Finance‖

REFERENCES:

1. Pandey, I. M., ―Financial Management‖
2. Fundamentals of Financial Management‖- James C. Van Horne.
3. http://stanford.edu/dept/MSandE

BBA005	**ENERGY ENGINEERING AND MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – NON RENEWABLE SOURCES OF ENERGY				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES:

To enlighten the student in the field of energy engineering concern with energy efficiency, energy service and facility management

COURSE OUTCOMES (COs)

CO1	Understand different energy resources and their uses.
CO2	Understand different energy conservation techniques.
CO3	Understand the impact energy on environment
CO4	Understand the different types of energy conservation schemes
CO5	Understand Insulated pipe work systems
CO6	Understand Optimal target investment schedules

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	F	g	h	i	j	k	l
2	CO1			H									
	CO2					H			M	L			
	CO3						H			L			
	CO4							M		L			L
	CO5						M		M				L
	CO6												

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
								√	
4	Approval		37th Meeting of Academic Council, May 2015						

UNIT I INTRODUCTION TO ENERGY AND ENVIRONMENT 9

Definition – Fossil fuel reserves – Energy consumption – Green house effect, global warming – Renewable energy resources – Environmental aspects, utilization – energy prizes – Energy policies.

UNIT II ENERGY CONSERVATION 9

Need – different types of energy conservation schemes – industrial energy use – energy surveying and auditing – energy index – cost of energy – cost index-energy conservation in engineering and process industry in thermal systems, in buildings and non conventional energy resources schemes.

UNIT III ENERGY GENERATION BY TECHNOLOGY 9

Fuels and consumption – Boilers – Furnaces – Waste heat recovery systems – Heat pumps and refrigerators – Storage systems – Insulated pipe work systems – heat exchangers.

UNIT IV ENERGY MANAGEMENT 9

Energy management principles – energy resource management – energy management.information systems – Instrumentation and measurement – Computerized energy management

UNIT V ENGINEERING ECONOMICS 9

Costing techniques – Optimization cost – Optimal target investment schedules – Finance appraisal – Profitability – Project management.

TEXTBOOK:

1.Amlan Chakrabarthi., Energy Engineering and Management.,PHI.,2011.

REFERENCES:

1. W.R. Murphy and G. Mckay, Energy Management, Butterworths, London, 1982.
2. Callaghan P.W. Design and Management for Energy Conservation, Pergamon Press, Oxford,1993.
3. https://**books**.google.com/**books**/.../**Energy_Engineering_and_Managem**...

BBA006	INDIAN CONSTITUTION AND SOCIETY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management studies				

OBJECTIVES

To know about Indian constitution. To know about central and state government functionalities in India. To know about Indian society.

COURSE OUTCOMES (COs)

CO1	To understand the historical background and fundamental rights
CO2	To understand the structure and functions of governments
CO3	To understand the Indian social structure
CO4	To gain knowledge in Indian federal system
CO5	To gain knowledge Indian social structure
CO6	To gain knowledge the right of women, children and SC&ST

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	L		H									
	CO2					H			M	L			
	CO3	L					H			L			
	CO4							M		L			L
	CO5	L					M		M				L
	CO6												

3	Category	Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I HISTORY 9

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT II CENTRAL STRUCTURE 9

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STATE STRUCTURE 9

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV PARLIAMENTARY SYSTEM 9

Indian Federal System – Center – State Relations – President's Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V SOCIAL STRUCTURE 9

Society : Nature, Meaning and definition; Indian Social Structure; Castle, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

TEXT BOOKS:

1. Durga Das Basu, " Introduction to the Constitution of India ", Prentice Hall of India, New Delhi.
2. R.C.Agarwal, " (1997) Indian Political System ", S.Chand and Company, New Delhi.

REFERENCES:

1. Sharma, Brij Kishore, "Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2. U.R.Gahai, "(1998) Indian Political System ", New Academic Publishing House, Jalaendhar.
3. R.N. Sharma, "Indian Social Problems ", Media Promoters and Publishers Pvt. Ltd.
4. Yogendra Singh, "(1997) Social Stratification and Charge in India ", Manohar, New Delhi
5. Maciver and Page, "Society: An Introduction Analysis ", Mac Milan India Ltd., New Delhi.
6. K.L.Sharma, " (1997) Social Stratification in India: Issues and Themes ", Jawaharlal Nehru University, New Delhi.

7.www.cgsird.gov.in/**constitution.pdf**

BBA007	**ENGINEERING ECONOMICS AND COST ANALYSIS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – PROCESS PLANNING AND COST ESTIMATION				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVE:

1. To know aboutengineering economics and cost analysis.

COURSE OUTCOMES (COs)

CO1	To learn aboutintroduction to economics.
CO2	To learn about value engineering.
CO3	To learn about cash flow.
CO4	To learn about economics of sampling and Replacement and Maintenance

CO5	To learn about depreciation and Evaluation of public alternatives.
CO6	To learn about design analysis

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

		a	b	c	d	e	f	g	h	i	j	k	l
1	COs/POs												
2	CO1	H											
	CO2		H										
	CO3			M		M							
	CO4				H			H		L		H	
	CO5						L		M		L		
	CO6												L

		Humanities and Social studies (HS)	Basic Sciences & Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/ Seminar/ Internship (PR)
3	Category							√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I INTRODUCTION TO ECONOMICS 8

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT II VALUE ENGINEERING 10

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW 9

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION 9

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TEXT BOOKS :

1. PanneerSelvam, R, Engineering Economics, Prentice Hall of India Ltd, New Delhi, 2001.

REFERENCES :

1.Chan S.Park, Contemporary Engineering Economics, Prentice Hall of India, 2002.
2.https://books.google.co.in/books?id=IWRI-5g0uHUC
3.www.springer.com/us/book/9780387970486

CURRICULUM & SYLLABUS (R2015)
CHOICE BASED CREDIT SYSTEM
(Applicable to the batches admitted from July 2015)

B.TECH – MECHATRONICS
FULL TIME
I – VIII SEMESTERS

SEMESTER I						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN101	HS	English-I	3	1	0	3
BMA101	BS	Mathematics –I	3	1	0	3
BPH 101	BS	Engineering Physics – I	3	0	0	3
BCH101	BS	Engineering Chemistry – I	3	0	0	3
BCS101	ES	Fundamentals of Computing and Programming	3	0	0	3
BSS101	HS	Personality Development	1	1	0	2
BBT 102	BS	Biology for Engineers	2	0	0	2
BCE101	ES	Basic Civil Engineering	2	0	0	2
BME101	ES	Engineering Graphics-E	2	3	0	4
PRACTICAL						
BCM1L1	ES	Basic Civil and Mechanical Engineering Practices Laboratory	0	0	3	1
BPC1L1/2L1*	BS	Physics and Chemistry Laboratory	0	0	3	0
BSS1L4/ 1L5/IL6	HS	NCC/NSS/NSO (to be conducted during week ends)	0	1	2	1
*Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)						
Total No. of Contact Hours: 37 Total No. of Credits: 27						

SEMESTER II						
Code No.	**Category**	**Course Title**	**L**	**T**	**P**	**C**
THEORY						
BEN 201	HS	English-II	3	1	0	3
BMA201	BS	Mathematics- II	3	1	0	3
BPH 201	BS	Engineering Physics – II	3	0	0	3
BCH201	BS	Engineering Chemistry – II	3	0	0	3
BFR201#	HS	Foreign/Indian Language	3	0	0	3
BME202	ES	Engineering Mechanics	3	1	0	3
BEE201	ES	Basic Electrical and Electronics Engineering	2	0	0	2
PRACTICAL						
BCS2L2	ES	Computer Practices Lab	0	0	3	1
BEE2L1	ES	Basic Electrical and Electronics Engineering Practices	0	0	3	1
BPC1L1/2L1*	BS	Physics and Chemistry Laboratory	0	0	3/3	1
BSS2L7	HS	Yoga	0	1	2	1

Any one of the following courses: BFR201 – French, BGM201 – German, BJP201- Japanese, BKR201 – Korean, BCN201 – Chinese, BTM201 – Tamil

*Laboratory Classes on alternate weeks for Physics and Chemistry. The lab examinations will be held only in the second semester (including the first semester experiments also)

Total No. of Contact Hours: 35 **Total No. of Credits: 24**

SEMESTER III						
Sub Code	**Category**	**Subject**	**L**	**T**	**P**	**C**
THEORY						
BMA301	BS	Mathematics – III	3	2	0	4
BME301	PC	Kinematics of Machines	4	0	0	4
BMT303	PC	Electronic Devices and Electronic Circuits	4	0	0	4
BMT304	PC	Mechanics of Solids and Fundamentals of Fluids	4	0	0	4
BMT301	PC	Digital Electronics	3	0	0	3
BMT302	PC	Electrical Machines & Drives	3	0	0	3
PRACTICAL						
BMT3L1	PC	Electronic Devices and Electronic Circuits - Lab	0	0	3	2
BMT3L2	PC	Electrical Machines & Drives Lab	0	0	3	2
BMT3L3	PC	Computer Aided Machine Drawing	0	0	3	2
Total No. of Contact Hours: 32 Total No. of Credits: 28						

SEMESTER IV						
Sub Code	**Category**	**Subject**	**L**	**T**	**P**	**C**
THEORY						
BMA402	BS	Numerical Methods	3	2	0	4
BME401	PC	Dynamics of Machines	4	0	0	4
BMT401	PC	Manufacturing Technology	3	0	0	3
BEE404	PC	Power Electronics	3	0	0	3
BEI402	PC	Control Systems	4	0	0	4
BCE406	BS	Environmental Studies	3	0	0	3
PRACTICAL						
BMT4L1	PC	Manufacturing Technology Lab	0	0	3	2
BMT4L2	PC	Machine Dynamics Lab	0	0	3	2
BEE4L2	PC	Power Electronics Lab	0	0	3	2
BMT4S1	PR	Technical Seminar	0	0	2	1
Total No. of Contact Hours: 33 Total No. of Credits: 28						

SEMESTER V						
Sub Code	**Category**	**Subject**	**L**	**T**	**P**	**C**
THEORY						
BMT501	PC	Thermodynamics Principles and Applications	4	0	0	4
BEC501	PC	Microprocessors & its Applications	3	0	0	3
BMT503	PC	Instrumentation & Control	3	0	0	3
BMT502	PC	CNC Technology	3	0	0	3
BMT504	PC	Dimensional Metrology	3	0	0	3
BMT5E1	CE	Core Elective – I	3	0	0	3
PRACTICAL						
BEC5L2	PC	Microprocessors Lab	0	0	3	2
BMT5L1	PC	Instrumentation and Control Lab	0	0	3	2
BMT5L2	PC	CNC Lab	0	0	3	2
BMT5C1	PR	Comprehension - I	0	0	0	1
Total No. of Contact Hours: 28		**Total No. of Credits: 26**				

SEMESTER VI						
Sub Code	**Category**	**Subject**	**L**	**T**	**P**	**C**
THEORY						
BMT601	PC	Sensors & Signal Processing	3	0	0	3
BMT602	PC	Applied Hydraulics & Pneumatics	3	0	0	3
BMT604	PC	Micro Controller & PLC	4	0	0	4
BSS601	HS	Value Education and Professional Ethics	3	0	0	3
BMT6E2	CE	Core Elective – II	3	0	0	3
BMT6E3	NE	Non Major Elective – I	3	0	0	3
PRACTICAL						
BMT6L1	PC	Sensors & Signal Processing Lab	0	0	3	2
BEC6L6	PC	Micro Controller & PLC Lab	0	0	3	2
BMT6L2	PC	Hydraulics & Pneumatics Lab	0	0	3	2
BMT6V1	PR	Inplant Training(End of V sem- 15 days)	0	0	0	1
Total No. of Contact Hours: 28		**Total No. of Credits: 26**				

SEMESTER VII						
Code No.	**Category**	**Subject**	**L**	**T**	**P**	**C**
THEORY						
BMT702	PC	Simulation & Modeling	3	0	0	3
BMT701	PC	Robotics & Machine Vision System	3	0	0	3
BAM705	PC	Automotive Electronics	3	0	0	3
BMT7E4	CE	Core Elective – III	3	0	0	3
BMT7E5	NE	Non Major Elective - II	3	0	0	3
BMT7E6	OE	Open Elective – I	3	0	0	3
PRACTICAL						
BME7L3	PC	CAD/CAM Lab	0	0	3	2
BMT7L3	PC	Robotics Lab	0	0	3	2
BMT7P1	PR	Term Paper	0	0	4	2
Total No. of Contact Hours: 27 Total No. of Credits: 24						

SEMESTER VIII						
Code No.	**Category**	**Subject**	**L**	**T**	**P**	**C**
THEORY						
BMT8E7	NE	Non Major Elective – III	3	0	0	3
BMT8E8	OE	Open Elective – II	3	0	0	3
PRACTICAL						
BMT8C1	PR	Comprehension– II	0	0	0	1
BMT8P1	PR	Project Work & Viva Voce	0	0	18	9
Total No. of Contact Hours:24 Total No. of Credits:16						

OVERALL CREDITS: 199

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.No.	Sub Area	Credit As per Semester								No. of Credit	% of credit
		I	II	III	IV	V	VI	VII	VIII		
1	Humanities & Social Sciences (HS)	6	7	-	-	-	3	-	-	16	08.04
2	Maths &Basic Sciences (BS)	11	10	4	7	-	-	-	-	32	16.58
3	Engineering Sciences (ES)	10	7	-	-	-	-	-	-	17	8.5
4	Professional Core (PC)	-	-	24	20	22	16	13	-	95	47.73
5	Core Electives (CE)	-	-	-	-	3	3	3	-	9	4.54
6	Non major Electives (NE)	-	-	-	-	-	3	3	3	9	4.54
7	Open Electives (OE)	-	-	-	-	-	-	3	3	6	3.03
8	Project Work, Seminar, Internship, Term Paper, etc. (PR)	-	-	-	1	1	1	2	10	15	7.57
	Total Credit	27	24	28	28	26	26	24	16	199	100%
	Total Contact Hour	37	35	32	33	28	28	26	24	242 Hrs	

LIST OF ELECTIVES

Code No.	Course Title	L	T	P	C
CORE ELECTIVE (CE)-I					
BMT001	Integrated Circuits	3	0	0	3
BMT002	Virtual Instrumentation	3	0	0	3
BME001	Industrial Engineering	3	0	0	3
CORE ELECTIVE (CE) - II					
BMT003	Computer Integrated Manufacturing	3	0	0	3
BMT004	Neural Network & Fuzzy Logic	3	0	0	3
BMT005	Embedded System and Design	3	0	0	3
CORE ELECTIVE(CE) -III					
BMT007	Micro Electronics and Nano Electronics	3	0	0	3
BMT008	MEMS and Nano Technology	3	0	0	3
BMT009	Rapid Prototyping	3	0	0	3
NON MAJOR ELECTIVE(NE)-I					
BMT010	Design of Mechatronics Systems	3	0	0	3
BMT011	Product Design and Costing	3	0	0	3
BMT012	Artificial Intelligence	3	0	0	3
NON MAJOR ELECTIVE(NE)-II					
BMT013	Medical Mechatronics	3	0	0	3
BMT014	Consumer Electronics	3	0	0	3
BMT015	Digital Signal Processing	3	0	0	3
NON MAJOR ELECTIVE(NE)-III					
BMT016	Digital Image Processing	3	0	0	3
BMT017	Networking of Computers	3	0	0	3
BMT018	Computational Fluid Dynamics	3	0	0	3
OPEN ELECTIVE(OE)- I					
BBA001	Principles of Management And Organizational Behavior	3	0	0	3
	Statistical Quality Control	3	0	0	3
BBA002	Entrepreneurship Development	3	0	0	3
BBA009	Intellectual Property Rights	3	0	0	3
BSS001	NSS Paper I	2	0	2	3
OPEN ELECTIVE(OE)- II					
BBA003	Marketing Management	3	0	0	3
BBA008	Total Quality Management	3	0	0	3
BBA006	Indian Constitution and Society	3	0	0	3
BBA007	Engineering Economics and Cost Analysis	3	0	0	3
BSS002	NSS Paper I	2	0	2	3
BMO001	Massive Open Online Course	3	0	0	3

BEN101	ENGLISH - I	L	T	P	C
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Dept of English				

OBJECTIVES

To make the students learn the basic modes of communication for fluency and attainment of confidence in speech, reading and writing.

COURSE OUTCOMES (COs)

CO1	Understand the importance of being responsible, logical, and thorough.
CO2	Respond to the situations where short reports and instructions are required.
CO3	Explain –how things work‖, and what to suggest when –things don‘t work
CO4	Develop our confidence and authority in the practical use of language.
CO5	Understand the importance of being responsible, logical, and thorough.
CO6	e to Face interviews and competitive examinations

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	H	H	H	M	L	L	H	H	H	H
	CO2							L					
	CO3	H						H		H			H
	CO4	H	M				M	L	H	H			H
	CO5							L					
	CO6	H		H	H	H	H	L		H	H	M	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT ISTRUCTURES 12

Parts of speech - Active and passive voices - Subject verb agreement. - Writing about School life, Hobbies, Family and friends – Word formation with prefixes and suffixes - Tenses - Concord - Summarizing - Note-making

UNIT II TRANSCODING 12

Cause and effect relations – Punctuations –Differences between verbal and nonverbal communication -E - mail communication – Homophones - Etiquettes of E mail communication. Interpreting graphic representation - Flow chart and Bar chart.

UNIT III REPORTING 12

Degrees of comparison – Positive, Comparative, Superlative - questions- SI units -Lab reports - Physics chemistry, workshop and Survey report for introducing new product in the market.

UNIT IV FORMAL DOCUMENTATION 12

Writing project proposals - Presentation skills - Prefixes and suffixes - If conditions - Writing a review-Preparing minutes of the meeting, Agenda, official circulars.

UNIT V METHODOLOGY 12

Accident reports (due to flood and fire) - Hints development - Imperatives - Marking the stress Connectives , prepositional relatives.

TEXT BOOK

1. Department Of Humanities and Social Sciences Division, Anna University, Oxford University Press, 2013.

REFERENCES:

1. S.P.Danavel, English and Communication for Students of Science and Engineering, Orient Blackswan, Chennai, 2011.
2. Rizvi, M.Asharaf, Effective Technical Communication, New Delhi, Tata McGraw Hill Publishibg Company, 2007.
3. Murali Krishna and Sunitha Moishra, Communication Skills for Engineers . Pearson, New Delhi, 2011.

BMA101	**MATHEMATICS I**									**L**	**T**	**P**	**C**
	Total Contact Hours - 60									3	1	0	3
	Prerequisite – + 2 Level Mathematics												
	Course Designed by – Dept of Mathematics												
OBJECTIVES To make the students learn Mathematics in order to formulate and solve problems effectively in their respective fields of engineering.													
COURSE OUTCOMES (COs)													
CO1	Study the fundamentals of mathematics												
CO2	Students learn multiple integral techniques												
CO3	Students gain knowledge in application of variables												
CO4	Find area and volume based on a function with one or more variables.												
CO5	Apply matrix operations to solve relevant real life problems in engineering.												
CO6	Formulate a mathematical model for three dimensional objects and solve												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2			M		H							
	CO3		H				M						

	CO4								L				
	CO5							H			L		
	CO6											L	
3	Category	Humanities & Social Studies (HS)		Basic Sciences &Maths (BS)		Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/ Seminar/ Internship (PR)
				√										
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016												

UNIT-1 MATRICES 12

Characteristic equations- Eigen values and eigen vectors of the real matrix- Properties- Cayley-Hamilton theorem(Excluding proof)- Orthogonal transformation of a symmetric matrix to diagonal form- Quadratic form- Reduction of quadratic form to canonical form by orthogonal transformation.

UNIT II THREE DIMENSIONAL ANALYTICAL GEOMETRY 12

Equation of a Sphere- Plane section of a sphere- Tangent plane- Equation of cone- Right circular cone- Equation of a cylinder- Right circular cylinder.

UNIT III DIFFERENTIAL CALCULUS 12

Curvature in Cartesian coordinates- Centre and radius of curvature- Circle of curvature- Evolutes-Envelopes- Applications of Evolutes and Envelopes.

UNIT 1V FUNCTIONS OF SEVERAL VARIABLES 12

Partial derivatives- Euler‘s theorem for homogeneous functions- Total derivatives- Differentiation of implicit functions- Jacobians- Taylor‘s expansion- Maxima and Minima- Method of Lagrangian multipliers.

UNIT V MULTIPLE INTEGRALS 12

Double integration- Cartesian and Polar coordinates- Change of order of integration- Change of variables between Cartesian and Polar coordinates- Triple integration in Cartesian coordinates- Area as double integral- Volume as triple integral.

TEXT BOOK:

1. Ravish R.Singh and Mukkul Bhatt, –Engineering Mathematics-I‖ First Reprint, Tata McGraw Hill Pub Co., New Delhi. 2011.
2. Grewal.B.S, –Higher Engineering Mathematics‖, 40th Edition, Khanna Publications, Delhi. 2007.

REFERENCES:

1. Ramana.B.V. –Higher Engineering Mathematics‖, Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Glyn James, –Advanced Engineering Mathematics‖, 7thEdition, Pearson Education, 2007.

3. Erwin Kreyszig, –Advanced Engineering Mathematics‖, 8th Edition, John Wiley and Sons, New York, 2003.
4. Murray R.Spiegel, –Advanced Calculus‖, Schaum‘s Outline Series, First Edn, McGraw Hill Intl Book Co.,New Delhi, 1981.

PH101	**ENGINEERING PHYSICS I**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	**3**	**0**	**0**	**3**
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES:
To enhance the fundamental knowledge in Physics and its applications relevant to various stre of Engineering and Technology

COURSE OUTCOMES (COs)

CO1	Understand the Principles and Laws of Physics
CO2	To understand the impact of Crystal Physics
CO3	Learn the Properties of Elasticity and Heat transfer.
CO4	Acquire Knowledge on Quantum Physics.
CO5	Understand the concepts on Laser & Ultrasonic‘s and its Applications
CO6	Understand the Principle of Laser and its Applications in Engineering and Medicine.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	A	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M			H		
	CO2		L	H		M				M		L	H
	CO3												
	CO4	H		M	L						L		M
	CO5		L	L								L	L
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius – Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and graphite structures (qualitative treatment)- Crystal growth techniques –solution, melt (Bridgman and Czochralski) and vapour growth techniques (qualitative)

UNIT II PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity-Hooke‘s law - Relationship between three modulii of elasticity (qualitative) – stress - strain diagram – Poisson‘s ratio –Factors affecting elasticity –Bending moment – Depression of a cantilever –Young‘s modulus by uniform bending- I-shaped girders Modes of heat transfer- thermal conductivity- Newton‘s law of cooling - Linear heat flow – Lee‘s disc method – Radial heat flow – Rubber tube method – conduction through compound media (series and parallel).

UNIT III QUANTUM PHYSICS 9

Black body radiation – Planck‘s theory (derivation) – Deduction of Wien‘s displacement law and Rayleigh – Jeans‘ Law from Planck‘s theory – Compton effect. Theory and experimental verification – Properties of Matter waves – G.P Thomson experiment-Schrödinger‘s wave equation – Time independent and time dependent equations – Physical significance of wave function – Particle in a one dimensional box - Electron microscope - Scanning electron microscope - Transmission electron microscope.

UNIT IV ACOUSTICS AND ULTRASONICS 9

Classification of Sound- decibel- Weber–Fechner law – Sabine‘s formula- derivation using growth and decay method – Absorption Coefficient and its determination –factors affecting acoustics of buildings and their remedies. Production of ultrasonics by magnetostriction and piezoelectric methods - acoustic grating -Non Destructive Testing – pulse echo system through transmission and reflection modes - A,B and C – scan displays, Medical applications – Sonogram.

UNIT V PHOTONICS AND FIBRE OPTICS 9

Spontaneous and stimulated emission- Population inversion –Einstein‘s A and B coefficients - derivation. Types of lasers – Nd:YAG, CO2, Semiconductor lasers (homo junction & hetero junction)- Industrial and Medical Applications. Principle and propagation of light in optical fibres – Numerical aperture and Acceptance angle - Types of optical fibres (material, refractive index, mode) – attenuation, dispersion, bending - Fibre Optical Communication system (Block diagram) - Active and passive fibre sensors- Endoscope.

TEXT BOOKS:

1. Jayaraman D Engineering Physics I. Global Publishing House, 2014.
2. Arumugam M. Engineering Physics. Anuradha publishers, 2010.
3. Gaur R.K. and Gupta S.L. Engineering Physics. Dhanpat Rai Publishers, 2009.
4. Mani Naidu S. Engineering Physics, Second Edition, PEARSON Publishing, 2011.

REFERENCES:

1. Searls and Zemansky. University Physics, 2009
2. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009.
3. Palanisamy P.K. Engineering Physics. SCITECH Publications, 2011.
4. http://ocw.mit.edu/courses/find-by-topic
5. http://nptel.ac.in/course.php?disciplineId=122
6. https://en.wikipedia.org/wiki/Engineering_physics

BCH101	ENGINEERING CHEMISTRY - I	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level Chemistry				
	Course Designed by – Department of Chemistry				

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Understand the principles of water characterization and treatment for portable and industrial purposes.
CO2	To impart knowledge on the essential aspects of Principles of polymer chemistry and engineering applications of polymers
CO3	Having a sound knowledge in the Field of the Conventional and non-Conventional energy
CO4	To impart knowledge on the essential aspects of electrochemical cells, emf and applications of EMF measurements
CO5	To make the students understand the Principles of corrosion and corrosion control .
CO6	To impart knowledge about the Conventional and non-conventional energy sources and energy storage devices

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences &Maths (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper/Seminar /Internship (PR)
			√						

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I WATER TECHNOLOGY 9

Introduction-Characteristics : Hardness of water – types - temporary and permanent hardness - estimation by EDTA method Alkalinity – types of alkalinity - Phenolphthalein and Methyl orange alkalinity - determination –Domestic water treatment – disinfection methods (Chlorination, Ozonation , UV treatment) Boiler feed water – requirements – disadvantages of using hard water in boilers Internal conditioning (Calgon Conditioning method) – External conditioning – Demineralization process – Desalination and Reverse osmosis.

UNIT II POLYMERS 9

Introduction-Polymers- definition – polymerization – degree of polymerization - types of polymerization– Addition polymerization and Condensation polymerization – Mechanism of Polymerization - free radical polymerization mechanism only, Plastics: Classification – thermoplastics and thermosetting plastics – difference between thermoplastics and thermosetting plastics - preparation, properties and uses of PVC, Teflon, nylon-6,6, PET, Rubber :Types – drawbacks of natural rubber -vulcanization of rubber - properties and uses of vulcanized rubber Synthetic rubbers – butyl rubber and SBR

UNIT III ELECTRO CHEMISTRY 9

Introduction CELLS: types of Electrochemical cells , Electrolytic cells – Reversible and irreversible cells EMF – measurement of EMF– Single electrode potential – Nernst equation Reference electrodes : Standard Hydrogen electrode -Calomel electrode Ion selective electrode :Glass electrode and measurement of pH using Glass electrode Electrochemical series – significance Titrations :Potentiometer titrations (redox - Fe^{2+}vs dichromate titrations) Conduct metric titrations (acid-base – HCI vs, NaOH titrations)

UNIT IV CORROSION AND CORROSION CONTROL 9

Introduction: Chemical corrosion Definition - Chemical Corrosion - Electrochemical corrosion – different types – galvanic corrosion – differential aeration corrosion – mechanism of Chemical and Electrochemical corrosion factors influencing corrosion control – sacrificial anode and impressed cathodic current methods – Protective coatings :Paints– constituents of the paint and their functions Metallic coatings – electroplating of Gold and electro less plating of Nickel.

UNIT V NON-CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Introduction : Nuclear fission and nuclear fusion reactions – differences between nuclear fission and nuclear fusion reactions – nuclear chain Reactions – nuclear energy critical mass - super critical mass - sub - critical mass Light water nuclear reactor for power generation (block diagram only) – breeder reactor Solar energy conversion – solar cells – wind energy Fuel cells – hydrogen – oxygen fuel cell Batteries :Primary and secondary Batteries – differences between Primary and secondary Batteries Secondary batteries :Lead–acid storage battery –working –uses Nickel–cadmium battery - working –uses Solid – state battery : Lithium battery

TEXT BOOKS:

1. P.C.Jain and Monica Jain, –Engineering Chemistry‖ Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S. Dara –A text book of engineering chemistry‖ S.Chand & Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, –Engineering Chemistry, Volume 1‖, Crystal Publications, Chennai, (2007).

REFERENCES :

1. B.K.Sharma –Engineering chemistry‖ Krishna Prakasan Media (P) Ltd., Meerut (2001).
2. B. Sivasankar –Engineering Chemistry‖ Tata McGraw-Hill Pub.Co.Ltd, New Delhi (2008).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Electrochemistry

BCS101	FUNDAMENTALS OF COMPUTING AND PROGRAMMING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 level Physics				
	Course Designed by – Department of Physics				

OBJECTIVES

Students will understand the basics of computers and solve computer oriented problems using various computing tools.

COURSE OUTCOMES (COs)

CO1	Learn the fundamental principles in computing.
CO2	Learn to write simple programs using computer language
CO3	To enable the student to learn the major components of a computer system.
CO4	Computing problems
CO5	To learn to use office automation tools.
CO6	To interpret and relate programs

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H						H					
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L			H					
	CO5		L	L									
	CO6	H						H					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO COMPUTER 9

Introduction- Characteristics of computer-Evolution of Computers-Computer Generations - Classification of Computers- Basic Computer Organization-Number system. Computer Software: Types of Software—System software-Application software-Software Development Steps

UNIT II PROBLEM SOLVING AND OFFICE AUTOMATION 9

Planning the Computer Program – Purpose – Algorithm – Flowcharts– Pseudo code Introduction to Office Packages: MS Word, Spread Sheet, Power Point, MS Access, Outlook.

UNIT III INTRODUCTION TO C 9

Overview of C-Constants-Variables-Keywords-Data types-Operators and Expressions.Managing Input and Output statements-Decision making-Branching and Looping statements.

UNIT IV ARRAYS AND STRUCTURES 9

Arrays - Handling of Character Strings - Pointers – Structures-Union -Functions – Recursion-Call by value and Call by reference.

UNIT V INTRODUCTION TO C++ 9

Overview of C++ - Applications of C++-Classes and objects-OOPS concepts -Constructor and Destructor- A simple C++ program –Friend classes and Friend Function.

TEXT BOOKS:

1. Ashok, N.Kamthane,‖Computer Programming‖, Pearson Education (2012).
2. Anita Goel and Ajay Mittal,‖Computer Fundamentals and Programming in C‖, Dorling V Kindersley (India Pvt Ltd).,Pearson Education in South Asia,(2011).
3. Yashavant P. Kanetkar, –Let us C‖,13th Edition,BPB Publications(2013).
4. Yashavant P. Kanetkar,‖Let us C++‖10th Edition, BPB Publications (2013**).**

REFERENCES:

1. Pradeep K.Sinha, Priti Sinha –Foundations of Computing‖, BPB Publications (2013).
2. Byron Gottfried, –Programming with C‖, 2nd edition, (Indian Adapted Edition), TMH Publication.
3. Pradip Dey, Manas Ghosh, Fundamentals of Computing and Programming in _C' First Edition, Oxford University Press(2009).
4. The C++ Programming Language , 4th Edition, Bjarne Stroustrop, Addison-Wesley Publishing Company (2013).

BSS101	**PERSONALITY DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	1	1	0	2
	Prerequisite – +2 Level Knowledge				
	Course Designed by – Department of Management Studies				
OBJECTIVES To make students groom their personality and prove themselves as good Samaritans of the socie					
COURSE OUTCOMES (COs)					
CO1	Individual or in-group class presentations pertaining to the applications of concepts, theories or issues in human development..				
CO2	Scores obtained from essay and or objective tests.				
CO3	Attendance, classroom participation, small group interactions.				
CO4	Research and write about relevant topics.				

CO5	Design and complete a research project that can take the form of a developmental interview, an observation or assessment through service learning.
CO6	Develop and maintain a Reflection

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	L		H				M					
	CO2		H	H				M					
	CO3							M	H				
	CO4									H	H		
	CO5							M			H	H	
	CO6							M					L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO PERSONALITY DEVELOPMENT 6

The concept personality- Dimensions of theories of Freud & Erickson- personality – significant of personality development. The concept of success and failure: What is success? - Hurdles in achieving success - Overcoming hurdles - Factors responsible for success – What is failure - Causes of failure. SWOT analyses.

UNIT II ATTITUDE & MOTIVATION 6

Attitude - Concept - Significance - Factors affecting attitudes - Positive attitude - Advantages – Negative attitude - Disadvantages - Ways to develop positive attitude - Difference between personalities having positive and negative attitude. Concept of motivation - Significance - Internal and external motives - Importance of self-motivation- Factors leading to de-motivation

UNIT III SELF-ESTEEM 6

Term self-esteem - Symptoms - Advantages - Do's and Don‘ts to develop positive self-esteem – Low self-esteem - Symptoms - Personality having low self esteem - Positive and negative self-esteem. Interpersonal Relationships – Defining the difference between aggressive, submissive and assertive behaviours - Lateral thinking.

UNIT IV OTHER ASPECTS OF PERSONALITY DEVELOPMENT 6

Body language - Problem-solving - Conflict and Stress Management - Decision-making skills - Leadership and qualities of a successful leader - Character-building -Team-work - Time management -Work ethics –Good manners and etiquette.

UNIT V EMPLOYABILITY QUOTIENT 6

Resume building- The art of participating in Group Discussion – Acing the Personal (HR & Technical) Interview -Frequently Asked Questions - Psychometric Analysis - Mock Interview Sessions.

TEXT BOOKS:

1. Hurlock, E.B (2006). Personality Development, 28th Reprint. New Delhi: Tata McGraw Hill.
2. Stephen P. Robbins and Timothy A. Judge (2014), Organizational Behavior 16th Edition, Prentice Hall.

REFERENCE BOOKS:

1. Andrews, Sudhir. How to Succeed at Interviews. 21st (rep.) New Delhi.Tata McGraw-Hill 1988.
2. Heller, Robert. Effective leadership. Essential Manager series. Dk Publishing, 2002
3. Hindle, Tim. Reducing Stress. Essential Manager series. Dk Publishing, 2003
4. Lucas, Stephen. Art of Public Speaking. New Delhi. Tata - Mc-Graw Hill. 2001
5. Mile, D.J Power of positive thinking. Delhi. Rohan Book Company, (2004).
6. Pravesh Kumar. All about Self- Motivation. New Delhi. Goodwill Publishing House. 2005.
7. Smith, B . Body Language. Delhi: Rohan Book Company. 2004

BBT102	**BIOLOGY FOR ENGINEERS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – Basic Science				
	Course Designed by – Department of Industrial Bio Technology				

OBJECTIVES

Gain vivid knowledge in the fundamentals and uses of biology, human system and plant system**.**

COURSE OUTCOMES (COs)

CO1	Graduates within the first five years will be able to grasp and apply biological engineering principles, procedures needed to solve real-world problems.
CO2	To understand the fundamentals of living things, their classification, cell structure and biochemical constituents
CO3	To apply the concept of plant, animal and microbial systems and growth in real life situations
CO4	To comprehend genetics and the immune system
CO5	To know the cause, symptoms, diagnosis and treatment of common diseases
CO6	To give a basic knowledge of the applications of biological systems in relevant industries

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H						M					
	CO2		H							H			
	CO3			H							M		
	CO4										H		
	CO5												

	CO6						H						M
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
				√									
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION TO LIFE 6

Characteristics of living organisms-Basic classification-cell theory-structure of prokaryotic andeukaryotic cell-Introduction to biomolecules: definition-general classification and important functions of carbohydrates-lipids-proteins-nucleic acids vitamins and enzymes-genes and chromosome.

UNIT II BIODIVERSITY 6

Plant System: basic concepts of plant growth-nutrition-photosynthesis and nitrogen fixation-Animal System: elementary study of digestive-respiratory-circulatory-excretory systems and their functions-Microbial System: history-types of microbes-economic importance and control of microbes.

UNIT III GENETICS AND IMMUNE SYSTEM 6

Evolution: theories of evolution-**Mendel"s** cell division–mitosis and meiosis-evidence of e **laws of inheritance**-variation and speciation- nucleic acids as a genetic material-central dogma immunity-antigens-antibody-immune response.

UNIT IV HUMAN DISEASES 6

Definition- causes, symptoms, diagnosis, treatment and prevention of diabetes, cancer, hypertension, influenza, AIDS and Hepatitis

UNIT V BIOLOGY AND ITS INDUSTRIAL APPLICATION 6

Transgenic plants and animals-stem cell and tissue engineering-bioreactors-biopharming-recombinant vaccines-cloning-drug discovery-biological neural networks-bioremediation-biofertilizer-biocontrol-biofilters-biosensors-biopolymers-bioenergy-biomaterials-biochips-basic biomedical instrumentation.

TEXT BOOKS:

1. A Text book of Biotechnology, R.C.Dubey, S. Chand Higher Academic Publications, 2013
2. Diseases of the Human Body, Carol D. Tamparo and Marcia A. Lewis, F.A. Davis Company, 2011.
3. Biomedical instrumentation, Technology and applications, R. Khandpur, McGraw Hill Professional, 2004

REFERENCE BOOKS

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
2. Cell Biology and Genetics (Biology: The unity and diversity of life Volume I), Cecie Starr,

Ralph Taggart, Christine Evers and Lisa Starr, Cengage Learning, 2008

3. Biotechnology Expanding horizon, B.D. Singh, Kalyani Publishers, 2012

BCE 101	BASIC CIVIL ENGINEERING	L	T	P	C
	Total Contact Hours – 30	2	0	0	2
	Prerequisite – +2 Level Maths & Physical Science				
	Course Designed by – Department of Civil Engineering				

OBJECTIVES: Understand the basic concepts of civil engineering.

COURSE OUTCOMES (COs)

CO1	Will gain knowledge in Design, concept preparation
CO2	Loading calculation
CO3	Structural component design
CO4	Drawing and chart preparation
CO5	Will understand the components of buildings.
CO6	Will learn the engineering aspects to dams , water supply and sewage disposal.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			H		L					
	CO2					H	H						
	CO3							H	L				
	CO4									L			
	CO5										H	L	
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CIVIL ENGINEERING MATERIALS 8

Introduction – Civil Engineering – Materials – Stones – Bricks – Sand – Cement – Plain Concrete – Reinforced Cement Concrete – Steel Sections – Timber – Plywood – Paints – Varnishes (simple examples only)

UNIT II SURVEYING 5

Surveying – objectives – classification – principles of survey-Measurement of distances – Chain survey – Determination of areas – Use of compass – Use of leveling Instrument – (simple examples only)

UNIT III FOUNDATION FOR BUILDING 5

Bearing Capacity of Soil – Foundation – Functions – Requirement of good foundations – Types of foundations – Merits & Demerits.

UNIT IV SUPERSTRUCTURE 7

Stone Masonry – Brick Masonry – Columns – Lintels – Beams – Roofing – Flooring – Plastering– White Washing (Simple examples only)

UNIT V MISCELLANEOUS TOPICS 5

Types of Bridges –Dam- purpose – selection of site - Types of Dams – Water Treatment & Supply sources – standards of drinking- distribution system.– Sewage Treatment (simple examples only)

TEXT BOOKS:

1. Raju.K.V.B, Ravichandran .P.T, ―Basics of Civil Engineering‖, Ayyappa Publications, Chennai, 2012.
2. SeetharamanS., ―Basic Civil Engineering‖, Anuradha Agencies, (1st ed. 2005).
3. Dr.M.SPalanisamy, ―Basic Civil Engineering‖ (3rded. 2000), TUG Publishers, New Delhi/Tata McGrawHill Publication Co., New Delhi

REFERENCE BOOKS:

1. Rangwala.S.C, ‖Engineering Materials‖, Charotar Publishing House, Anand, 41st Edition: 2014.
2. National Building Code of India, Part V, ―Building Materials‖, 2005
3. Ramesh Babu―A Textbook on Basic Civil Engineering‖ (1998). Anuradha Agencies, Kumbakonam.
4. Ramamrutham S., ―Basic Civil Engineering‖, Dhanpat Rai Publishing Co. (P) Ltd. (1999).

BME 101	**ENGINEERING GRAPHICS- E**									**L**	**T**	**P**	**C**
	Total Contact Hours - 60									2	3	0	4
	Prerequisite – +2 Level Maths & Physical Science												
	Course Designed by – Department of Mechanical Engineering												
OBJECTIVES:To understand techniques of drawings in various fields of engineering													
COURSE OUTCOMES (COs)													
CO1	To know about different types of lines & use of different types of pencils in an Engineering Drawing												
CO2	To know how to represents letters & numbers in drawing sheet												
CO3	To know about different types of projection												
CO4	To know projection of points ,straight lines, solids etc.												
CO5	To know development of different types of surfaces.												
CO6	To know about isometric projection.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H											H
	CO2	M	H										M

	CO3			L									M
	CO4						L		H	H			L
	CO5			L						H			L
	CO6			L							H		L
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)
					√								
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I BASIC CURVES, PROJECTION OF POINTS AND STRAIGHT LINES 6+6

Conics-construction of ellipse, parabola and hyperbola by eccentricity method-construction of cycloids- construction of involutes of square and circle-Drawing of tangent and normal to the above curves-Scales-Basic drawing conventions and standards-Orthographic projection principles- Principal planes-First angle projection- Projection of points. Projection of straight lines (only first angle projections) inclined to both the principal planes- Determination of true lengths and true inclinations by rotating line method and trapezoidal method and traces.

UNIT II PROJECTIONS OF PLANES AND SOLIDS 6+6

Projection of planes (Polygonal and circular surfaces) inclined to both the principal planes. Projection of simple solids like prisms, pyramids, cylinder, cone, tetrahedron and truncated solids when the axis is inclined to one of the principal planes/ both principal planes by rotating object method and auxiliary plane method.

UNIT III ORTHOGRAPHIC PROJECTIONS, ISOMETRIC PROJECTIONS & FREEHANDSKETCHING 6+6

Orthographic projection of Simple parts from 3D diagram-Principles of isometric projection and isometric view-isometric scale- Isometric projections of simple solids and truncated solids- Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems Free hand sketching of orthographic & Isometric projection

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6+6

Sectioning of solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other-obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids- Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

.

UNIT V PERSPECTIVE PROJECTION, BUILDING DRAWING AND COMPUTER AIDED DRAFTING 6+6

Perspective projection of simple solids-Prisms, Pyramids and cylinders by visual ray method.Introduction- components of simple residential or office building-specifications-plan and elevation of different types of Residential buildings and office buildings.Introduction to drafting packages and basic commands used in AUTO CAD.Demonstration of drafting packages.

TEXT BOOKS:

1. N.D.Bhatt and V.M.Panchal, ―Engineering Drawing‖, Charotar Publishing House, 50th Edition, 2010.
2. K.V.Natarajan ―A Text book of Engineering Graphics‖, Dhanalakshmi Publishers, Chennai, 2009.

REFERENCES:

1. K.R.Gopalakrishna, ―Engineering drawing‖,(Vol-I & II combined) Subhas stores, Bangalore,2007.
2. K.Venugopal and V. Prabhu Raja, ―Engineering Graphics‖, New Age International Private limited,2008.
3. Luzzader, Warren.J., and Duff, John.M.,, ―Fundamentals of Engineering Drawing with an introduction to Interactive computer graphics for design and production‖, Eastern Economy Edition, Prentice Hall of India Pvt Ltd, New Delhi,2005.

Special points applicable to University Examinations on Engineering Graphics

1) There will be five questions, each of either or type covering all units of the syllabus.
2) All questions will carry equal marks of 20 each making a total of 100.

BCM1L1	**BASIC CIVIL & MECHANICALENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	0	0	2	1
	Prerequisite – Basic Civil and Mechanical Engineering				
	Course Designed by – Department of Mechanical Engineering& Civil Engineering				

OBJECTIVES

To provide exposure to the students with hands on experience on various basic Civil & Mechanical Engineering practices.

COURSE OUTCOMES (COs)

CO1	Learn Basic concepts
CO2	Students will get exposure regarding pipe connection for pumps & turbines and to study the joint used in roofs, doors, windows and furniture‘s.
CO3	Students will get exposure regarding smithy, foundry operations and in latest welding operations such as TIG, MIG, CO2, spot welding etc.,
CO4	Students will get hands on experience on basic welding techniques, machining and sheet metal works.
CO5	Students will get hands on experience on basic machining techniques
CO6	Students will get hands on experience on basic sheet metal techniques

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	H	L										
	CO2				H								
	CO3					H	L	L					
	CO4		H				M		L			H	
	CO5		H				M		L			H	
	CO6		H				M		L			H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
					√								
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

LIST OF EXPERIMENTS

I. CIVILENGINEERINGPRACTICE

Buildings:

a) Studyofplumbingandcarpentrycomponentsofresidentialandindustrialbuildings.Safetyaspects.

PlumbingWorks:

a) Studyofpipelinejoints,itslocationandfunctions:valves,taps,couplings,unions,reducers,elbowsin householdfittings.

b) Studyofpipeconnectionsrequirementsforpumpsandturbines.

c) Preparationofplumbinglinesketchesforwatersupplyandsewageworks.

d) Hands-on-exercise:Basicpipeconnection ofPVCpipes&G.I.Pipes– Mixedpipematerialconnection–Pipe connectionswithdifferentjoiningcomponents.

e) Demonstrationofplumbingrequirementsofhigh-risebuildings.

CarpentryusingHandtoolsandPowertools:

a) Studyofthejointsinroofs,doors,windowsandfurniture.

b) Hands-on-exercise:Woodwork,jointsbysawing,planningandcutting.

c) Preparationofhalfjoints,MortiseandTenonjoints.

II MECHANICALENGINEERINGPRACTICE

Welding:

a) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

BasicMachining:

a) Simple Turning and Taper turning

b) Drilling Practice

SheetMetalWork:

a) Forming&Bending:

b) Modelmaking–Trays,funnels, etc.
c) Differenttypeofjoints
d) Preparationofair-conditioningducts
e) Preparationofbuttjoints,lapjointsandteejointsbyarcwelding

Machineassemblypractice:

a) Assembling,dismantlingand Studyofcentrifugalpump
b) Assembling,dismantlingand Studyofairconditioner
c) Assembling,dismantlingandStudyoflathe

Moulding:

a) Mouldingoperationslikemouldpreparationfor gearandstepconepulleyetc

Fitting:

a) FittingExercises–Preparationofsquarefittingandvee–fittingmodels.

Demonstration:

a) Smithyoperations,upsetting,swaging,settingdownandbending.Example–Exercise–Productionofhexagonalheaded bolt.
b) Gaswelding.

REFERENCES:

1 K. Jeyachandran, S. Nararajan& S, Balasubramanian, ―A Primer on Engineering Practices Laboratory‖ ,Anuradha Publications, (2007).
2 T.Jeyapoovan, M. Saravanapandian& S. Pranitha, ―Engineering Practices Lab Manual‖,Vikas Publishing House Pvt. Ltd. (2006)
3 H. S. Bawa, ―Workshop Practice‖, Tata McGraw–Hill Publishing Company Limited, (2007).
4 A. Rajendra Prasad & P. M. M. S Sarma, ―Workshop Practice‖, SreeSai Publication, (2002).
5 P. Kannaiah& K.L. Narayana, ―Manual on Workshop Practice‖, Scitech Publication, (1999).

BPC 1L1/2L1	**PHYSICS AND CHEMISTRY LABORATORY**									**L**	**T**	**P**	**C**
	Total Contact Hours – 45									0	0	3	1
	Prerequisite – Physics and Chemistry												
	Course Designed by – Department of Physics & Chemistry												
OBJECTIVES: To impart knowledge to the students in practical physics and chemistry													
COURSE OUTCOMES (COs)													
CO1	Students will understand the concept of hall effect												
CO2	Students will understand the concept of semiconductors. .												
CO3	Student will understand the working of spectrometer.												
CO4	Student will able practically understand the chemical reactions.												
CO5	Students will Study the magnetic hysteresis and energy product												
CO6	Students understand the Determination of Band gap of a semiconductor												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II-LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler‘smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)
8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS 1L5 / 2L5 **NSS PRACTICAL** **L T P C 0 1 2 1**

OBJECTIVES

1. Understand the community in which they work and their relation
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop capacity to meet emergencies and natural disasters
4. Practice national integration and social harmony and
5. Utilize their knowledge in finding practical solutions to individual and community problems.

1. Regular Activities Programme

1) Traffic regulation
2) Working with Police Commissioner's Office
3) Working with Corporation of Chennai
4) Working with Health Department
5) Blind assistance
6) Garments collection
7) Non-formal education
8) Environmental Education, Awareness and Training (EEAT)
9) Blood donation

2.Special camp Programme

A) Legal awareness
B) Health awareness
C) First-aid
D) Career guidance
E) Leadership training - cum - Cultural Programme
F) Globalization and its Economic Social Political and Cultural impacts.

REFERENCE BOOKS:

1. National Service Scheme Manual, Government of India.
2. Training Programme on National Programme scheme, TISS.
3. Orientation Courses for N.S.S. Programme officers, TISS.
4. Case material as Training Aid for field workers, Gurmeet Hans.
5. Social service opportunities in Hospitals, Kapil K.Krishan,TISS.
6. Social Problems in India, Ram Ahuja.

BEN 201	**ENGLISH II**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – English I				
	Course Designed by – Department of English				
OBJECTIVES Students will be able to actively participate in group discussions. Students will have Telephonic Skills, Giving Directions and Information Transfer					
COURSE OUTCOMES (COs)					
CO1	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)				
CO2	To make students comprehend the habit of intelligent Reading as well as Computer- based competitive exams glob				

CO3	To achieve a reasonably good level of competency in Report Writing.
CO4	To make the students aware to different kinds of Learner-friendly modes of language to a variety of self- instructional learning (Computer based)
CO5	To achieve a reasonably good level of competency in group discussions
CO6	To achieve a reasonably good level of competency in public speaking

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	J	k	l
2	CO1	M	L	H	L	M			H		M	L	
	CO2			H	L				H		M	L	
	CO3			H	L	M			H		H	L	
	CO4			H	L	M			H		M	L	
	CO5			H	L	M			H		M	L	
	CO6			H	L	M			H		M	L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ORIENTATION12

Numerical adjectives - Meanings in context - Same words used as different parts of speech - Paragraph writing - Non- verbal communication - Regular and Irregular verbs.

UNIT II ORAL SKILL 12

Listening to audio cassettes - C.Ds , News bulletin - Special Lectures, Discourse - Note taking - Sentence patterns - SV, SVO, SVC, SVOC, SVOCA - and Giving Instructions - Reading Comprehension answering questions. Inferring meaning.

UNIT III THINKING SKILL 12

Self- introduction describing –Group Discussion – Debate –Role play- Telephone- Things-etiquette- Recommendation and Sequencing jumbled sentences to make a suggestions-paragraph-advertisement and notice, Designing or drafting posters, writing formal and informal invitations and replies.

UNIT IV WRITING SKILL 12

Definitions - Compound nouns - Abbreviations and acronyms – (a) business or official letters(for making enquiries, registering complaints, asking for and giving information, placing orders and sending replies): (b) Letters to the editor (giving suggestions on an issue) .

UNIT V FORMAL INFORMATION 12

Editing – Prepositions - Articles - Permission letter for undergoing practical training , Essay writing - Application for a job , letter to the principal authorities regarding admissions, other issues, requirement or suitability of course etc.

TEXT BOOK:

1. Meenakshi Raman, Sangeetha Sharma , Technical English for Communication: Principle and Practice, OUP, 2009.

REFERENCE BOOKS:

1. Sumanth , English for Engineers, Vijay Nicole , Imprints pvt ltd.2013.
2. Meenakshi Raman and SangeethaSharma , Technical Communication Principles and Practice, Oxford University Press, 2009.
3. Sangeetha Sharma, Binodmishra , Communication skills for engineers and scientists , PHI Learning Pvt Ltd, New Delhi, 2010.

BMA 201	**MATHEMATICS – II**									**L**	**T**	**P**	**C**
	Total Contact Hours - 60									3	1	0	3
	Prerequisite – Mathematics I												
	Course Designed by – Department of Mathematics												
OBJECTIVES Ability to apply these principles of mathematics in projects and research works.													
COURSE OUTCOMES (COs)													
CO1	Student shall be able to Solve differential equations, simultaneous linear equations, and s special types of linear equations related to engineering.												
CO2	Relate the use of mathematics in applications of various fields namely fluid flow, heat flow, s mechanics, electrostatics, etc.												
CO3	Ability to test hypothesis												
CO4	Find intensity of degree of relationship between two variables and also bring out regres equations.												
CO5	Understand to solve matrix problems related to real life problems.												
CO6	Formulate mathematical models												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H		L									
	CO2		H				H		L	L		M	
	CO3		H				H		L	L		M	
	CO4					M						M	
	CO5										M	M	
	CO6										M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ORDINARY DIFFERENTIAL EQUATION 12

Higher order linear differential equations with constant coefficients - Method of variation of parameters – **Cauchy‟s** and L**egendre‟s linear equations** - simultaneous first order linear equations with constant coefficients.

UNIT II VECTOR CALCULUS 12

Gradient, divergence and curl –Directional derivatives –Irrotational and solenoidal vector fields – vector integration– **Green‟s theorem in a plane , Gauss divergence theorem and** S**toke‟s theorem (**without proofs) – simple applications involving cubes and rectangular parallelepipeds.

UNIT III ANALYTIC FUNCTIONS 12

Functions of a complex variable – Analytic functions – Necessary conditions, Cauchy-Riemann equation and sufficient conditions (without proofs) – Harmonic and orthogonal properties of analytic functions – Harmonic conjugate – construction of analytic functions – conformal mapping: W= Z+C, CZ, 1/Z and bilinear transformation.

UNIT IV COMPLEX INTEGRATION 12

Complex integration – **Statement and application of Cauchy‟s integral theorem and Cauchy‟s integral formula** –Taylor and Laurent expansions – Singular points – Residues – Residue theorem –Application of Residue theorem to evaluate real integrals – Unit circle and semi-circular contour (excluding poles on boundaries).

UNIT V STATISTICS 12

Mean, Median, Mode – Moments –Skewness and Kurtosis – Correlation – Rank Correlation – Regression –Chi square test for contingency tables.

TEXT BOOK:

1. R.M.Kannan and B.Vijayakumar– Engineering Mathematics–II –2nd Edition, SRB Publication, Chennai 2007.
2. Bali.N.P and Manish Goyal , –Engineering Mathematics—, 3rd Edition, Laxmi Publications (P) Lltd, 2008 .
3. Grewal .B/S –Higher Engineering Mathematics‖, 40th Editon, Khanna Publications, Delhi, 2007

REFERENCES :

1. Ramana.B.V, ―Higher Engineering Mathematic―, Tata McGraw Hill Publishing Company, New Delhi, 2007.
2. Gupta SC, and VK.Kapoor, ―Fundamentals Mathematical Statistics‖, 11th edition, Sultan Chand Sons, New Delhi, 2014.

BPH201	**ENGINEERING PHYSICS -II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING PHYSICS -I				
	Course Designed by – Department of Physics				

OBJECTIVES

- To expose the students to multiple areas of science of engineering materials which have direct relevance to different Engineering applications
- To understand the concepts and applications of conducting, Semiconducting, magnetic & dielectric materials as well as their optical properties.

COURSE OUTCOMES (COs)

CO1	Understand about properties and advancements of conducting materials.
CO2	Understand the principle and properties semiconducting materials.
CO3	Acquire Knowledge on Magnetic and dielectric Materials.
CO4	To Know about the creation of new materials with novel properties
CO5	To Understand the impact of modern materials in technical uses.
CO6	Learn new engineering materials and its characteristics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H											
	CO2		L	H		M							
	CO3		M		H								
	CO4	H		M	L								
	CO5		L	L									
	CO6	H											

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CONDUCTING MATERIALS 9

Conductors – classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann – Franz law – Lorentz number – Draw backs of classical theory – Quantum theory –

Fermi distribution function – Effect of temperature on Fermi Function – Density of energy states – carrier concentration in metals.

UNIT II SEMICONDUCTING MATERIALS 9

Intrinsic semiconductor – carrier concentration derivation Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination – compound semiconductors -direct and indirect band gap- derivation of carrier concentration in n-type and p-type semiconductor – variation of Fermi level with temperature and impurity concentration — Hall effect –Determination of Hall coefficient – Applications.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Bohr magneton – comparison of Dia, Para and Ferro magnetism – Domain theory – Hysteresis – soft and hard magnetic materials – antiferromagnetic materials – Ferrites and its applications Superconductivity : properties – Type I and Type II superconductors – BCS theory of superconductivity(Qualitative) - High Tc superconductors – Applications of superconductors – SQUID, cryotron, magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Electrical susceptibility – dielectric constant – electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius – Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials (capacitor and transformer) – ferroelectricity and applications.

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: preparation, properties and applications. Shape memory alloys (SMA): Characteristics, properties of NiTi alloy, application, Nanomaterials– Preparation -pulsed laser deposition – chemical vapour deposition – Applications – NLO materials –Birefringence- optical Kerr effect – Classification of Biomaterials and its applications.

TEXT BOOKS:

1. Jayaraman D Engineering Physics II. Global Publishing House, 2014.
2. Palanisamy P.K. Materials Science. SCITECH Publishers, 2011.
3. Senthilkumar G. Engineering Physics II. VRB Publishers, 2011.

REFERENCES:

1. Arumugam M., Materials Science. Anuradha publishers, 2010
2. Pillai S.O., Solid State Physics. New Age International(P) Ltd., publishers, 2009
3. Marikani A. Engineering Physics. PHI Learning Pvt., India, 2009
4 http://ocw.mit.edu/courses/find-by-topic
5 http://nptel.ac.in/course.php?disciplineId=122
6 https://en.wikipedia.org/wiki/Engineering_physics

BCH 201	**ENGINEERING CHEMISTRY-II**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – ENGINEERING CHEMISTRY –I				

	Course Designed by – Department of Chemistry

OBJECTIVES

To impart a sound knowledge on the principles of chemistry involving application oriented topics required for all engineering branches.

COURSE OUTCOMES (COs)

CO1	Students will understand the concepts and further industrial applications of surface chemistry
CO2	To impart knowledge about the Industrial importance of Phase rule and alloys
CO3	To make the students to be conversant with Analytical techniques of chemistry and their importance
CO4	To have an idea and knowledge about the Chemistry of Fuels and
CO5	Understanding of engineering materials
CO6	All about bonding and molecular structures

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L		H		H				M	
	CO2		H			H		H					
	CO3	H		L		H		H				M	
	CO4			L		H		H					
	CO5			L		H		H					
	CO6			L		H		H		H		M	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SURFACE CHEMISTRY 9

Introduction **:** Adsorption , absorption , desorption , adsorbent , adsorbate and sorption – (definition only) Differences between adsorption and absorption Adsorption of gases on solids – factors affecting adsorption of gases on solids – Adsorption isotherms –Frendlich adsorption isotherm and Langmuir adsorption isotherm Role of adsorbents in catalysis, Ion-exchange adsorption and pollution abatement.

UNIT II PHASE RULE AND ALLOYS 9

Introduction **:**Statement of Phase Rule and explanation of terms involved – one component system – water system – Construction of phase diagram by thermal analysis - Condensed phase rule [Definition only] Two Component System : Simple eutectic systems (lead-silver system only) – eutectic temperature – eutectic composition – Pattinsons Process of desilverisation of Lead Alloys: Importance, ferrous alloys –nichrome and stainless steel – 18/8 stainless steel -

heat treatment of steel – annealing – hardening – tempering normalizing – carburizing - nit riding . Non- ferrous alloys: Brass and Bronze

UNIT III ANALYTICAL TECHNIQUES 9

Introduction: Type of Spectroscopy - Atomic spectroscopy – molecular spectroscopy - Explanation IR spectroscopy – principles – instrumentation (block diagram only) – applications - finger print region UV-visible spectroscopy –– principle – instrumentation (block diagram only) – Beer-**Lambert‟s law**- – estimation of iron by colorimetry– Atomic absorption spectroscopy- principle - instrumentation (block diagram only) - estimation of Nickel by Atomic absorption spectroscopy Flame photometry– principles – instrumentation (block diagram only) - estimation of sodium ion by Flame photometry

UNIT IV FUELS 9

Introduction **:** Calorific value – types of Calorific value - gross calorific value – net calorific value Analysis of Coal –- Proximate and ultimate analysis – hydrogenation of coal - Metallurgical coke – manufacture by Otto-Hoffmann method Petroleum processing and fractions – cracking – catalytic cracking – types – fixed bed catalytic cracking method- Octane number and Cetane number (definition only) Synthetic petrol – Bergius processes – Gaseous fuels- water gas, producer gas, CNG and LPG (definition and composition only) Flue gas analysis – importance - Orsat apparatus

UNIT V ENGINEERING MATERIALS 9

Introduction: Refractory‟s – classification – acidic, basic and neutral refractory‟s – properties (refractoriness, refractoriness under load, dimensional stability, porosity, thermal spalling) Manufacture of Refractory‟s: alumina bricks and Magnesite bricks, Abrasives – natural and synthetic abrasives Natural type : Siliceous - quartz ; Non –siliceous – diamond Synthetic Abrasives : silicon carbide and boron carbide. Lubricants: Liquid lubricants - Properties – viscosity index, flash and fire points, cloud and pour points, oiliness) Solid lubricants – graphite and molybdenum sulphide

TEXT BOOKS:

1. P.C.Jain and Monica Jain, –Engineering Chemistry‖ Dhanpat Rai Pub, Co., New Delhi (2002).
2. S.S.Dara –A text book of Engineering Chemistry‖ S.Chand &Co.Ltd., New Delhi (2006).
3. P. J. Lucia, M. Subhashini, –Engineering Chemistry, Volume 1‖, Crystal Publications, Chennai, (2007).

REFERENCES:

1. B.Sivasankar –Engineering Chemistry‖ Tata McGraw-Hill Pub. Co.Ltd, New Delhi,(2008)
2. B.K.Sharma –Engineering Chemistry‖ Krishna Prakasan Media (P) Ltd., Meerut (2001).
3. http://ocw.mit.edu/courses/find-by-topic
4. http://nptel.ac.in/course.php?disciplineId=122
5. https://en.wikipedia.org/wiki/Spectroscopy

	FRENCH	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3

BFR 201	Prerequisite – +2 Level English
	Course Designed by – Department of English

OBJECTIVES

Language gives access and insights into another culture. It is a fundamental truth that cultures define themselves through languages.

COURSE OUTCOMES (COs)

CO1	Introduce the basics of the language to beginners
CO2	Understand a dialogue and dialogue presentation
CO3	To develop their knowledge as well as their communicative skills so as to be able to respond in simple everyday contexts.
CO4	Synchronies I includes documents which initiate the learners to another world, another culture and which acclimatize them to the authentic use of the French language through the exploitation of written and iconographic documents. The Indian context has been used.
CO5	Grammatical and lexical notions as well as activities required for communication are learnt by the students.
CO6	Interpreting skills and confidence in the language.
CO6	Interpreting skills and confidence in the language.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 8

At the airport: Savoir– faire: exchanging greetings, self introduction, introducing another, welcoming someone, identifying someone - Grammar: verbs _to be', _to call oneself', subject pronouns, interrogation

UNIT II GRAMMAR 8

At the University: Savoir-faire: enquiring after one‘s welfare, taking leave, expressing appreciation -Grammar: definite & indefinite articles, gender of nouns, adjectives, present tense of regular _er‘ verbs, _to have‘, _to learn‘, negation, irregular verbs

UNIT III CONVERSATION 8

At the café: Savoir –faire: speaking about one‘s likes, giving information, expressing admiration, asking information about someone - Grammar: Interrogative adjectives, irregular verbs, possessive and interrogative adjectives

UNIT IV PROPOSAL WRITING 7

At the beach: Savoir faire: proposing an outing, accepting/ refusing the proposal - Grammar: singular & plural, indefinite pronoun, demonstrative adjectives, negation, irregular verbs

UNIT V FORMAL LETTERS 7

A concert: Savoir –faire: inviting, accepting, expressing one‘s inability to accept an invitation

UNIT VI REGULAR & IRREGULAR VERBS 7

Grammar: Present tense of more irregular verbs, contracted articles, future tense, interrogative adverbs, **At Nalli‟s** Savoir- faire: asking the price of an article, protesting against the price, Grammar: possessive adjectives, Exclamative adjectives, imperative tense

REFERENCES:

1. Course Material: Synchronie I –Méthode de Français
2. Madanagobalane -Samita Publications, Chennai, 2007

BGM 201	**GERMAN**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

At the end of this course, students shall be able to obtain good knowledge of the language, to read, write and speak German, whereby the emphasis is laid on speech.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand German lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

Course structure:

A. German Language (speaking, reading, writing, grammar and test)
B. Life in Germany (shopping, restaurant, doctor, government, bank, post)
C. The German Way (introduction, doing business, conversation, meetings, dining)
D. Germany (Culture, Climate)

UNIT I PRONOUNCIATION 9

Welcome: Introduction to the Language, Spelling and Pronunciation (The alphabets and numbers) Greetings, ordering, requesting, saying thank you - Grammar **– the article "the", conjugation** of verbs

UNIT II SELF INTRODUCTION 9

Shopping - Grammar **–** adjectives, endings before nouns, practice. Self introduction

UNIT III TRAINING 9

Addresses, Occupations, Studies - Grammar - **„to be", the definite/indefinite** articles, individual Training

UNIT IV ORAL 9

Leisure Time, Sports, Hobbies - Grammar **–** position of a verb in a main clause , oral practice

UNIT V NARRATION 9

At a Restaurant, Food and Drink - Grammar **–** the personal pronoun in the Nominative and Accusative, Narrating an event

RESOURCES:

1. Sprachkurs Deutsch 1 (Verlag Diesterweg), New Delhi Learning Centre

	JAPANESE	L	T	P	C
BJP 201	Total Contact Hours - 45	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Japanese language, Japanese culture and heritage
To impart knowledge Japanese lifestyle.
To give sufficient exposure to develop basic conversational skills.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Japanese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CULTURAL HERITAGE 9

Introduction-history and origin of Japanese language-Japan and its cultural heritage-Self introduction-counting numbers (1-100)-time-conversation with the use of audio devices, grammar– usage of particles wa, no, mo and ka

UNIT II USAGE 9

Greetings, seasons, days of the week and months of the year-numbers (up to 99,999)-grammar– usage of kore, sore, are, kono, sono, ano, koko and kochira, arimasu and imasu-i-ending and na-ending adjectives-use of audio and drills for practice

UNIT III ORAL 9

Asking the price–associated vocabulary-usage of particles ni, ga and ne- use of audio and drills for practice-Introduction to basic Kanji characters- use of audio and drills for practice

UNIT IV ART AND CULTURE 9

Family relationships- colours-Kanji (numbers) and festivals of Japan-religion-Japanese art and culture-ikebana, origami-introduction to hiragana- use of audio and drills for practice

UNIT V DRILLS AND PRACTICE 9

Vocobulary associated with directions-asking way-particles – e, de, mo, koko, soko, asoko, doko, nani, mae, ushiro, ue, shita- use of audio and drills for practice-introduction to katakana

TEXT BOOKS

1. Japanese Hiragana and Katakana for beginners, Timothy G. Stout, 2011
2. Genki I: An integrated course in elementary Japanese, Eri Banno and Yuko Ikeda, 2011

REFERENCE BOOKS

1. Japanese Reader collection Volume I, Yumi Boutwell and Clay Boutwell, Kotoba books, 2013
2. Living Language Japanese Complete Edition beginners through advanced course, Living Language, 2012

BKR 201	**KOREAN**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	1	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Korean language, Korean culture and heritage
To impart knowledge on Korean lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.
CO3	Will develop basic conversational skills.
CO4	Will understand Korean lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture .

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective	Open Elective	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PLANNING 9

Asking/giving reasons for studying Korean, making plans for the holiday, writing letters, describing past travel experiences and future travel plans, shopping in a grocery store, shopping in electronics store, storytelling Grammar: would like to (do), want to (do), construct future tense.

UNIT II MODIFIERS 9

Asking about feelings, asking about problems and giving advice, brief introductions - Grammar: Noun modifier, please try doing (something), irregular adjective/verb

UNIT III PLACING ORDERS 9

Asking about hobbies, asking about abilities (sports), job requirements, Ordering things for delivery, ordering a meal at a restaurant - Grammar: Sentence ending for the honorific form, please do something for me, have tried (something),

UNIT IV DESCRIPTIONS 9

Asking about evening plans, making plans with others, making preparations - Asking about rooms, describing your room to your classmates, describing your house. Grammar: to know/not know how to do something, must (do), have to (do), should,

UNIT V GRAMMAR 9

Describing your plans and giving reasons, cancelling appointments. Grammar: Shall we~? / Should we~?, with, and, irregular verbs/adjective, so, because, cannot, intend to, plan to, or hope to, (more) than, the most, tag question/is n‟t it? ,will (do)

COURSE MATERIAL:

Korean for Non-Native Speakers (Student Book 1B) Korean Language Education Center, Sogang University

BCN 201	**CHINESE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	3	0	0	3
	Prerequisite – +2 Level English				
	Course Designed by – Department of English				

OBJECTIVES

To have a basic knowledge of Chinese language, Chinese culture and heritage

To impart knowledge on Chinese lifestyle and heritage.

COURSE OUTCOMES (COs)

CO1	Will have a basic knowledge of the language
CO2	Will acquire reading and writing skills.

CO3	Will develop basic conversational skills.
CO4	Will understand Chinese lifestyle
CO5	Will gain confidence to survive in a global environment
CO6	Will have attained to survive and adopt change in a foreign culture

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L										
	CO2			H	L				H	H	M	L	L
	CO3			H	L				H	H	M	L	L
	CO4			H					H	H	M	L	L
	CO5			H	L				H	H	M		L
	CO6			H					H	H	M		L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT 1 RISE OF DIALECTS 9

History, Origins, Old and middle Chinese, Rise of northern dialects

UNIT II VARIETIES 9

Influences 3 Varieties of Chinese. 1.Classification 2.Standard Chinese and 3.Nomenclature

UNIT III CHARACTERS 9

Chinese characters, Homophones, Phonology

UNIT IV TRANSCRIPTIONS 9

Tones, Phonetic transcriptions, Romanization, Other phonetic transcriptions

UNIT V GRAMMAR 9

Grammar and morphology, Vocabulary, Loanwords, Modern borrowings and loanwords

REFERENCES:

1. Hannas, William C. (1997), Asia's Orthographic Dilemma, University of Hawaii Press, ISBNHYPERLINK –http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-1892-0" 978-0-8248- 1892-0.
2. Qiu, Xigui (2000), Chinese Writing, trans. Gilbert Louis Mattos and Jerry Norman, Society for the Study of Early China and Institute of East Asian Studies, University of California, Berkeley, ISBN HYPERLINK http://en.wikipedia.org/wiki/Special:BookSources/978-1-55729 071-7,978-1-55729-071-7.

3 Ramsey, S. Robert (1987), The Languages of China, Princeton University Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-691-01468-5" 978-0-691-01468-5.
4 Schuessler, Axel (2007), ABC Etymological Dictionary of Old Chinese, Honolulu: University of Hawaii Press, ISBNHYPERLINK "http://en.wikipedia.org/wiki/Special:BookSources/978-0-8248-2975-9"978-0-8248-2975-9.
5 R. L. G. " Language borrowing Why so little Chinese in English?" The Economist. June 6, 2013

BME 202	**ENGINEERING MECHANICS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	3	1	0	3
	Prerequisite – Engineering Mathematics I , II, Engg. Physics				
	Course Designed by – Department of Mechanical Engineering				

OBJECTIVES: To understand the concept of basic engineering mechanism

COURSE OUTCOMES (COs)

CO1	Students will understand the concepts of engineering mechanics
CO2	Students will understand the vectorial representation of forces and moments
CO3	Students will gain knowledge regarding center of gravity and moment of inertia and apply them for practical problems.
CO4	Students will gain knowledge regarding various types of forces and reactions and tom draw free body diagram to quicker solutions for complicated problems.
CO5	Student will gain knowledge in solving problems involving work and energy
CO6	Student will gain knowledge on friction on equilibrium and its application.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	H		H		L		H	H	
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective	Project/Term Paper Seminar/ Internship
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I BASICS AND STATICS OF PARTICLES 12

Introduction - Units and Dimensions - Laws of Mechanics – **Lame"s theorem, Parallelogram and triangular Law** of forces – Vectors –Vectorial representation of forces and moments – Vector operations on forces - Coplanar Forces – Resolution and Composition of forces – Resultant of several concurrent forces - Equilibrium of a forces – Forces in space - Equilibrium

of particle in space - Equivalent systems of forces – Principle of transmissibility – Single equivalent force.

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports and their reactions – requirements of stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis –Vectorial representation of moments and couples– Scalar components of a moment – **Varignon"s theorem** - Equilibrium of Rigid bodies in two dimensions -Equilibrium of Rigid bodies in three dimensions.

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Determination of areas – First moment of area and the Centroid of standard sections – T section, I section, Composite figures, Hollow section – second moments of plane area – Rectangle, triangle, circle - T section, I section, Hollow section – Parallel axis theorem and perpendicular axis theorem – Polar moment of inertia – Principal moments of inertia of plane areas – Principal axes of inertia – Basic concept of Mass moment of inertia.

UNIT IV FRICTION12

Frictional force – Laws of Coloumb friction – Cone of friction – Angle of repose – Simple contact friction – Sliding of blocks – Wedge friction - Ladder friction – Screw Jack – Belt friction - Rolling resistance.

UNIT V DYNAMICS OF PARTICLES12

Displacements, Velocity and acceleration, their relationship – Relative motion – Relative acceleration – Curvilinear motion of particles – **Newton"s law** – work energy equation – impulse and Momentum – Impact of
elastic bodies.

TEXT BOOK:

1. Beer, F.P and Johnson Jr. E.R, –Vector Mechanics for Engineers: Vol. 1 Statics and vol. 2 Dynamics", McGraw-Hill International Edition, 2013.
2. Rajasekaran, S, Sankarasubramanian, G., Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt., Ltd., 2011.

REFERENCES :

1. Kumar, K. L Kumar, V., Engineering Mechanics, Tata McGraw – Hill, New Delhi, 2010
2. Palanichamy, M.S., Nagan, S., Engineering Mechanics – Statics & Dynamics, Tata McGraw - Hill, 2013.
3. Timoshenko, and Young, Engineering Mechanics, Tata McGraw-Hill, New Delhi, 2013.
4. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, IV Edition – Pearson Education Asia Pvt., Ltd., 2006.

BEE 201	**BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 30	2	0	0	2
	Prerequisite – Engineering Mathematics, Engineering Physics-I & II				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To understand the laws of electrical engineering.													
COURSE OUTCOMES (COs)													
CO1	Students will gain knowledge regarding the various laws and principles associated with electrical systems.												
CO2	Students will gain knowledge regarding electrical machines and apply them for practical problems.												
CO3	Students will gain knowledge regarding various types semiconductors.												
CO4	Student will gain knowledge digital electronics.												
CO5	Student will gain knowledge on electronic systems.												
CO6	Students will acquire knowledge in using the concepts in the field of electrical e projects and research.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L			
	CO2		H	M			L		L	L			
	CO3		H	M			L		L				
	CO4	M	H	M			L		L	L			
	CO5	M	H	M			L		L				
	CO6		H				L		L	H			
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)	
					√								
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I ELECTRIC CIRCUITS 6

Ohm‘s law – Kirchoff‘s Laws, V – I Relationship of Resistor (R) Inductor (L) and capacitor (C). Series parallel combination of R, L&C – Current and voltage source transformation – mesh current & node voltage method –superposition theorem –Thevenin‘s and Norton‘s Theorem - Problems.

UNIT II ELECTRICAL MACHINES6

Construction, principle of operation, Basic Equations and applications - D.C.Generators and D.C.Motors**.** -Single phase Induction Motor - Single Phase Transformer.

UNIT III BASIC MEASUREMENT SYSTEMS6

Introduction to Measurement Systems, Construction and Operating principles of PMMC, Moving Iron, Dynamometer Wattmeter, power measurement by three-watt meter and two watt method **–** and Energy meter.

UNIT IV SEMICONDUCTOR DEVICES6

Basic Concepts of semiconductor devices – PN Junction Diode Characteristics and its Applications – HWR, FWR –Zener Diode – BJT (CB, CE, CC) configuration & Characteristics.

UNIT V DIGITAL ELECTRONICS6

Number system – Logic Gates – Boolean Algebra– De-**Morgan"s Theorem –** Half Adder & Full Adder – Flip Flops.

TEXT BOOKS:

1. N.Mittal –Basic Electrical Engineering‖. Tata McGraw Hill Edition, New Delhi, 1990.
2. A.K. Sawhney, ‗A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2004.
3. Jacob Millman and Christos C-Halkias, –Electronic Devices and Circuits‖, Tata McGraw Hill

REFERENCE BOOKS:

1. Edminister J.A. –Theory and Problems of Electric Circuits‖ Schaum's Outline Series. McGrawHill Book Compay, 2nd Edition, 1983.
2. Hyatt W.H and Kemmerlay J.E. –Engineering Circuit Analysis‖, McGraw Hill Internatinal Editions, 1993.
3. D. P. Kothari and I. J. Nagrath– Electric Machines‖Tata McGraw-Hill Education, 2004
4. Millman and Halkias, –Integrated Electronics‖, Tata McGraw Hill Edition, 2004.

BCS 2L2	**COMPUTER PRACTICE LABORATORY**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									0	0	3	1
	Prerequisite – Fundamentals of Computer												
	Course Designed by – Department of Computer Science &Engineering												
OBJECTIVES: To impart basic computer knowledge													
COURSE OUTCOMES (COs)													
CO1	Demonstrate major algorithms and data												
CO2	Implementation of array operations												
CO3	Implementation of binary tree.												
CO4	Implementation of linked list												
CO5	Students will able to do analyse data using spread sheet												
CO6	Student will able to understand the basics of C programming.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	L	H		H		L		H	H	H
	CO2						H	H	L				
	CO3						H	H	L		M		
	CO4						H	H	L		M		
	CO5						H	H	L		M		
	CO6						H	H	L		M		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
				√					
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

A) WORD PROCESSING **6**

Document creation, Text manipulation with Scientific Notations.Table creation, Table formatting and Conversion.Mail merge and Letter Preparation. Drawing-Flow Chart

B) SPREAD SHEET **9**

Chart-Line Xy Bar and Pie – Formula-Formula Editor-Spread sheet-Inclusion of Object, Picture and Graphics Protecting the document and sheet-Sorting and Import/Export features.

C) SIMPLE C PROGRAMMING* **15**

Data types, Expression Evaluation, Condition Statement. Arrays structures and Unions – Functions

D) SIMPLE C++PROGRAMMING **15**

-Classes and Objects

-Constructor and Destructor

***For Programming exercises Flow chart and Pseudo code are essential.**

BEE2L1	**BASIC ELECTRICAL AND ELECTRONIC ENGINEERING PRACTICES LABORATORY**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Basic Electrical and Electronics Engineering				
	Course Designed by – Department of Electrical & Electronics Engineering				

OBJECTIVES: To enhance the student with knowledge on electrical and electronic equipment

COURSE OUTCOMES (COs)

CO1	Students will able to handle basic electrical equipments.
CO2	Students will able to do staircase wiring.
CO3	Students will able to understand domestic wiring procedures practically.
CO4	Student will able to assemble electronic systems.
CO5	Students will understand all the fundamental concepts involving electrical engineering
CO6	Students will understand all the fundamental concepts involving electronics engineering

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	M	H	M			L		L	L	M	H	
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	
	CO5	M	H	M			L		L		M	H	
	CO6		H				L		L	H		H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
						√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

I LIST OF EXPERIMENTS FOR ELECTRICAL ENGINEERING LAB

1. Fluorescent lamp wiring
2. Stair case wiring
3. Measurement of electrical quantities-voltage current, power & power factor in RLC circuit
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter
5. Measurement of energy using single phase energy meter
6. Measurement of resistance to earth of electrical equipment

II LIST OF EXPERIMENTS FOR ELECTRONICS ENGINEERING LAB

1. Study of electronic components and equipments.
   a. Resistor colour coding using digital multi-meter.
   b. Assembling electronic components on bread board.
2. Measurement of ac signal parameters using cathode ray oscilloscope and function generator.
3. Soldering and desoldering practice.
4. Verification of logic gates (OR, AND, OR, NOT, NAND, EX-OR).
5. Implementation of half adder circuit using logic gates.

	PHYSICS AND CHEMISTRY LABORATORY	**L**	**T**	**P**	**C**
BPC 1L1/2L1	Total Contact Hours – 45	0	0	3	1
	Prerequisite – Physics and Chemistry				
	Course Designed by – Department of Physics & Chemistry				
OBJECTIVES: To impart knowledge to the students in practical physics and chemistry					
COURSE OUTCOMES (COs)					
CO1	Students will understand the concept of hall effect				
CO2	Students will understand the concept of semiconductors. .				
CO3	Student will understand the working of spectrometer.				

CO4	Student will able practically understand the chemical reactions.
CO5	Students will Study the magnetic hysteresis and energy product
CO6	Students understand the Determination of Band gap of a semiconductor

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	H	M			L		L	L	M	H	M
	CO2		H	M			L		L	L		H	
	CO3		H	M			L		L			H	
	CO4	M	H	M			L		L	L	M	H	M
	CO6		H				L		L	H		H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

I -LIST OF EXPERIMENTS – PHYSICS

1. Determination of Wavelength, and particle size using Laser
2. Determination of acceptance angle in an optical fiber.
3. Determination of velocity of sound and compressibility of liquid – Ultrasonic interferometer.
4. Determination of wavelength of mercury spectrum – spectrometer grating
5. Determination of thermal conductivity of a bad conductor – Lee‟s Disc method.
6. Determination of Young‟s modulus by Non uniform bending method
7. Determination of specific resistance of a given coil of wire – Carey Foster‟s Bridge
8. Determination of Young‟s modulus by uniform bending method
9. Determination of band gap of a semiconductor
10. Determination of Coefficient of viscosity of a liquid –Poiseuille‟s method
11. Determination of Dispersive power of a prism - Spectrometer
12. Determination of thickness of a thin wire – Air wedge method
13. Determination of Rigidity modulus – Torsion pendulum

II- LIST OF EXPERIMENTS – CHEMISTRY

1. EstimationofhardnessofWaterbyEDTA
2. EstimationofCopper in brass byEDTA
3. Determination of DOin water (Winkler‘smethod)
4. EstimationofChloride in Watersample (Argento metry)
5. Estimationof alkalinityofWater sample
6. Determinationofmolecularweight
7. Conduct metric titration (Simple acid base)

8. Conduct metric titration (Mixture of weak and strong acids)
9. Conduct metric titration using $BaCl_2$vs Na_2SO_4
10. Potentiometric Titration (Fe^{2+} / $KMnO_4$ or $K_2Cr_2O_7$)
11. pH titration (acid & base)
12. Determination of water of crystallization of a crystalline salt (Copper Sulphate)
13. Estimation of Ferric iron by spectrophotometer.

BSS1L7/BSS2L7 YOGA FOREMPOWERMENT

L T P C
0 1 2 1

OBJECTIVE:
Providing Value Education to improve the Students' character - understanding yogic life and physical health - maintaining youthfulness - Measure and method in five aspects of life

UNIT I PHYSICAL HEALTH 6
Manavalakalai (SKY) Yoga: Introduction - Education as a means for youth empowerment - Greatness of Education - Yoga for youth Empowerment.
Simplified Physical Exercises: Hand, Leg, Breathing, Eye exercises - Kapalabathi, Makarasana Part I, Makarasana Part II, Body Massage, Acu pressure, Relaxation exercises - Benefits.
Yogasanas 1: Pranamasana - Hastha Uttanasana - Pada Hasthasana - Aswa Sanjalana Asana - Thuvipatha asva Sanjalana asana - Astanga Namaskara - Bhujangasana - Atha Muktha Savasana - Aswa Sanjalana Asana - Pada Hasthasana - Hastha Uttanasana - Pranamasana.
Pranayama: Naddi suddi - Clearance Practice - Benefits.
Simplified Physical Exercise - Kayakalpa Practices - Meditation Practices.

UNIT II LIFE FORCE 6
Reasons for Diseases: Natural reasons (Genetic / imprints, Planetary Position, Natural calamities and climatic changes) - Unnatural reasons (Food habits, Thoughts, Deeds)
Philosophy of Kaya kalpa: Physical body - Sexual vital fluid - Life force - Bio-Magnetism - Mind.
Maintaining youthfulness: Postponing old age - Transformation of food into seven components - Importance of sexual vital fluid - Measure and method in five aspects of life - Controlling undue Passion.
Kayakalpa practice: Aswini Mudra - Ojas breath - Benefits of Kaya Kalpa.

UNIT III MENTAL HEALTH 6
Mental Frequencies: Beta, Apha, Theta and Delta wave - Agna Meditation explanation-benefits.
Shanti meditation: Shanthi Meditation explanation-benefits
Thuriya Meditation: Thuriya Meditation explanation-benefits
Benefits of Blessing: Self blessing(Auto suggestion) - Family blessing - Blessing the others - World blessing - Divineprotection

UNIT IV VALUES 6
Human Values: Self control - Self confidence - Honesty Contentment - Humility - Modesty Tolerance – Adjustment - Sacrifice - Forgiveness

Purity(Body,Dress,Environment) - Physicalpurity-Mentalpurity - Spiritual purity

Social Values :
Non violence - Service Patriotism - Equality
Respectforparentsandelders - careandprotection - Respectforteacher Punctuality - TimeManagement

UNIT V MORALITY (virtues) 6
Importance of Introspection: I - Mine (Ego, Possessiveness)
SixEvilTemperaments-Greed-Anger - Miserliness-Immoralsexualpassion - InferiorityandsuperiorityComplex - Vengeance
Maneuvering of Six Temperaments: Contentment - Tolerance - Charity - Chastity – Equality - Pardon (Forgiveness)
FiveessentialQualitiesacquiredthroughMeditation:Perspicacity – Magnanimity – Receptivity - Adaptability - Creativity(ImprovedMemoryPower)

Total periods: 30

REFERENCE BOOKS:

1. Yoga for modern age - ThathuvagnaniVethathiri Maharishi
2. Simplified Physical Exercises - ThathuvagnaniVethathiri Maharishi
3. Kayakalpam - Thathuvagnani VethathiriMaharishi
4. Thirukkural -Rev.Dr.G.U.pope
5. Mind-ThathuvagnaniVethathiriMaharishi
6. SoundHealththroughyoga-Dr.Chandrasekaran
7. Light on yoga -BKS.lyenger
8. உணவுமுறை – தத்துவஞானிவவதாத்திரிமகரிஷி

BMA301	**MATHEMATICS – III**	**L**	**T**	**P**	**C**
	Total Contact Hours - 75	3	2	0	4
	Prerequisite – Engineering Mathematics-I, Engineering Mathematics -II,				
	Course Designed by – Dept of Mathematics				

OBJECTIVES
To understands the concepts of Fourier series analysis, Fourier transform techniques and Z transform techniques

COURSE OUTCOMES (COs)

CO1	To learn the problem solving methods in linear differential equations
CO2	To learn Dirichlet‘s condition and operations using Fourier series
CO3	To have a clear understanding about 2nd order equations and wave equations
CO4	Properties of Laplace transform and problem solving using it
CO5	Properties of Fourier transform and problem solving using it
CO6	To understand the concepts of various transform and partial differential equation technique

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1	H	H										
	CO2	H	H			M							
	CO3	H	H			M							
	CO4	H	H										
	CO5	H	H										
	CO6	H	H			L	L						
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
				√									
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+6

Formation-solutions of standard types of first order equations-LaGrange‘s equation-linear partial differential equations of second and higher order with constant coefficients.

UNIT II FOURIER SERIES 9+6

Dirichlet‘s condition-General Fourier series-half range sine and cosine series-Parseval‘s identity.Harmonic Analysis.

UNIT III BOUNDARY VALUE PROBLEMS 9+6

Classification of second order linear partial differential equations-Solutions of one- Dimensional wave equations, one-dimensional heat equations.

UNIT IV LAPLACE TRANSFORMS 9+6

Transforms of simple functions-basic operational properties-transforms of derivatives and integrals-Initial and Final value theorems-Inverse transforms-Convolution theorem. Periodic functions. Applications of Laplace Transforms for solving linear ordinary differential equations up to second order with constant coefficients and integral equations.

UNIT V FOURIER TRANSFORMS 9+6

Statement of Fourier integral theory-Fourier transforms pairs-Fourier Sine Cosine transforms-Properties-Transforms of simple functions-Convolution theory-Parseval‘s identity.

TEXTBOOKS:

1. Kreyszig, E.‖Advanced Engineering Mathematics‖8th Edition, John Wiley and Sons, (Asia) Pvt., Ltd, Singapore, 2006.
2. Grewal, B.S.,‖Higher Engineering Mathematics‖ (35thEdition), Khanna Publishers, Delhi2000.

REFERENCE:

1. Kandasamy, P., Thilakavathy, K., and Gunavathy, Kk. ‖Engineering Mathematics‖, Volumes 1 and 3(4th Edition) S Chand and Co., New.
2. Narayanan, S.ManicavachangamPillay, T.K.Ramanaiah, G.‖Advanced mathematics for

Engineering Students‖, Volume2 and 3(2nd Edition), S.Viswanathan (printers & publishers Pte, Ltd.,) 1992.
3. Venkataraman, M.K‖Engineering Mathematics‖Volumes3-A&B, 13th Edition National Publishing Company, Chennai, 1998.
4. Shanmugam,T.N.:http:.www.annauniv.edu/shan/trans.html.

BME301	**KINEMATICS OF MACHINES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engg Mathematics-I, Basic Mechanics				
	Course Designed by – Dept of Mechanical				

OBJECTIVES

To understand the various concepts in kinematics of various machines and mechanisms.

COURSE OUTCOMES (COs)

CO1	Upon completion of this course, the students can able to apply fundamentals of mechanism for the design of new mechanisms and analyze them for optimum design
CO2	Will know the impact of numerical methods in engineering analysis
CO3	Better understanding on the theoretical background of mechanisms
CO4	Will get the confidence in using mechanisms
CO5	Capability of solving engineering problems will increased
CO6	To understand the concepts of kinematics of various mechanism

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		W	M							
	CO2	H	H		W	M							
	CO3	H	H		W	M							
	CO4	H	H		W	M							
	CO5	H	H		W	M							
	CO6	H	H		W	M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INTRODUCTION TO MECHANISMS 12

Introduction-Science of mechanisms-Terms and definitions-Planar, Spherical and spatial mechanisms, Mobility-Classification of mechanisms-Indexing mechanisms, reciprocating mechanism etc. Straight line generators- kinematic inversion- Slider crank chain inversions- Four bar chain inversions- Grashof‘s law.Determination of velocities and acceleration in mechanisms-Relative motion method (Graphical) for Mechanisms having turning, sliding and rolling pair.

UNIT II SYNTHESIS OF MECHANISMS 16

Classification of kinematics- Synthesis problems- Chebyshev‘s spacing, Two point synthesis-Freudenstein method- Four bar mechanism and slider crank mechanism.
Types of cams and followers- Follower motions- Uniform, parabolic, SHM, Cycloidal and polynomial-Synthesis of cam profiles for different followers. Cams with specified contours

UNIT III FRICTION 10

Friction-Types-Application-Inclined plane, Screw jack, Clutch, Brakes Bearings, Journal bearing, Flat pivot bearing, multi collar bearings Belt drives.

UNIT IV THEORY OF GEARING 12

Classification of gears, Law of gearing, nomenclature-Forms of teeth, Cycloidal teeth, Involute teeth-Length of path of contact-Length of arc of contact-Contact ratio-Interference and undercutting- Minimum number of teeth to avoid interference- Internal gears- Extended center distance system- Long and short addendum system- Gear trains-Types-Epicyclical gear trains-Automobile differential unit.

UNIT V CONTROL MECHANISMS 10

Governors- Gravity controlled governors-Spring control governors, Hartnell governor, and Hartung governor-Governor characteristics- Governor Effort and power.Gyroscopes-Gyroscopic forces and couple- Forces on bearing due to gyroscopic action- Gyroscopic effects on the movement of aero plans and ships, stability of two wheel drive and four wheel drive, Gyroscopic effects in grinding machines.

TEXTBOOKS:

1. S.S.Rattan-Theory of Machines- Tata McGraw Hill, 3rd Edition, 2009.
2. Bansal- Theory of Machines, 2006.

REFERENCE:

1. Shigley.J.E-Theory of Machines and Mechanisms, 2nd Edition- McGraw Hill Inc,1995
2. V.P.Singh-Theory of Machines ,2001
3. Rao J.S. & Dukkipatti R.V.Mechanisms and Machine Theory, 2nd Edition-Wiley Estern Ltd-1992.

BMT303	**ELECTRONIC DEVICES AND ELECTRONIC CIRCUITS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engineering Mathematics-I, Basic Electronics Engineering				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To understand the basics concepts of various methods of Electronics circuits analysis and various types of electronics devices.

COURSE OUTCOMES (COs)

CO1	Able to get the knowledge about the construction and working of RC, RL and RLC circuits.
CO2	Able to get the knowledge about the semiconductor diodes and special diodes.
CO3	Able to get the basic concepts of Oscillators and Multi-vibrators
CO4	To understand the working principle of Rectifiers.
CO5	To study about the design of various power supply circuits.
CO6	To understand the concepts of various types of electronics devices working and its applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	W	M	H							
	CO2	H	H		M	H							
	CO3	H	M		M	H							
	CO4	H	M	W	M	H							
	CO5	H	H		M	H							
	CO6	H	H	W	W	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CIRCUIT ANALYSIS TECHNIQUES 12

Kirchoff's current and voltage laws – series and parallel connection of independent sources – R, L and C – Network Theorems – Thevenin, Superposition, Norton, Maximum power transfer and duality – Star-delta conversion.

UNIT II TRANSIENT RESONANCE IN RLC CIRCUITS 12

Basic RL, RC and RLC circuits and their responses to pulse and sinusoidal inputs –frequency response – Parallel and series resonances – Q factor – single tuned and double tuned circuits.

UNIT III SEMICONDUCTOR DIODES AND SPECIAL DEVICES 12

SEMICONDUCTOR DIODES: Review of intrinsic & extrinsic semiconductors – Theory of PN junction diode – Energy band structure – current equation – space charge and diffusion capacitances – effect of temperature and breakdown mechanism – Zener diode and its characteristics.

SPECIAL DIODES : Tunnel diodes – PIN diode, varactor diode — UJT – Diac and Triac – Laser, CCD, Photodiode, Phototransistor, Photoconductive and Photovoltaic cells – LED, LCD.

UNIT IV OSCILLATORS AND MULTIVIBRATORS 12

Oscillators: Classification of oscillators – Barkhausen criterion operation and analysis of RC phase shift, Wien's bridge, Hartely, colpitts oscillators.

Multivibrators: Astable, monostable and bistable – Analysis of performance parameters of multivibrators using 68ehavio Trigger – Blocking oscillators.

UNIT V RECTIFIERS AND POWER SUPPLIES 12

Single –phase, half-wave and full-wave rectifiers – Bridge rectifiers – Ripple factor, rectification efficiency-Transformer Utilisation Factor and regulation – Performance characteristics of rectifiers with filters – Regulated power supply – Series and shunt type voltage regulators – Switched mode power supplies.

TEXTBOOKS:

1. Joseph A. Edminister, Mahmood, Nahri, –Electric Circuits‖ – Shaum Series,TataMcGraw Hill, (2001)
2. S. Salivahanan, N. Suresh Kumar and A. Vallavanraj, –Electronic Devices andCircuits‖,Tata McGraw Hill, 2nd Edition, (2008).
3. David A. Bell, –Electronic Devices and Circuits‖, Oxford University Press, 5thEdition, (2008).

REFERENCE:

1. Robert T. Paynter, –Introducing Electronics Devices and Circuits‖, Pearson Education, 7th Education, (2006).
2. William H. Hayt, J.V. Jack, E. Kemmebly and steven M. Durbin, –Engineering CircuitAnalysis‖, Tata McGraw Hill, 6th Edition, 2002.
3. J. Millman & Halkins, Satyebranta Jit, –Electronic Devices & Circuits‖,Tata McGrawHill, 2nd Edition, 2008.

BMT304	**MECHANICS OF SOLIDS AND FUNDAMENTALS OF FLUIDS**	**L**	**T**	**P**	**C**
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Engg Mathematics-I, Engg Mathematics-III, Basic Mechanical engineering				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To understand the basics concepts of various mechanism in solids and fundamentals about fluids

COURSE OUTCOMES (COs)	
CO1	textbook and auxiliary handout reading assignments
CO2	To understand the different types of beams and bending moment and shear force
CO3	To learn the power transmission and strain energy and stiffness and buckling
CO4	To learn the flow characteristic fluid continuity, Euler's equation

CO5	To learn the principles of dimensional analysis												
CO6	To learn the various applications of solids and fluids mechanism												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M		L	H	L						
	CO2	H	M		L	H	L						
	CO3	H	M		L	H	L						
	CO4	H	M		L	H	L						
	CO5	H	M		L	H	L						
	CO6	H	M		L	H	L						
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)				
					√								
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 12

Concept of stress-strain- Hooke‘s law- Tension- Compression and shear- Stress strain diagram, poisson‘s relation-Volumetric strain- Elastic constants and their relation- Stress in simple and composite bars subjected to axial loading and temperature- State of stress at a point-Principle plane- Principle stress-Normal and longitudinal stresses on a given plane-Mohr‘s circle of stresses.

UNIT II TRANSVERSE LOADING ON BEAMS, SHEAR FORCE AND BENDING MOMENT 12

Types of Beams- Transverse loading on beams shear force and Bending moment in beams – Cantilever- Simply supported, overhanging beam subjected to concentrated load and UDL – Maximum bending moment and point of contra flexure-Theory of simple bending and assumption – Derivation of formulae M/I = F/Y = E/R and its applications to engineering – Leaf spring.

UNIT III TORSION, SPRINGS AND COLUMNS 12

Theory of torsion and assumption – Torsion of circular shafts- solid & hollow – strain energy in torsion- Power transmission- Strength and stiffness of shafts- Types of springs- Stiffness stresses and deflection in helical spring- Columns – Buckling and stiffness due to axial loads – Euler, Rankin and Empirical formulae for columns with different conditions.

UNIT IV FLUID FLOW CONCEPTS AND DYNAMICS OF FLUIDS 12

Flow characteristics- Concepts of system and control volume –Continuity equation – Application of control volume to continuity – Energy Equation – Euler‘s Equation – Bernoulli equation and Momentum Equation – simple problems.

UNIT VDIMENSIONAL ANALYSIS AND FLOW THROUGH CIRCULAR CONDUITS **12**

Dimension and units, Buckingham's Π theorem- Boundary layer concepts- Boundary layer thickness- Darcy-Weisbach equation- Friction factor and Moody diagram-Commercial pipes- Minor losses- Flow though pipes in series and in parallel.

TEXTBOOKS:

1. Ramamurtham.S and Narayanan.R, –Strength of material‖, Dhanpat Rai Pvt. Ltd., New Delhi, 2001.
2. Bansal.R.K, –Strength of Material‖, Lakshmi publications Pvt. Ltd., New Delhi, 1996.
3. Kumar.K.L, –Engineering Fluid Mechanics‖, Eurasla publishers Home Ltd., New Delhi, 1995.
4. Bansal.R.K, –Fluid Mechanics and Hydraulic Machines‖ , Laxmi publications (P) Ltd., New Delhi, 1995.
5. Popov.E.P, –Mechanics of Materials‖, Prentice Hall, 1982.
6. Timoshenko.S.P and Gere .M.J, –Mechanics of Materials‖, C.B.S. publishers,1986.

REFERENCE:

1. Ferdinand P. Beer and Russell Johnston.E, –Mechanics of Materials‖, SI metric Edition McGraw Hill, 1992
2. Srinath.L.N, –Advanced Mechanics of Solids‖, Tata McGraw Hill Ltd., New Delhi.
3. Ramamurthan.S, —Fluid Mechanics and Hydraulics‖, Dhanpat Rai and Sons, Delhi, 1988.
4. Fox R.W and Mc. Donald .A.T, –Introduction to fluid Mechanics‖, 5th Ed. John Wiley and Sons, 1999

BMT301	**DIGITAL ELECTRONICS**								**L**	**T**	**P**	**C**	
	Total Contact Hours - 45								3	0	0	3	
	Prerequisite – Engg Mathematics-I, Engg Mathematics-III, Basic electronics												
	Course Designed by – Dept of Mechatronics												
OBJECTIVES To understand the basics concepts of number system and various digital logic designs													
COURSE OUTCOMES (COs)													
CO1	To learn different types logic gates												
CO2	To understand the Boolean algebra												
CO3	To understand the different types ofcombinational circuits												
CO4	To learn the sequential circuits and flip-flops												
CO5	To learn the Asynchronous sequential circuits.												
CO6	To learn the Algorithmic state machines.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	L		M	H	L	L					
	CO2	M	L		M	H	L	L					

	CO3	M	L		M	H	L	L					
	CO4	M	L		M	H	L	L					
	CO5	M	L		M	H	L	L					
	CO6	M	L		M	H	L	L					
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I NUMBER SYSTEM AND BASIC LOGIC 10

Number systems-Binary, Octal, Hexadecimal, BCD, excess 3, complements conversions and arithmetic. Boolean theorems, Boolean algebra – AND, OR, NOT NAND & NOR operation, sum of product and product of sum forms. Minimization – Karnaugh's map, tabular minimization procedures.

UNIT II COMBINATIONAL CIRCUITS 10

Problem formulation and design of combinational circuits, adder / substractor, Encoder / decoder MUX/DEMUX, comparator, code converter.Design of combinational circuits, ROM, EPROM, EEPROM, introduction to PAL and PLA and their use in design.

UNIT III SEQUENTIAL CIRCUITS 10

Sequential circuits – SR, JK, D, T flip flops, triggering analysis of clocked sequential circuits, ripple counter, synchronous counters. Registers – shift registers, serial to parallel, parallel to serial conversions. Timing signal, RAM, semiconductor memories.

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 8

Stable unstable states, output specifications, cycles and races, Race free assignments, reduction of state and flor tables, hazards, pulse mode sequential circuits.

UNIT V ALGORITHMIC STATE MACHINES 7

ASM chart-timing considerations-control implementation-design with multiplexers and PLA.

TEXTBOOKS:

1. Morris Mano M, ‑Digital Circuits and Logic Design‖, Prentice Hall of India, II Edition, 1996.

REFERENCE:

1 W.H.Gothmann, ‑Digital Electronics-Introduction Theory and Practice‖, PHI, 1992.2nd Edition.

2 T.L.Floyd, ‑Digital Fundamentals‖, PHI, 1986.10th Edition.

3 S.C.Lee, ‑Digital Circuits and Logic Design‖, PHI, 2000.

4 R.R. Jain, ―Modern digital electronics‖, 4th edition, Tata McGraw-Hill, 3rd edition2003.

5 Leach and Malvino, –Digital Principles of Electronics & Applications‖, Tata McGraw-Hill, 5th Edition, 2003.

BMT302	**ELECTRICAL MACHINES & DRIVES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engg Mathematics-I, Engg Mathematics-III, Basic electrical engineering				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To understand the basics concepts of various types of DC and AC machines with its drives

COURSE OUTCOMES (COs)

CO1	Able to get the basic knowledge about the Electric and Magnetic circuits, AC fundamentals and transformers.
CO2	Able to get the knowledge about the construction and working of DC, AC and Special machines.
CO3	Able to get the knowledge about the starting and speed control AC and DC machines.
CO4	Able to get the basic concepts of Drives, Electric drives, types and factors influencing the choice of electrical drives
CO5	To understand the working principle of DC &AC motors drives and their characteristics and its braking methods
CO6	To understand the concept of various application of electrical machines and its drives

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	L		M	H	L	L					
	CO2	M	L		M	H	L	L					
	CO3	M	L		M	H	L	L					
	CO4	M	L		M	H	L	L					
	CO5	M	L		M	H	L	L					
	CO6	L	L		L	M	L	L					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective	Project/Term Paper Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I CIRCUITS AND TRANSFORMERS 6

D.C. Voltage, current, power-Ohms law-series, parallel circuits – Kirchoff‘s laws – mesh analysis – A.C. voltage – sinusoidal waves, phasor representation – power factor – complex power - basic idea of transformers – simple problems.

UNIT II ELECTRICAL MOTORS 12

Constructional details, principle of operation and performance characteristics of D.C. motors, single phase induction motor, three phase induction motor, synchronous motors, universal motors, stepper motors and reluctance motor.

UNIT III SPEED CONTROL AND STARTING 9

Speed control of D.C. motors – three phase induction motors – starting methods of D.C. motor and three phase induction motor – electrical braking – simple problems.

UNIT IV ELECTRICAL DRIVES 9

Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems.

UNIT V SOLID STATE DRIVES (QUALITATIVE TREATMENT ONLY) 9

Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power regulators.

TEXTBOOKS:

1. S.K. Bhattacharya –Electrical Machines‖ Tata McGraw-Hill Pvt. Company Ltd., 3rd edition, 2008.

REFERENCE:

1. I.J. Nagrath, T.P. Kothari., –Basic Electrical Engineering‖, McGraw-Hill Publishing company Ltd., Second edition, 2002.
2. N.K.De., P.K.Sen –Electric Drives‖, Prentice Hall, First edition 1999.
3. G.K. Dubey –Fundamental Electrical Drives‖ second edition 2002, Narosa Publications, Second edition, 2002.
4. Pillai, S.K., –A Seish course on Electrical Drives‖, Wilay Eastern Ltd., New Delhi, 1982.

BMT3L1	**ELECTRONIC DEVICESAND ELECTRONIC CIRCUITS – LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Engg Mathematics-I, Basic electronics Lab				
	Course Designed by – Dept of Mechatronics				
OBJECTIVES					

To design an working of basic electronics circuits like power supply, oscillator, amplifier etc	
COURSE OUTCOMES (COs)	
CO1	To study the characteristics of diodes like PN diode and zener diode
CO2	To study the I/O characteristics of transistors in various configurations
CO3	To study the various characteristics of power transistors
CO4	To study the various characteristics of special transistors
CO5	To design and test rectifier circuits and series voltage regulators
CO6	To design and test amplifier, oscillator, multi-vibrator and clipper and clamper circuits

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		H		H							
	CO2	M		H		H							
	CO3	M		H		H							
	CO4	M		H		H							
	CO5	M		H		H							
	CO6	M		H		H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Characteristics of PN junction and Zener diode.
2. Input and Output characteristics of CB, CE configuration.
3. Drain and Transfer characteristics of JFET.
4. Characteristics of SCR, Triac, Diac & UJT.
5. Half wave Rectifier & Full Wave rectifier.
6. Series voltage regulator.
7. Design of RC coupled amplifier &FET Amplifier.
8. Hartley Oscillator & Colpitt's oscillator.
9. Astable, Monostable, Bistable Multivibrator.
10. Clippers & clampers.

LIST OF EQUIPMENTS AND COMPONENTS

1. Variable Power Supply (0-30V) - 6
2. CRO - 4
3. Digital Multimeter - 6
4. Function Generator - 4
5. DC Ammeter - 4

Consumables

6. Transformers
7. Resistors ¼ Watt Assorted
8. Capacitors
9. Inductors
10. Diodes and Zener diodes
11. Bread Boards
12. ICS – 555, 741, LM 328, LM 324
13. BC107, BC147,BC 108, BC 148, BC547, BC 548, SL 100, SK100 or Equivalent transistors
14. Wires

BMT3L2	**ELECTRICAL MACHINES &DRIVES LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Engg Mathematics-I, Basic Electrical Lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES: The ability to conduct testing and experimental procedures on different types of electrical machines.

COURSE OUTCOMES (COs)

CO1	Understand the concept of efficiency and the short circuit impedance of a three-phase transformer from no-load test, winding resistance, short circuit test, and load test.
CO2	Understand the effect of unbalanced loading on a three-phase transformer with different connections, and the effects and limitations of each connection.**.**
CO3	Understand the starting and connecting procedures of synchronous generators, and to obtain the _V' curves of synchronous motors**.**
CO4	Experimentally obtain the load characteristics of various dc motors and generators
CO5	Experimentally obtain the load characteristics, starting current and starting torque of a squirrel-cage induction motor and to derive circuit parameters from no-load and blocked-rotor tests
CO6	Experimentally analysis the speed control of AC and DC machines

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H				M		H	H		S	
	CO2	H		M	H	M	H	M			M		
	CO3							M	M	H			
	CO4		M	H	M			H				S	M
	CO5					H	M			M	S		S
	CO6	H	L		M	H			L	L			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Load test on D.C. shunt motor.
2. Speed control of D.C. shunt motor.
3. Swinburne‘s test
4. Load test on three phase induction motor.
5. No load and blocked rotor tests on three-phase induction motor.
6. Load test on single phase induction motor.
7. No load and blocked rotor tests on single phase induction motor.
8. Load test on Synchronous motors
9. Performance characteristics of Stepper motors.
10. Performance characteristics of single phase transformer.

LIST OF EQUIPMENT

(For a batch of 30 students)

S.No	Equipments	Qty
1.	Shunt motor 5HP	3
2.	Single phase Induction Motor 2HP	2
3.	Three phase induction Motor 5HP	2
4.	Single phase transformer 2KVA	1
5.	Three phase quto transformer	2
6.	Single phase auto transformer	2
7.	3 point starter	3
8.	DPST, TPST	Each 2
9.	DC source 300v, 100A	1
10.	Ammeter (0-5A), (0-10A) MC	Each 2
11.	Ammeter (0-5A), (0-10A) MI	Each 2
12.	Voltmeter (0-300V) MC	3
13.	Voltmeter (0-150V), (0-300V), (0-600V) MI	Each 2
14.	Wattmeter 150/300V, 5/10A UPF	2
15.	Wattmeter 300/600V, 5/10A UPF	2
16.	Wattmeter 150/300V, 5/10A LPF	2
17.	Wattmeter 300/600V, 5/10A LPF	2
18.	Stepper motor 5Kg	1
19.	Synchronous motor 5KW	1
20.	Rheostat 360 ohm/1.2A	3
21.	Rheostat 50 ohm/5A	3
22.	Tachometer	5

BMT3L3	COMPUTER AIDED MACHINE DRAWING	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Engg Mathematics-I, Engineering Graphics				
	Course Designed by – Department of Mechatronics				

OBJECTIVES

To understand the basics concepts of designing of various machine drawing

COURSE OUTCOMES (COs)

CO1	Able to get the basic knowledge about technical drawing standard and mechanical part drawing
CO2	Able to get the knowledge about various types of fitting with drawing representation
CO3	Able to get the knowledge about Drafting work using mini drafter
CO4	Able to get the basic concepts of dimensional and text writing in drawing
CO5	To understand the concept of drafting software and editing of drawing
CO6	To understand the concept of 2D drawing using CAD software

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M	L		M	H	L						
	CO2	M	L		M	H	L						
	CO3	M	L		M	H	L						
	CO4	M	L		M	H	L						
	CO5	M	L		M	H	L						
	CO6	L	L		M	H	L						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT IBASICS OF ENGINEERING DRAW 9

Indian standard code of practice for engineering drawing – general principles of Presentation. Conventional representations of threaded parts, springs, gear and Common features. Abbreviations and symbols for use on technical drawings. Conventions for sectioning and dimensioning.

UNIT IIREPRESENTATION OF SYMBOL 9

Tolerances – types – representation of tolerances on drawing fits – types – selection of Fits – allowance. Geometric tolerances – form – and positional tolerances – datum, datum Features. Maximum material principle – symbols and methods of indicating it on drawing Surface finish

symbols – welding symbols and methods of indicating it on drawing.

UNIT III (Drafting work using mini drafter)PART AND ASSEMBLY DRAWINGS9
Preparation of part and assembly drawings of Plummer block, screw jack, machine vice, lathe tailstock, and tool head of the shaper, stuffing box, piston & connecting rod universal join)

UNIT IVINTRODUCTION TO DRAFTING SOFTWARE 9
Introduction to the use of any drafting software – creation of simple geometric bodies using primitives (line, arc, circle etc.,) and editing for the drawing, Dimensioning and text writing, concept of layer creation and setting, line types.

UNIT V2-D & 3-D DRAWINGS 9
Preparation of 2-D drawings using CAD software for components and assemblies of Plummer block, screw jack, machine vice, lathe tailstock, tool head of the shaper. Introduction to 3-D modeling solid and wire frame modeling.

TEXTBOOKS:
1. Sadhu Singh & P.L. Sah, Fundamentals of Machine Dynamics, Prentice Hall of India Pvt Ltd, 2003.
2. P.N. Rao, CAD/CAM Principles and Applications, Tata McGraw-Hill 2004. 2nd Edition.

REFERENCE:
1. K. Venugopal, Engineering Graphics AutoCAD, John Wiley & Sons, 2002. 4th Edition.

List Of Equipment And Software Required (for a batch of 30 students)
1. Computer System 30
VGA Color Monitor, Pentium IV Processor, 20 GB HDD, 256 MB RAM
2. Laser Printer 01
3. Plotter (A2 size) 01
4. Software: AutoCAD or Mechanical Desktop or Pro / E or CATIA or IDEAS 30 Licenses or Solidworks
5. Drawing Boards and Tables in Drawing Hall 30 Nos.

BMA402	**NUMERICAL METHODS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 75	3	2	0	4
	Prerequisite – Engineering Mathematics-I,II & III				
	Course Designed by – Dept of Mathematics				

OBJECTIVES
This course aims at providing the necessary basic concepts of a few numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.

COURSE OUTCOMES (COs)

CO1	Have a fundamental knowledge of the basic solutions of equations and Eigen value problems
CO2	Have a well-founded knowledge of standard numerical differentiation and integration which can describe real life phenomena.

CO3	Acquire skills in handling situations involving first and second order differential equations
CO4	Understand boundary value problems on ordinary and partial differential equations
CO5	Be able to analyze the interpolation techniques.
CO6	To learn finite difference solutions for one dimensional heat equations, one dimensional wave equation, Two dimensional, Laplace and Poisson equation.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									
	CO3	M			H								
	CO4					H		H			H		
	CO5	H									M		
	CO6	H	H				M			M	M		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEM 9+6

Iterative method, Newton-Raphson method for single variable-solutions of linear system by Gaussian, Gauss-Jordan, Jacobian and Gauss-Siedel methods, Inverse of matrix by Gauss-Jordan method, Eigen value of a matrix power and Jacobian methods.

UNIT II INTERPOLATION (FINITE DIFFERENCES) 9+6

Newton‘s Divide difference formula, Lagrange‘s interpolation-forward and backward difference formula-Stirling_s Bessel‘s central difference formula

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+6

Numerical differentiation with interpolation polynomials, Numerical integration by Trapezoidal Simpson‘s (Both 1/3‖ and 3/8‖) rule, Double integrals using Trapezoidal and Simpson‘s rule.

UNIT IVINITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+6

Single step methods, Taylor series, Euler and modified Euler, Runge kutta method of first and second order differential equations, multiple step methods, Milne and Adam‘s –Bash forth predict and corrected method

UNIT V BOUNDARY VALUE PROBLEMS FOR ODE AND PDE 9+6

Finite difference for the second order ordinary differential equations, finite difference solutions for one dimensional heat equations (both implicit and explicit), one dimensional wave equation, Two dimensional, Laplace and Poisson equation.

TEXTBOOKS:

1. M.K.Venkatraman: Numerical Methods in Science and Engineering–NPC –Chennai.

REFERENCES

1. Jain.M.K.Iyengar, S.R.K.Andjain, RK Numerical methods for scientific and Engineering computation,(6^{th} edition, New age International publication,Co(2007))
2. Grewal.B.S.'Higher Engineering Mathematics' (43^{rd} edition) Khanna publisher, Delhi, 2014
3. http:// www.b-u.ac.in/sde_book/msc_mathnum.pdf

BME401	**DYNAMICS OF MACHINES**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engineering Mechanics, Mechanics of Solids				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

To introduce the concept of dynamics of machines. To acquaint the student with various techniques involved in dynamics and various new technology in dynamics of machines.

COURSE OUTCOMES (COs)

CO1	To learn the concept about force analysis for mechanism.
CO2	To understand the various methods of balancing in different situation.
CO3	To learn the Concept about free vibration of single degree of freedom.
CO4	To study the Concept about forced vibration of single degree of freedom.
CO5	To learn human population and the women and child welfare.
CO6	To learn the concept about critical speed of rotating shaft

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	S			M			L				
	CO2	H	S			M							
	CO3	H	S			M			L				
	CO4	H	S			M							
	CO5	H	S			M			L				
	CO6	H	S			M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I FORCE ANALYSIS OF MECHANISMS 12

Static, Inertia and combined force analysis- Graphical and analytical method- Slider crank mechanism and four bar mechanism. Turning moment diagram and flywheel-Applications in engine, Punching presses.

UNIT II BALANCING 12

Static and dynamic balancing-Balancing of rotating masses- Balancing of several masses in different planes.Primary and secondary unbalanced forces of reciprocating parts-Balancing of in line engines- Firing order- Balancing of _V' and _W' engines.

UNIT III FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEM 12

Fundamentals of vibrations-Undamped free vibrations of single d.o.f systems–Derivation & solution of differential equation-Torsional Vibrations-single rotor- Equivalent stiffness of spring combinations-Bifilar, Trifilar suspensions-Compound pendulum-Types of damping-Damped free vibrations of single d.o.f-over, critical, under damped- Damping coefficient - Critical damping coefficient-Logarithmic decrement

UNIT IV FORCED VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS 12

Forced vibrations with-Constant harmonic excitation-Rotating & Reciprocating unbalance-Excitation of the support-Energy dissipated by damping-Forced vibrations with couloumb, viscous damping-Vibration Isolation and Transmissibility- Vibration Absorbers

UNIT V CRITICAL SPEEDS AND SHAFTS WITH ROTORS 12

Lateral vibration of beams - Whirling speed of shaft - Shafts with two & three rotors-Geared system. Dunkerly's method for different types of beams & shaft with several loads.

TEXTBOOKS:

1. S.S.Rattan-Theory of Machines- Tata McGraw Hill(4th Edition), 2014.
2. Singh.V.P. Mechanical Vibrations-Dhanpatrai & co (p) Ltd(4th edition), 2010

REFERENCES

1. Rao.J.S. and Dukkipatti, Mechanism and Machines Theory, 2nd Edition-Wiley Eastern Ltd, 2007.
2. Balaguru.S. Dynamics of Machinery, Sci Tech Publications (India) Pvt Ltd, 2011.
3. Grover.G.K. Mechanical Vibrations- Nemchand & Bros.(8th Edition), 2012
4. https://books.google.co.in/books?isbn=1259051285.

BMT401	MANUFACTURING TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic mechanical engineering				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To Understand the various concept of manufacturing technology to produce new product and to acquaint the student with various manufacturing technologies used in production engineering.

COURSE OUTCOMES (COs)

CO1	To learn different types of foundry technology
CO2	To understand the different types offorming– processes
CO3	To learn the material removal processesand machine (i.e. lathe)
CO4	To learn the material removal processesand machine **(**i.e. milling)
CO5	To learn the principles & applications of joining processes.
CO6	To Understand Principles and applications of Brazing and Soldering.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M			H	H							
	CO2					H							
	CO3		M		H	H							
	CO4				M	H							
	CO5					H							
	CO6	M			M	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I FOUNDRY TECHNOLOGY 9

Pattern and Core making – Molding sand – Melting furnaces Cupola and Induction furnaces – Special casting processes – Shell, Investment, Die casting – Defects in casting.

UNIT II FORMING– PROCESSES 9

Hot and Cold Working

Rolling: Introduction – Rolling Mills – Rolling Operations – Production of Seamless Tubing and Pipe.

Forging : Introduction – Related Forging Operations – Drop forging

Extrusion and Drawing: Extrusion Practice – Hot, Cold, Impact and Hydrostatic extrusion. Drawing Process – Defects and Residual Stresses – Drawing Equipment.Sheet metal operations – Blanking, Punching and Piercing.

UNIT III MATERIAL – REMOVAL PROCESSES 9

Lathes and Lathe Operations, Drilling and Drilling Machines, Reaming and Reamers, Tapping and Taps – Tool nomenclature, cutting speed, feed, machining Time calculations.

UNIT IV MATERIAL – REMOVAL PROCESSES 9

Milling Machines and Operations, Planning and Shaping, Broaching, Gear Hobbing and Shaping.

Grinding Process – Abrasives – Finishing Operations – Lapping, Honing Powder coating.

UNIT V PRINCIPLES & APPLICATIONS OF JOINING PROCESSES 9

Gas welding, Basic Arc Welding Processes, Thermit Welding, Electron – Beam Welding, Laser – Beam Welding. Solid State Welding: Cold Welding, Ultrasonic Welding, Friction Welding, Resistance Welding and Explosive Welding. Principles and applications of Brazing and Soldering.

TEXTBOOKS:

1. KALPAKJIAN, S., –Manufacturing Engineering and Technology‖, Pearson education India, 7th edition, 2015 (**SBN-13:** 978-9814514828)

REFERENCES

1. Hajra Choudhury, S.K., and Haqjra Choudhury, A.K., –Elements of Workshop Technology‖, Volume I and II, Media Promoters and Publishers Private Limited, Mumbai, 2010.
2. Paul Degarma E, Black J.T. and Ronald A. Kosher, Eighth edition, Materials and Processes in Manufacturing Prentice – Hall of India, 2011.
3. Sharma P.C. A Textbook of Production Technology, S. Chand and Co., Ltd., 2007.
4. https://books.google.co.in/books?isbn=8185099154, 1118163737, 8121911141.

BEE404	POWER ELECTRONICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Basic Electronics engineering, Basic electrical Engineering				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To get an overview of different types of power semi-conductor devices and to understand parameters of controlledrectifiers, inverters, AC voltage controller and cycloconverters.

COURSE OUTCOMES (COs)

CO1	To learn different types of power semi-conductor devices and their characteristics.
CO2	To understand the operation, characteristics and performance parameters of controlled rectifiers
CO3	To study the operation, switching techniques and basic topologies of DC-DC converters.
CO4	To learn the operation of different types of inverters like VSI, CSI, PWM Inverters, Series inverter and parallel inverter.
CO5	To study the operation of AC voltage controller and cycloconverters.

CO6	To study the Principle of operation step up and step down chopper

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H	M	H	L			H	H			
	CO2	H	H	H	H	H			H	H			
	CO3	H	H	H	H	H			H	H			
	CO4	H	H	L	H	M			H	H			
	CO5	M	M	H	H	H			H	H			
	CO6	H	H	H	H	H			H	H			

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I POWER SEMI CONDUCTOR DEVICES

9Principle of operation – Characteristics of power diodes, SCR, TRIAC, GTO, Power BJT, Power MOSFET and IGBT – Thyristor protection circuits.

UNIT II PHASE CONTROLLED CONVERTERS **9**Single phase full converters, 3 phase half converter and 3 phase full converter – inverter operation – input power factor – effect of source inductance – Thyristor triggering circuits.

UNIT III DC TO DC CHOPPERS **9**

DC Chopper – Principle of operation – step up and step down chopper – Forced commutation – different techniques – voltage, current and load – commutated choppers – step up and step down chopper.

UNIT IV INVERTERS **9**

Voltage source inverters – series, parallel and bridge inverters – PWM inverters – current source inverters.

UNIT V AC VOLTAGE CONTROLLERS AND CYCLOCONVERTERS **9**

Single phase AC voltage controller – multistage sequence control – step up and step down cycloconverters – three phase to single phase and three phase cycloconverters.

TEXTBOOKS:

1. Reshid, M.H., ‑Power Electronics – Circuits Devices and Application‖ Prentice Hall International, New Delhi, 3rd Edition, 2011.

REFERENCES

1. Lander, W., –Power Electronics‖ McGraw-Hill and Company, 4th Edition, 2009.
2. Singh, M.D., Khanchandani, K.B., –Power Electronics‖, Tata McGraw-Hill, 2008.
3. Dubey, G.K., Doradia, S.R., Joshi, A. and Singh, R.M., –Thyristorised Power Controllers‖, Wiley Eastern Limited, 2005.
4. Joseph Vithayathil, –Power Electronics – Principle and Applications‖, and Robbins, –Power Electronics‖, McGraw-Hill Inc, New York, 2006.
5. Mohan Undeland and Robbins, –Power Electronics‖, John Wilry and Sons, New York, 2011.
6. https://books.google.co.in/books?isbn=8184317212, 0070583897, DttqSQAACAAJ

BEI402	**CONTROL SYSTEMS**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									4	0	0	4
	Prerequisite – Engg Mathematics-I, Engg Mathematics -III, Basic Electronic Engineering, Basic Electrical Engineering.												
	Course Designed by – Dept of Mechatronics												

OBJECTIVES

To provide an introduction to the analysis of linear control systems. This will permit to exploit time domain and frequency domain tools.

COURSE OUTCOMES (COs)

CO1	To learn the concept of System and their representation.
CO2	To understand the Concept of time response analysis.
CO3	To learn the Concept of frequency response analysis.
CO4	To study the various methods for stability of the systems.
CO5	To learn the various types of compensation techniques.
CO6	To Understand Transient response analysis, Root locus, Bode diagrams, Nyquist plots with MATLAB

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H			M							
	CO2	H	H	L		M							
	CO3	H	H		L	M							
	CO4	H	H			M							
	CO5	H	H			M							
	CO6	H	H			M							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SYSTEMS AND THEIR REPRESENTATION 9

Basic elements in control systems – open and closed loop systems Examples – Mathematical model, Translational & Rotational systems – transfer function – block diagram reduction techniques – signal flow graph.

UNIT II TIME RESPONSE 9

Time response – time domain specifications – types of test inputs – I and II order system response – error coefficients – generalized error series – steady state error – P, PI, PD, PID Controller characteristics.

UNIT III FREQUENCY RESPONSE ANALYSIS AND DESIGN 9

Performance specifications – correlation to time domain specifications – Bode plots and polar plots – gain and phase margin – constant M and N circles and Nichols chart – all pass and non-minimum phase systems.

UNIT IV STABILITY OF CONTROL SYSTEMS 9

Characteristic equation – location of roots in s-plane for stability – Routh Hurwitz criterion – root locus techniques – construction – gain margin and phase margin – Nyquist stability criterion.

UNIT V COMPENSATION DESIGN 9

Design concepts – realization of basis compensation – cascade compensation in time domain and frequency domain (simple MATLAB applications to analysis and compensators design problems.)

TEXTBOOKS:

1. M. Gopal, ―*Control Systems: Principles and Design*‖, 3rd Edition, McGraw, Hill, 2014.

REFERENCE:

1. Katsuhiko Ogata, ―Modern Control Engineering‖ 5th Edition, Prentice Hall of India Private Ltd., New Delhi, 2012.
2. ChesmondC.J. ―Basic Control System Technology‖, Viva Low Priced Student Edition, 2012.
3. Datton K., Banaclough W. and Thompson S., ―The Art of Control Engineering‖, Addison Wesley 2005.
4. R.C. Dorf and R.H. Bishop, ―Modern Control Systems‖, 12th Edition, Prentice, Hall, 2010.
5. Leonard N.E. and William Levine, ―Using MATLAB to Analyze and Design Control Systems‖, Addision Wesley (2nd edition), 2006.
6. http//www.controlsys.com

BCE406	ENVIRONMENTAL STUDIES	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Physical Sciences				
	Course Designed by – Dept of Civil Engineering				

OBJECTIVES

1. To study the nature and facts about environment.
2. To find and implement scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.

4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth‘s interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

COURSE OUTCOMES (COs)

CO1	Play an important role in transferring a healthy environment for future generations
CO2	Analyze the impact of engineering solutions in a global and societal context
CO3	Discuss contemporary issues that results in environmental degradation and would attempt to provide solutions to overcome those problems
CO4	Ability to consider issues of environment and sustainable development in his personal and professional undertakings
CO5	Highlight the importance of ecosystem and biodiversity

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H	H	S		S			M
	CO2	M					H						
	CO3						H						M
	CO4	M								S			
	CO5			M			M	S				S	M
	CO6	M		M			M	S		S		M	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
			√						

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I THE MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance, Need for public awareness.

Natural Resources : Renewable And Non – Renewable Resources

Natural resources and associated problems

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effect on forests and tribal people.
b) Water resources : Use and over-utilization of surface and ground water, flood, drought conflicts over water, dams-benefits and problems.
c) Mineral resources : Uses and exploitation, environmental effects of extracting and using mineral resources, case studies.
d) Food resources : World food problems, changes caused by agriculture and overgrazing , effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, Land degradation, man induced landslides, soil erosion and desertification

Role of an individual in conversation of natural resources, Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS 8

Concepts of an ecosystem. Structure and function of an ecosystem, producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids - Introduction, types, characteristic features, structure and function of the following ecosystem :- Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)-

Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation - Ethics : Issues and possible Solutions, Climate change, global warming, acid rain, ozone layer depletion.

UNIT III BIODIVERSITY AND ITS CONSERVATION 7

Introduction and Definition - genetic, species and ecosystems diversity, Biogeographical classification of India - Value biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values - Biodiversity at global, national and local levels. India as a mega-diversity nation, Hot-spots of biodiversity -Threats to biodiversity, habitat, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation biodiversity - In-situ and Ex-situ conservation of biodiversity.

Environmental Pollution 7

Definition, Causes, effects and control measures of ;- Air Pollution, Water pollution, Soil Pollution, Marine Pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management : Causes, effects and control measures of urban and industrial wastes - Role of an individual in prevention of pollution - Pollution case studies - Disaster Management : floods earthquake, cyclone and landslides.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 8

From Unsustainable to Sustainable development, Urban problems related to energy, nuclear accident and holocaust, case studies, wasteland reclamation, Environmental Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife protection Act, Forest Conservation Act, Issues involved in enforcement of environmental Legislation, public awareness –

Fireworks and its impact on the Environment – Chemicals used in Fireworks – (Fuel –oxidizing Agent – Reducing Agent –Toxic Materials – Fuel –Binder- Regulator) – Harmful nature of ingredients – chemical effects on health due to inhaling fumes – Noise produced by fire crackers – Noise pollution – Noise level standards for fire crackers – Intensity of sound – Impact on hearing – Safety measures.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 6

Population growth, variation among nations, population explosion-Family Welfare programs, Environment and human health, Human Rights, Value Education, HIV and AIDS, Women and Child Welfare, Role of Information Technology in Environment and Human health - Case Studies.

TEXTBOOKS:

1. Gilbert M.Masters, –Introduction to Environmental Engineering and Science‖, Pearson Education Pvt., Ltd., Second Edition, ISBN 81-297-0277-0, 2004.
2. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,Ahmedabad – 380 013, India, 1989.
4. Benny Joseph, –Environmental Studies‖., TATA McGraw Hill, 2010

REFERENCES

1. Trivedi R.K., –Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards‖, Vol.I and II, EnviroMedia 2009
2. Cunningham, W.P.Cooper, T.H.Gorhani, –Environmental Encyclopedia‖, Jaico Publ., House, Mumbai, 2001.
3. Wager K.D. –Environmental Management‖, W.B. Saunders Co., Philadelphia, USA, 1998.
4. Trivedi R.K. and P.K. Goel, –Introduction to Air Pollution‖, Techno Science Publications 2013
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB),2001.
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
8. Jadhav, H &Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
9. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Rao M N. &Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publish Co. Pvt. Ltd. 345p.
12. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut.
13. http://eng.mft.info/uploadedfiles/gfiles/c8e31c9e52d84c3.pdf

BMT4L1	**MANUFACTURING TECHNOLOGY LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Basic Mechanical and Civil lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

Study of various types of lathe operations. To produce various shapes using machines and gear shape

COURSE OUTCOMES (COs)	
CO1	To practices on lathe machines and make different shapes.
CO2	To practices on making holes using drilling machine.

CO3	To practices on surface finish using milling machine.												
CO4	To practices on making key ways and dove tail machining.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				H	M	L						
	CO2				H	M	L						
	CO3				H	M	L						
	CO4				H	M	L						
	CO5												
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

UNIT 1 LATHE PRACTICE

a. Plain Turning b. Taper Turning c. Thread Cutting

Estimation of machining time for the above turning processes.

UNIT II DRILLING PRACTICE

a. Drilling, b. Tapping c. Reaming

UNIT III MILLING

a. Surface Milling,b. Gear Cutting c. Contour Milling

UNIT IV PLANNING AND SHAPING

a.Cutting Key Ways, b. Dove tail machining.

LIST OF EQUIPMENT(for a batch of 30 students)

1. Lathe - 15 Nos.
2. Drilling Machine - 1 Nos.
3. Milling Machine - 2 Nos.
4. Planning Machine - 1 Nos.
5. Shaping Machine - 2 Nos.

BMT4L2	MACHINE DYNAMICS LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Fluid Mechanics and Machinery lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To learn about Governors /CAM, Motorized Gyroscope and Vibrating system Spring mass.

COURSE OUTCOMES (COs)

CO1	To learn&Pratices about Governors /CAM
CO2	To Learn &Practice The Experiments Like Gyroscope
CO3	To Learn &Practice The Experiments Like Vibrating System Mass.
CO4	To Learn &Practice The Experiments Like Determination of Moment of inertia

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M			H			H	H		
	CO2			M			H			H	H		
	CO3			M			H			H	H		
	CO4			M			H			H	H		
	CO5												
	CO6												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Governors - Determination of sensitivity, effort, etc. for watt, porter, proell, Hartnell governors
2. Cam - Study of jump phenomenon and drawing profile of the cam.
3. Motorized Gyroscope-Verification of law‘s -Determination of gyroscopic couple.
4. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
5. Balancing of reciprocating masses.
6. Balancing of rotating masses.
7. Determination of Moment of inertia by oscillation method for connecting rod and flywheel.
8. Vibrating system spring mass-system-Determination of damping co-efficient of single degree of freedom system.
9. Determination of influence co-efficient for multi degree freedom suspension system.
10. Determination of transmissibility ratio - vibrating table.

11. Determination of tensional frequencies for compound pendulum and flywheel -system with lumped Moment of inertia
12. Transverse vibration –free- Beam. Determination of natural frequency and deflection of beam.

LIST OF EQUIPMENT (for a batch of 30 students)

1. Cam analyzer. - 1 No
2. Motorized gyroscope. - 1 No.
3. Governor apparatus - watt, porter, proell and hartnell governors. - 1 No.
4. Whirling of shaft apparatus. - 1 No.
5. Dynamic balancing machine. - 1 No.
6. Static and dynamic balancing machine. - 1 No.
7. Vibration test facilities apparatus - 1 No.

BEE4L2	**POWER ELECTRONICS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Basic Electrical & Electronics lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES: To practice SCR, MOSFET, UJT, TRIAC and the SCR converters

COURSE OUTCOMES (COs)

CO1	To Study the SCR, MOSFET & IGBT characteristics
CO2	To learn & practice the SCR phase control circuit
CO3	To learn & practice TRIAC phase control circuit
CO4	To learn & practice SCR single-phase cyclo converter & SCR series and parallel inverters
CO5	To Study & practice IGBT Chopper & IGBT based PWM inverter (single phase)
CO6	To Study of three phase AC regulator module

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M			H			H	H		
	CO2			M			H			H	H		
	CO3			M			H			H	H		
	CO4			M			H			H	H		
	CO5			M			H			H	H		
	CO6			M			H			H	H		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

LIST OF EXPERIMENTS

1. Study of SCR, MOSFET & IGBT characteristics
2. UJT, R, RC firing circuits for SCR
3. Voltage & current commutated chopper
4. SCR phase control circuit
5. TRIAC phase control circuit
6. Study of half controlled & fully controller converters
7. Study of three phase AC regulator
8. Speed controls of DC shunt motor using three phase fully controlled converter.
9. SCR single-phase cyclo converter
10. SCR series and parallel inverters
11. IGBT Chopper
12. IGBT based PWM inverter (single phase)

LIST OF EQUIPMENT (for a batch of 30 students)

S.No	Equipments	Qty
1	Study of SCR, MOSFET & IGBT characteristics module IJT, R, RC firing circles for SCR module Voltage & current commutated chopper module	1
2	SCR phase control circuit module	1
3	TRIAC phase control circuit module	1
4	Study of half controlled & fully controller converters	1
5	module	1
6	Study of three phase AC regulator module	1
7	Speed control of DC shunt motor using three phase fully	
8	controlled converter module SCR single phase cyclo converter module	1
9	SCR series and parallel inverters module IGBT chopper module	1
10	IGBT based PWM inverter (single phase) module	1
11	Ammeter (0-5A) MC, (0-2A) MC, (0-2A) MI, (0-5V) MI	1
12	Voltmeter (0-300V) MC, (0-600V) MC,	1
13	(0-300V) MI, (0-600V) MI	Each 3
14	Multimeter CRO	Each 3
15	Transformer 1KVA, 1:1, 230V	4
16	CRO Transformer 1KVA, 1:1,230V	5

	TECHNICAL SEMINAR	L	T	P	C
	Total Contact Hours -30	0	0	2	1

BMT4S1	Prerequisite – Basic English knowledge
	Course Designed by –Dept of Mechatronics
OBJECTIVE: To improve the communication skills of the students.	
COURSE OUTCOMES (COs)	
CO	To improve the communication skills of the students

During the Seminar session each student is expected to prepare and present a topic on engineering/ technology, for duration of about 8 to 10 minutes. In a session of three periods per week, 15 students are expected to present the seminar. A faculty guide is to be allotted and he/she will guide and monitor the progress of the student and maintain attendance also.
Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews.

BMT501	**THERMODYNAMICS PRINCIPLES AND APPLICATIONS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 60	4	0	0	4
	Prerequisite – Engineering Chemistry, Engineering Physics, Fuel Mechanics Machinery				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

The purpose of this course is to introduce the undergraduate students with the basic concepts about laws of thermodynamics, air standard cycles, air compressors, vapor power and vapor compression cycles along with conduction heat transfer and convection and radiation heat transfer.

COURSE OUTCOMES (COs)

CO1	To learn the basics about first law and second law of thermodynamics.
CO2	To learn air standard cycles and air compressor working principles.
CO3	To analyze a vapor power cycle given a set of operational parameters and constraints.
CO4	To learn the conduction heat transfer.
CO5	To learn the convection and radiation heat transfer.
CO6	To Understand the concept of heat exchangers

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									
	CO3	M			H						M		
	CO4					H		H					
	CO5	H									H		
	CO6							M		H	H		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I FIRST LAW OF THERMODYNAMICS 12

Thermodynamics – microscopic and macroscopic point of view – systems, properties, process, path, cycle. Units – pressure, temperature – Zeroth law. First law – application to closed and open systems, internal energy, specific heat capacities CV and CP – enthalpy

UNIT II SECOND LAW OF THERMODYNAMICS 12

SecondLaw of thermodynamics – statements – equivalents of Kelvin Plank and Clausius statements. Reversibility – Irreversibility, reversible cycle – Carnot cycle and theorem

UNIT III INTERNAL COMBUSTION ENGINES 12

Classification of IC engine - IC engine components and functions. Valve timing diagram and port timing diagram - Comparison of two stroke and four stroke engines, Comparison of petrol & diesel engine, Fuel supply systems, total fuel consumption, specific fuel consumption, mechanical efficiency, BHP, IHP, FP - Ignition Systems, Lubrication system, Cooling system, MPFI, DTSI, CRDI.

UNIT IV REFRIGERATION AND AIR-CONDITIONING 12

Principles of refrigeration, refrigerator& heat pump cycle, refrigerants, refrigerant properties, refrigerant selection, vapour compression refrigeration cycle, vapour absorption cycle, dry bulb temperature, wet bulb temperature, relative humidity, comfort air-conditioning, Psychrometric chart, humidification, de-humidification, air coolers, cooling towers.

UNIT V HEAT TRANSFER (Qualitative Treatment Only) 12

Heat transfer through conduction and convection, Fourier‘s law of conduction - Problems on one dimensional heat conduction through plain walls, composite walls, cylinder walls, spheres. Extended surfaces: Fins. Problems on heat transfer through rectangular fin, triangular fin, circumferential fin, pin fin, fin efficiency, fin effectiveness. Heat transfer through radiation, Stefan Boltzman Law, black body, grey body, shape factor. Types of Heat Exchangers.

TEXTBOOKS:

1. Nag P. K, _Engineering Thermodynamics‘ Tata McGraw-Hill(5 th edition), 2013.

REFERENCES

1 Michael A. Boles, Yunus A. Cengel, YunusCengel, –Thermodynamics‖, 7 th Edition, Mc Graw-Hill India, 2011.

2 Kothandaraman. C.P., Domkundwar. S. & Domkundwar.A.V., –A course in ThermalEngineering‖ Dhanpatrai & Co (P) Ltd, Fifth edition, 2010.

3 Kothandaraman. C.P., –Heat and Mass Transfer‖, New Age International (P),8th edition reprint Feb 2014.
4 Holman.J.P., –Thermodynamics‖, 3rd Ed. McGraw-Hill, 2002.

BEC501	**MICROPROCESSORS &ITS APPLICATIONS**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									3	0	0	3
	Prerequisite – Basic Electronics Engineering												
	Course Designed by – Dept of Electronics Engineering												

OBJECTIVES

To introduce the architecture of 8085, interfacing of 8085,designing of input output devices

COURSE OUTCOMES (COs)

CO1	To learn basics about 8085 block diagram.
CO2	To understand the different types input output devices.
CO4	To learn matrix keyboard& digital transmission.
CO5	To understand the applications of 8085.
CO6	To know about real time applications.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									
	CO3	M			H						M		
	CO4					H		H					
	CO5	H									H		
	CO6							M	M			H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 10

Organization of Micro Computers – Organization of 8085: Architecture, Internal Register Organization and Pin Configuration – Instruction Set of 8085 – addressing modes - instruction and machine cycles with states and timing diagram. Methods of 8085 programs and 8085 assembly language.

UNIT II INTERFACING AND I/O DEVICES 9

Need for Interfacing – Memory Interfacing: address space partitioning – address map – Address decoding – Designing decoder circuit for the given address map – Bus connection and Z – line Control – Access Time Computations.I/O Interfacing: Data transfer schemes – programmed Synchronous and asynchronous – Interrupt driven Transfer – Multiple devices and multiple interrupt levels – enabling disabling and masking of interrupts.DMA transfer: Cycle stealing – Burst mode – Multiple DMA devices – DMA transfer in 8085 system – serial data transfer.

UNIT III INTERFACING DEVICES 9

Programmable peripheral device – programmable interval timer (8253) – Programmable communication interface (USART) – Programmable interrupt controller – Programmable DMA Controller (8257) – Programmable Keyboard/ display controllers.

UNIT IV DESIGN USING PERIPHERAL DEVICES 9

Interfacing A/D and D/A converters – Matrix Keyboard design using 8255 using 8085 programs. Designing real time clock, detecting power failure, detecting presence of objects using 8253 – Design of Keyboard and display interfacing using 8279 – Design of digital transmission with modems and telephone lines using 8251 A.

UNIT V MICROPROCESSOR APPLICATIONS 8

Temperature monitoring system – Automotive applications – Closed loop process control – Stepper motor control.

TEXTBOOKS:

1. Introduction to Microprocessor – Third Edition – Aditya P Mathur, Tata McGraw- Hill Publishing Company Ltd., New Delhi 3rd Edition 2008.

REFERENCES

1. Microprocessor Architecture. Programming and Applications with the 8085 Ramesh Goankar, fifth edition- Penram International Publishing (India) Private Limited.
2. ―Microprocessors and Interfacing, Programming and Hardware‖ Douglas V.Hall. Tata McGraw–Hill Publishing Company Ltd., (3rd edition) New Delhi, 2008.

BMT503	**INSTRUMENTATION & CONTROL**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –control system				
	Course Designed by – Dept of Electronics & instrumentation Engineering				

OBJECTIVE

To introduce the various instrumentation involved in the industry, and to introduce the current trends in the various types of instrument.

COURSE OUTCOMES (COs)

CO1	To learn general concept of measurement
CO2	To understand the different types ofTemperature Measurements
CO3	To learn the different types of Pressure, Flow and Level Measurements

CO4	To learn the different types of Displacement, Force and torque Measurements												
CO5	To learn the concept of pneumatic and electronic PID controller												
CO6	To Understand the concept of controllers in measurement												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H High, M-Medium, L-Low -													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									
	CO3	M			H						M		
	CO4					H		H					
	CO5	H									H		
	CO6					M				H	H		
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I :GENERAL CONCEPTS OF MEASUREMENT 9

Generalized Measurement System – Performance Characteristics – Static and Dynamic Characteristics – Errors in Measurements – Calibration and Standards – Generalized Performance of Zero Order, First Order and Second Order Systems – Classifications of Transducers.

UNIT II :TEMPERATURE MEASUREMENT 9

Mechanical Type – Filled Thermometers – Liquid Filled – Gas Filled – Vapour Filled – Bimetallic Thermometer – Electric Type – RTD – Thermistor, Thermocouple, IC Thermometer – Non Contact Total Radiation Pyrometer – Optical Pyrometer.

UNIT III: PRESSURE, FLOW AND LEVEL MEASUREMENTS 9

Pressure: Monometers – Elastic Transducers – Bourdon Gauge – bellows – diaphragm – Calibration of Pressure Gauge using Dead Weight Testers. Vaccum: McLeod Gauge, Thermal Conductivity Gauge – Ionization Gauge. Flow Measurement: Orifice, Venturi, Nozzle, Pitot tube, Turbine Flow meter, Hot wire Anemometer.Level Measurement: Float Level, surge type, Differential Pressure Type, Electrical Type- Resistance and Capacitance.

UNIT IV: DISPLACEMENT, FORCE, TORQUE & VIBRATION MEASUREMENT9

Load Cells – Different Types – Potentiometer – Strain Gauges Resistive and Semiconductor – Different Forms – Measurement Circuits – Use in Displacement, Force and Torque Measurement. LVDT Characteristics – Measurement Circuits – Use in Displacement - RVDT for

angular measurement.Piezo Electric Transducer – Different Types – Characteristics – Measurement Circuits – Application in Acceleration and Vibration Measurement.Optical Encoder for Displacement and Velocity Measurement.

UNIT V :PNEUMATIC AND ELECTRONIC PID CONTROLLERS 9

Pneumatic and Electronic PID Controllers – Automatic Speed Control of Drives- Pneumatic Two Step Controller – Machine Tool Control.

TEXTBOOKS:

1. Ernest O. Doebelin, ―Measurement Systems Application and Design‖, McGraw-Hill Publishing Company, 5th Edition, 2006.

REFERENCES

1 Beckwith, T.G. and Buck, N.L. ―Mechanical Measurements‖ Addition Wesley Publishing Company Limited, 1995.

2 Jain R.K. ―Mechanical and Industrial Measurements‖ Khanna Publishers, Delhi, 1999.

3 Rangan, Mani and Sharma, ―Instrumentation‖, Tata McGraw-Hill Publications, New Delhi,(2nd edition) 1989.

4 Nagrath I. G. and Gopal, M. ―Control Systems Engineering‖, Wiley Eastern Limited, (5th edition) 2000.

5 Murthy ―Transducers and Instrumentation Printing Hall of India‖, New Delhi, 2003.

BMT502	CNC TECHNOLOGY	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Engineering Machanics,Basic Mechanical Engineering				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVE

To introduce the CNC technology for to production of product sand to learn the student with various CNC technology used in production engineering. To introduce the industrial current trendsin the production technology.

COURSE OUTCOMES (COs)

CO1	To introduce the fundamentals of CNC Technology.
CO2	To understand the constructional features and retrofitting of CNC machines.
CO3	To learn the types of controls system, various feedback devices and tooling.
CO4	To practice writing programs using G codes and M Codes.
CO5	To learn the economics and maintenance of CNC installation.
CO6	To know about real-time applications.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									

	CO3	M			H						M		
	CO4					H		H					
	CO5												
	CO6							H			H	H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I FUNDAMENTALS OF CNC MACHINES 9

Introduction to Computer Numerical Control: CNC Systems – An Overview of Fundamental aspects of machine control, Different types of CNC machines – Advantages and disadvantages of CNC machines.

UNIT II CONSTRUCTIONAL FEATURES OF CNC MACHINES AND RETROFITTING 10

Features of CNC Machines: Structure, Drive Mechanism, gearbox, Main drive, feed drive, Spindle Motors, Axes motors. Timing belts and pulleys, Spindle bearing – Arrangement and installation. Slide ways. Re - circulating ball screws – Backlash measurement and compensation, linear motion guide ways. Tool magazines, ATC, APC, Chip conveyors.Retrofitting of Conventional Machine Tools: Modification to be carried out on conventional machines for retrofitting.

UNIT III CONTROL SYSTEMS, FEED BACK DEVICES AND TOOLING 10

Description of a simple CNC control system.Interpolation systems. Features available in a CNC system – introduction to some widely used CNC control systems. Types of measuring systems in CNC machines – Incremental and absolute rotary encoders, linear scale – resolver – Linear inductosyn – Magnetic Sensors for Spindle Orientation. Qualified and pre-set tooling – Principles of location – Principles of clamping – Work holding devices.

UNIT IV CNC PART PROGRAMMING 9

Part Program Terminology-G and M Codes – Types of interpolation Methods of CNC part programming – Manual part programming – Computer Assisted part programming – APT language – CNC part programming using CAD/CAM-Introduction to Computer Automated Part Programming.

UNIT V ECONOMICS AND MAINTENANCE 7

Factors influencing selection of CNC Machines – Cost of operation of CNC Machines – Practical aspects of introducing CNC machines in industries – Maintenance features of CNC Machines – Preventive Maintenance, Other maintenance requirements.

TEXTBOOKS:

1. Yorem Koren, –Computer Control of Manufacturing Systems‖, McGraw Hill, 2000.

REFERENCES

1. Radhakrishnan P., Computer Numerical Control Machines, New Central Book Agency, 2000.
2. BERRY LEATHAM – JONES, Computer Numerical Control, Pitman, London, 1987.
3. STEAVE KRAR and ARTHUR GILL, CNC Technology and Programming, McGraw–Hill Publishing Company, 1990.
4. HANS B.KIEF and T.FREDERICK WATERS, Computer Numerical Control Macmillan/McGraw-Hill, 1992.
5. G.E.THYER, Computer Numerical Control of Machine Tools. Second Edition, B/H NEWNES, 1993.
6. GROOVER, M.P., Automation, Production Systems and Computer Integrated Manufacturing, Prentice Hall (3rd Edition), 2008.
7. MIKE MATTSON, –CNC Programming Cengage Learning, 2009.

BMT504	**DIMENSIONAL METROLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours -45	3	0	0	3
	Prerequisite – Engineering Physics				
	Course Designed by – Dept of Mechatronics				

OBJECTIVETo introduce concept of metrology and measurement, measurement systems, metrological equipments.

COURSE OUTCOMES (COs)

CO1	To explain theconcept of metrology and measurement and various terms used in the metrology
CO2	To understand the vernier caliper, micrometer and gauge block
CO3	To explain the measurement by comparison
CO4	To explain the optical metrology
CO5	To explain the surface measurement
CO6	To Understand the concept non contact type measurement

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H			M	H		M			M		M
	CO2			M									
	CO3	M			H						M		
	CO4					H		H					
	CO5												
	CO6										H	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I BASICS OF MEASUREMENT & METROLOGY 9

Measurement & Metrology – Introduction, uses, acts and applications of measurement, codification of measurement – Accuracy, precision and reliability – Evolution of standards – metric systems – fundamental & Practical Criteria – metrological, communication and computational considerations – Rounding of numerical values. Measurements and Tolerances – Geometric Dimensioning and Tolerance – Statistics and metrology – probability and acceptance sampling.

UNIT II MEASUREMENT INSTRUMENTS 9

Measurement with scales and scaled Instruments – steel rule – role of error – calipers – types and applications.Vernier Instruments – Vernier Caliper, Depth gauge, Height gauge – height master – Three elements of measurements. Micrometer Instruments – Principle, Types, applications.Development and use of gauge blocks – Calibration, applications, combining gauge blocks.

UNIT III MEASUREMENT METHODS 9

Measurement by comparison – Dial Indicator – Principle, selection, use and Calibration – Accessories and attachments – constructive use of Error. High – Amplification comparators – Electronic measurement – applications – advantages of multiple scales. Pneumatic measurement – Principles, applications and advantages of pneumatic comparators – Calibration – Role of error, Calibration Procedure.

UNIT IV OPTICAL MEASUREMENT METHODS 9

Optical Flats and Optical alignment – light waves as standards – measurement with optical flats, applications of optical flat measurement – principles of optical metrology – Alignment Telescope – Straightness measurement – Optical squares and squareness measurement – Sight level – Plumbness, optical polygons – Angles, Jig Transit – Planes, Theodolite Angles and planes. Reference planes-Flatness, Perpendicularity and modern reference planes. Angle measurement-Basic geometry function, sign bars and plates and mechanical angle measurements.

UNIT V SURFACE MEASUREMENT METHODS 9

Surface Measurement – surface Evaluation, stylus method, Numerical values for surface Assessment, surface Texture specimens, surface Evaluation, other methods, Roundness measurement. Coordinate measuring machines – types, operational details and metrological features – coordinate systems. Non-contact type measurement – Principles of microscope, applications, optical comparator, profile projector, machine vision systems, Laser measurement.

TEXTBOOKS:

1. Connie Dotson, Ronger Harlow and Richard L. Thomson, ―Fundamentals of Dimensional Metrology‖, 5th Edition, 2009. Thomson Asia Pvt. Ltd. Singapore. ISBN 981-243-685-5.

REFERENCES

1. R.K. Jain, ―Engineering Metrology‖, Khanna Publishing, 2002.
2. Gaylor, Shotbolt and Sharp, ―Metrology for Engineers, O.R. Cassel, London, 1993.
3. Thomas, ―Engineering Metrology‖, Butthinson & Co., 1984.

BEC5L2	**MICROPROCESSORS LAB**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									0	0	3	2
	Prerequisite -Basic Electronics Engineering												
	Course Designed by – Dept of Electronics Engineering												
OBJECTIVESTo understand 8085 basics and practice various programs in the laboratory.													
COURSE OUTCOMES (COs)													
CO1	To learn about basic programming using 8085.												
CO2	To learn about ascending/descending order.												
CO3	To study about interfacing devices.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M			H	M		
	CO2	M					H			M			
	CO3			H							M		
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	**Non-Major Elective (NE)**	**Open Elective (OE)**		Project/Term Paper Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

LIST OF EXPERIMENTS

I. **PROGRAMMING** 30

1. Addition of two 8-bit numbers, sum of 8-bits and 16 bits.
2. Decimal addition of two 8-bit numbers Sum: 16 bits.
3. 8-bit subtraction.
4. 8-bit decimal subtraction.
5. Additional of two 16-bit numbers, Sum: 16 bits or more.
6. Multibyte subtraction.

7. To arrange a series of numbers in Ascending order
8. To arrange a series of numbers in Descending order
9. 8-bit Multiplication.
10. 8-bit Division.
11. Decimal to hexadecimal conversion and hexadecimal number to decimal number conversion.

II. **INTERFACING** 30

1. Analog to digital conversion
2. Digital to analog conversion
3. Stepper motor controller.
4. Temperature controller

LIST OF EQUIPMENT
(for a batch of 30 students)

S.No	Equipments	Qty
1	8085 Microprocessor trainer kits	15
2	ADC interface card	3
3	DAC interface card	3
4	Stepper motor interfacing card with stepper motor	3
5	Temperature controller with sensors like thermocouple	3

BMT5L1	**INSTRUMENTATION & CONTROL LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Basic Instrumentation engineering				
	Course Designed by – Dept of Electronics& communication Engineering, Department of Electronics &instrumentation engineering				

OBJECTIVES

To introduce the concept of various instrument involved in industry with various practical concepts in instrumentation and control and to introduce the various advanced technology in controlling technique.

COURSE OUTCOMES (COs)

CO1	To learn the practical experiments about pressure measurement and control
CO2	To understand the practical experiments about force and torque measurement
CO3	To learn the practical experiments about temperature measurement and control
CO4	To learn the practical experiments about speed measurement and control
CO5	To learn the practical experiments about application of data acquisition system for industrial purposes

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	S							
	CO2				M	S							
	CO3				M	S							
	CO4				M	S							
	CO5				M	S							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. PRESSURE MEASUREMENT AND CONTROL
   Pressure measuring devices – Pressure and vacuum gauge calibration.
2. TEMPERATURE MEASUREMENT AND CONTROL
   Temperature measuring devices like platinum resistance thermometer, thermocouple, radiation pyrometer, etc.
3. SPEED MEASUREMENT AND CONTROL
   Studying the devices and characters and measuring the speed using tachometer, stroboscope, etc.
4. FORCE MEASUREMENT
   Force measuring devices, load cells and proving rings.
5. TORQUE MEASUREMENT
   Torque measurement –using torque measuring devices.
6. POWER MEASUREMENT
   Power measurement using prony brake.
7. STRAIN MEASUREMENT
   Study and use of strain – strain gauge indicator.
8. DISPLACEMENT MEASUREMENT
   LVDT-Displacement and velocity measurement using encoders.
9. SOUND MEASUREMENT
   Measurement of sound level using sound level meters.
10. Study on the application of data acquisition system for industrial purposes.

BMT5L2	**CNC LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours -45	0	0	3	2
	Prerequisite – Basic Mechanical Engineering				
	Course Designed by – Dept of Mechanical Engineering, Dept of Mechatronics Engineering				

OBJECTIVE

To teach part programming in the CNC machines and produce various shapes CNC machine.

COURSE OUTCOMES (COs)	
CO1	To explain theconcept of metrology and measurement and various terms used in the metrology
CO2	To practices on programming and simulation of machining
CO3	To practices on Linear and Circular interpolation
CO4	To practices on Pocket milling, slotting, peck drilling and other fixed canned cycles

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	M								
	CO2			H	M								
	CO3			H	M	L							
	CO4			H	M								
	CO5												

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Manual part programming using G and M codes for Turning, step turning, Taper turning, thread cutting and radius turning on cylindrical components.
2. Programming and Simulation of machining using the following features.
   a. Linear and Circular interpolation
   b. Pocket milling, slotting, peck drilling and other fixed canned cycles.
3. Given a component drawing to write the manual part programming and execute on CNC Lathe and Milling Machine.

LIST OF EQUIPMENT (for a batch of 30 students)

1.CNC Lathe with Fanuc controller - 1 No.
2. CNC Milling Machine with Fanuc controller- 1 No.
3. Master CAM software - 10 Licenses
4. Computer nodes - 10 Nos

BMT5C1	**COMPREHENSION I**	**L**	**T**	**P**	**C**
	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses up to fifth semester				
	Course Designed by – Dept. of Mechatronics				

OBJECTIVES

- To provide a complete review of Mechatronics topics covered up to fifth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to fifth semester.

BMT601	SENSORS &SIGNAL PROCESSING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Instrumentation and Control				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the various Sensors involved in the industry.To introduce sensors input and output signals processing.To introduce the current trends in the various types of sensors and it‘sprocessing.

COURSE OUTCOMES (COs)

CO1	To learn general concept of sensors and its type
CO2	To understand the different types ofElectrical sensors
CO3	To learn the different types of smart sensors
CO4	To learn the various types of signal conditioning
CO5	To understand the concept of data Acquisition
CO6	To understand the concept of current trends in the various types of sensors and it‘sprocessing.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H						L	
	CO2	M			M	H		M					
	CO3				M	H			H				M
	CO4	M			M	H		H	M				
	CO5				M	H							M
	CO6			M	M	H						L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION ANDMECHANICAL SENSORS 10

Sensors and transducers - Classification of sensors- Static and Dynamic characteristics of sensors
Temperature: Filled thermometer – Bimetallic thermometer – monometers.
Elastic transducers– bourdon gauge – bellows – diaphragm.
Vacuum: McLeod gauge, thermal conductivity gauge –Ionization gauge.
Flow measurement: orifice, venture, nozzle, pilot tube, turbine flow meter, hot wire anemometer.

UNIT II ELECTRICAL SENSORS 9

Resistive transducers – Potentiometer– RTD – Thermistor – Thermocouple – Strain gauges – use in displacement, temperature, force measurement – Inductive transducer – LVDT – RVDT – use in displacement – Capacitive transducer – Piezo electric transducer – Digital displacement transducers.

UNIT III SMART SENSORS 9

Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors – applications - Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring.

UNIT IV SIGNAL CONDITIONING 9

Amplification, Filtering – Level conversion – Linearisation - Buffering – Sample and Hold circuit – Quantization – Multiplexer / Demultiplexer – Analog to Digital converter – Digital to Analog converter.

UNIT V DATA ACQUISITION 8

Data Acquisition conversion-General configuration-single channel & multichannel data acquisition – Digital filtering – Data Logging – Data conversion – Introduction To Digital Transmission system.

TEXTBOOKS:

1. Patranabis. D, –Sensors and Transducers‖, 2nd edition PHI, New Delhi, 2003.
2. David G. Alciatore and Michael B.Histand, –Introduction to Mechatronics and Measurement systems‖, 3rd edition Tata McGraw-Hill, 2007.

REFERENCES

1. Bolton, -Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering-, 2nd Edition, Addison Wesley Longman Ltd., 1999.
2. Ernest O.Doebelin, –Measurement Systems – Applications and Design‖, Tata McGraw-Hill, 2004.
3. Murthy DVS, –Transducers and Instrumentation‖, 2nd Edition, PHI, New Delhi – 2008.
4. C.S. Rangan, G.R. Sarma, VSV.Mani, –Instrumentation Devices and Systems‖, 2nd edition, Tata McGraw-Hill Publishing company Ltd, 2002.

	APPLIED HYDRAULICS AND PNEUMATICS	L	T	P	C
BMT602	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Theory of Machines				

	Course Designed by – Dept of Mechatronics												
OBJECTIVES To learn about the basic concepts of fluid power systems and various application and its circuits													
COURSE OUTCOMES (COs)													
CO1	To introduce fundamentals of fluid power systems.												
CO2	To learn various types and function of hydraulic components.												
CO3	To design hydraulic circuits for simple practical applications.												
CO4	To learn various types and function of pneumatic components.												
CO5	To design pneumatic circuits for simple practical applications.												
CO6	To Understand the concept of fluid power systems and the components of pneumatic and hydraulics of the system.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H							
	CO2	M			M	H							
	CO3				M	H		H		L			
	CO4				M	H		H					
	CO5				M	H		H					
	CO6			M		H							
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction: Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids – Fluid power symbols.Basics of hydraulics – Applications of Pascal‘s Law-Laminar and turbulent flow – Reynolds‘s number-Darcy‘s equation – Losses in pipe, valves and fittings.

UNIT II HYDRAULIC SYSTEM AND COMPONENTS 9

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps.

Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tandem, Rodless, Telescopic. Cushioning mechanism, Construction of double acting cylinder, Rotary actuators. Fluid motors, Gear, Vane and Piston motors.

UNIT III DESIGN OF HYDRAULIC CIRCUITS 9

Construction of Control Components: Directional control valve – 3/2 way valve – 4/2, 4/3 way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram.

Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit

UNIT IV PNEUMATIC SYSTEMS & COMPONENTS 9

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, and Lubricator Unit – Air control valves, Quick exhaust valves, pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V DESIGN OF PNEUMATIC CIRCUITS 9

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves.Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and trouble shooting.

TEXTBOOKS:

1. Anthony Esposito, –Fluid Power with Applications‖, Prentice Hall, 2006.

REFERENCES

1. Anthony Lal, –Oil hydraulics in the service of industry‖, Allied publishers, 1982.
2. Harry L. Stevart D.B, –Practical guide to fluid power, –Taraoeala sons and Port Ltd. Broadey, 1976.
3. Majumdar S.R., –Pneumatic systems – Principles and maintenance‖, Tata McGraw-Hill, 1995

BMT604	MICRO CONTROLLER &PLC	L	T	P	C
	Total Contact Hours – 60	4	0	0	4
	Prerequisite – Microprocessor & its Applications				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the Architecture of 8051 and addressing modes. To get the knowledge about 8051 micro controller design, testing design and the applications of the PLC.

COURSE OUTCOMES (COs)

CO1	To learn the Architecture of 8051 microcontroller.
CO2	To understand the 8051 micro controller design and testing design.
CO3	To learn the 8051 micro controller applications.
CO4	To learn the programmable logic controllers.
CO5	To learn the applications of the PLC.
CO6	To Understand the working of micro controller and PLC system from the block diagram.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				L	H							H
	CO2	M			M	H							
	CO3				L	H		M					H
	CO4				L	H		M					
	CO5				M	H							
	CO6				L	L		M					
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
										√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION TO MICROCONTROLLER 12

8051 Architecture: Microcontroller Hardware – I/O Pins, Ports – External memory – Counters and Timers – Serial data I/O – Interrupts –Instruction set of 8051-Addressing modes- Data transfer instructions, Arithmetic and Logical Instructions, Jump and Call Instructions, interrupts.

UNIT II 8051 MICROCONTROLLER DESIGN 12

8051 Microcontroller Design: 8051 Microcontroller Specification 8051 – Microcontroller System Design – Testing the Design, Timing Subroutines, Look up Tables – Serial Data Transmission.

UNIT III INTERFACING AND APPLICATIONS 12 Stepper motor control-Keyboard interfacing-Alpha-Numeric display interfacing Devices –Analog to digital converter interfacing-Digital to analog converter interfacing- Interfacing of Electronic weighing bridge.

UNIT IV INTRODUCTION TO PLC 12 Programmable Logic Controllers: Introduction – Parts of PLC – Principles of operation – PLC sizes – PLC hardware components — PLC programming Simple instructions – Connecting PLC to computer interlocks and alarms -Latching relays PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram.

UNIT V APPLICATIONS OF PLC 12

Timer instructions ON DELAY, OFF DELAY and RETENTIVE Timers, UP COUNTER, DOWN COUNTER and UP DOWN COUNTERS, control instructions – Data manipulating instructions, match instructions; Applications of PLC –case study of Tank level control system - Automatic lubrication of supplier Conveyor belt - Automatic control of warehouse door.

TEXTBOOKS:

1. Kennath J. Ayala.The 8051 Microcontroller Architecture, Programming and Applications, Penram International Publishing (India), 3rd Edition, Mumbai.
2. Microcontroller-Internals, Instructions, Programming & Interfacing by Subrata Ghoshal, Pearson.
3. David Calcutt, Frederick Cowan, and Hassan Parchizadeh,‖ 8051 Microcontroller: An ApplicationsBased Introduction ―.
4. FrankD.Petruzella.―Programmable Logic Controllers‖, McGraw–HillBook, 1989.3rd Ed

REFERENCES

1. B.P. Singh, Microprocessors and Microcontrollers, Galcotia Publications (P) Ltd, 2nd Edition, New Delhi, 1997.
2. Embedded Controller Hand book, Intel Corporation, USA.
3. Microcontroller Hand Book, INTEL, 1984.

BSS601	**VALUE EDUCATION AND PROFESSIONAL ETHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

- To teach the philosophy of Life, personal value, social value, mind cultural value and personal health
- To teach professional ethical values, codes of ethics, responsibilities, safety, rights and related global issues.

COURSE OUTCOMES (COs)

CO1	To learn about philosophy of Life and Individual qualities
CO2	To learn and practice social values and responsibilities
CO3	To learn and practice mind culture, forces acting on the body and causes of diseases and their curing
CO4	To learn more of Engineer as Responsible Experimenter.
CO5	To learn more of Risk and Safety assessment with case studies.
CO6	To learn more of Responsibilities and Rights as Professional and facing Global Chalenges

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
		√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I : PHILOSOPHY OF LIFE AND INDIVIDUAL QUALITIES 9

Human Life on Earth - Purpose of Life, Meaning and Philosophy of Life. The Law of Nature – Protecting Nature /Universe. Basic Culture - Thought Analysis - Regulating desire - Guarding against anger - To get rid of Anxiety – The Rewards of Blessing - Benevolence of Friendship - Love and Charity - Self – tranquility/Peace

UNIT II : SOCIAL VALUES (INDIVIDUAL AND SOCIAL WELFARE) 9

Family - Peace in Family, Society, The Law of Life Brotherhood - The Pride of Womanhood – Five responsibilities/duties of Man : - a) to himself, b) to his family, c) to his environment, d) to his society, e) to the Universe in his lives, Thriftness (Thrift)/Economics. Health - Education - Governance - People‘s Responsibility / duties of the community, World peace.

UNIT III: MIND CULTURE & TENDING PERSONAL HEALTH 9

Mind Culture - Life and Mind - Bio - magnetism, Universal Magnetism (God –Realization and Self Realization) - Genetic Centre – Thought Action – Short term Memory – Expansiveness – Thought – Waves, Channelizing the Mind, Stages - Meditation, Spiritual Value. Structure of the body - the three forces of the body- life body relation, natural causes and unnatural causes for diseases, Methods in Curing diseases

UNIT IV: ENGINEERING AS SOCIAL EXPERIMENTATION AND ENGINEERS‟S RESPONSIBILITIES FOR SAFETY 9

Engineering as Experimentation – Engineer as Responsible Experimenters – Codes of Ethics – The Challenger, case study.Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk – The Three Mile Island and Chernobyl case studies.

UNIT V: ENGINEERS‟S RESPONSIBILITIES FOR RIGHTS AND GLOBAL ISSUES 9

Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Whistle Blowing – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination.Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development –Engineers as Managers – Consulting Engineers – Engineers as Expert Eye Witnesses and Advisors – Moral Leadership

TEXTBOOKS:

1. Value Education for Health, Happiness and Harmony, The World Community Service, Centre Vethathiri Publications (Unit 1 – III).
2. Mike W Martin and Roland Schinzinger, Ethics In Engineering, Tata Mcgraw Hill, Newyork 2005 (Units IV & V)

REFERENCE:

1. Philosophy of Universal Magnetism (Bio - magnetism, Universal Magnetism) The World Community Service Centre Vethathiri Publications (for Unit III)
2. Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road,Thanjavur 613 004 (for Units I - III)
3. R S Nagaarazan, Textbook On Professional Ethics And Human Values, New Age International Publishers, 2006 (for Units IV-V)
4. Charles D Fledderman, Engineering Ethics, Prentice Hall, New Mexico, 2004 (Units IV-V)

BMT6L1	**SENSORS AND SIGNAL PROCESSING LAB**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									0	0	3	2
	Prerequisite – Instrumentation and Control Lab												
	Course Designed by – Dept of Mechatronics												

OBJECTIVES

To introduce the concept of various sensors and its signal processing using its circuits

COURSE OUTCOMES (COs)

CO1	To learn the concept wave shaping circuit and A/D converter.
CO2	To understand the practical experiments about speed sensor and proximity sensor.
CO3	To learn the practical experiments about V/F and F/V converter.
CO4	To learn the practical experiments about temperature sensors.
CO5	To learn the practical experiments about displacement sensors.
CO6	To Understand the concept of wave shaping circuit and speed sensor by the practical experiments.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H							M
	CO2	M				H		M			L		
	CO3					H		M					M
	CO4					H		M					
	CO5					H		M			L		
	CO6			M									

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

LIST OF EXPERIMENTS

1. Wave Shaping circuit
2. Analog to Digital Converters
3. Digital Comparator
4. Speed measurement using Inductive pickup / Proximity sensor
5. Voltage to frequency converter
6. Frequency to Voltage Converter
7. Measurement of temperature using thermocouple, thermistor and RTD
8. Measurement of displacement using LVDT & Capacitive transducer
9. Position and velocity measurement using encoders
10. Position measurement using linear scales
11. Absolute encoders

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Equipment	Qty
1	Cathode Ray Oscilloscope	5
2	Function Generator	5
3	Regulated power supply	7
4	Displacement Measurement Trainer using LVDT	1
5	Capacitive pickup trainer module (dielectric)	1
6	Position and Velocity measurement using encoder kit	1
7	Position measurement using linear scales kit	1
8	Speed Measurement uses inductive pickup /Proximity sensor kit	1
9	Speed measurement and closed loop control of DC Motor using photo electric pickup kit	1
10	RTD module	1
11	Thermistor module	1
12	Thermocouple module	1
13	Absolute encoder	1
14	PC based data acquisition unit (optional)	1

BEC6L6	MICRO CONTROLLER &PLC LAB	L	T	P	C
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – Micro Processor Lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the programming concepts in 8051 Microcontroller and interfacing of Electronics Devices

COURSE OUTCOMES (COs)

CO1	To learn the basic programming of 8051 microcontroller.
CO2	To understand the 8051 micro controller interface Programming Exercises.
CO3	To learn the 8051 micro controller applications.

CO4	To learn the ladder programming in PLC												
CO5	To learn the Sequential operation pneumatic cylinders												
CO6	To Understand the concept of 8051 microcontroller and programmable logic controllers by the practical experiments.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H							M
	CO2	M			M	H		M			L		
	CO3				M	H			H				M
	CO4				M	H		M					
	CO5				M	H					L		
	CO6			M	M	H							
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

1. Study of Microcontroller Kits.
2. 8051 / 8031 Programming Exercises.
3. Stepper Motor interface.
4. D.C. motor controller interface.
5. Study of interrupt structure of 8051.
6. Interfacing high power devices to microcomputer port lines, LED relays and LCD displays.
7. Linear actuation of hydraulic cylinder with counter and speed control.
8. Hydraulic rotation with timer and speed control.
9. Sequential operation of pneumatic cylinders.
10. Traffic light controller.
11. Speed control of DC motor using PLC.
12. Testing of Relays using PLC.

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS

S.No	Equipments	Qty
1	Regulated power supply	7
2	Pulse generator	1
3	Function generator	5
4	Cathode ray osilloscope	5
5	8051 MicroController Kit	5
6	stepper Motor	2
7	stepper motor interfacing board	2

8	PLC trainer kit and related software	2
9	Hudraulic cylinder	1
10	Pneumatic cylinder	1
11	LED/LCD interface units	1
12	SCR/Triac/Power MOSFET interface unit	1

BMT6L2	**HYDRAULICS &PNEUMATICS LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – **HYDRAULICS &PNEUMATICS**				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce design and testing hydraulic and pneumatic circuits. To learn the various control valves like flow, pressure, direction. To practice the simulation using given software.

COURSE OUTCOMES (COs)

CO1	To design and test the hydraulic circuits using various valves.
CO2	To design and test the pneumatics circuits using various valves.
CO3	To model and analysis of fluid power system using MATLAB/LABVIEW.
CO4	To simulate basic electric, hydraulic and pneumatic circuits.
CO5	To learn the practical experiments about pneumatics circuits.
CO6	To Understand the concept of hydraulic circuits and pneumatic circuits by the practical experiments.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H							
	CO2	M			M	H							M
	CO3				M	H							
	CO4				M	H							M
	CO5				M	H							
	CO6			M									

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. **Design and testing of hydraulic circuits such as**
   - **i)** Pressure control

ii) Flow control
iii) Direction control
iv) Design of circuit with programmed logic sequence, using an optional PLC in hydraulic Electro hydraulic Trainer.

2. **Design and testing of pneumatic circuits such as**
   i) Pressure control
   ii) Flow control
   iii) Direction control
   iv) Circuits with logic controls
   v) Circuits with timers
   vi) Circuits with multiple cylinder sequences in Pneumatic Electro pneumatic Trainer.
3. Modeling and analysis of basic electrical, hydraulic, and pneumaticsystems using**MATLAB/LABVIEW** software.
4. Simulation of basic hydraulic, pneumatic and electrical circuits using Automationstudio software.

LIST OF EQUIPMENT(for a Batch of 30 students)

S.No	Equipments	Qty
	Hydraulic Equipments	
1	Pressure relief valve	4
2	Pressure reducing valves	2
3	Flow control valves	2
4	Pressure switch	1
5	Limit switches	2
6	Linear actuator	1
7	Rotary actuator	1
8	Double solenoid actuated DCV	2
	Single solenoid actuated DCV	1
9	Hydraulic power pack with 2 pumps & 2 pressure relief valve	1
10	PLC	1

S.NO	Pneumatics Equipment	Qty
1	Pneumatic trainer kit with FRL Unit, Single acting cylinder, push buttons.	1
2	Pneumatic trainer kit with FRL unit, Double acting cylinder, manually actuated DCV.	1
3	Pneumatic training kit with FRL unit, Double acting cylinder, pilot actuated DCV.	1
4	Pneumatic trainer kit with FRL unit, Double acting cylinder, Double solenoid actuated DCV, DCV with sensors/ magnetic reed switches.	1
5	PLC with Interface card	1
6	LABVIEW Software& Automation studio software	

Pneumatics Equipment
LABVIEW Software& Automation studio software.

BMT702	SIMULATION &MODELING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Mathematics-II,Control System				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the concepts and current trends in Simulation and Modeling and to acquaint the student with various technique used in simulation of Mechatronics system.

COURSE OUTCOMES (COs)

CO1	To learn the basic concepts of system and simulation
CO2	To understand the various methods of generating and testing random numbers
CO3	To learn the various methods of random Variate generation
CO4	To learn the concept about analysis of simulation data
CO5	To learn the various software for simulation and modeling
CO6	To develop simulation models for various systems

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M			M	H							
	CO2	M	W		L	H							
	CO3	M	W		M	H							
	CO4					H							
	CO5				H	H							
	CO6			H									

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I SYSTEM AND SYSTEM ENVIRONMENT 9

Component of a System – Continuous and discrete systems – Types of model; Steps in Simulation study; Simulation of an event occurrence using random number table – Single server queue –two server queue – inventory system.

UNIT II RANDOM NUMBER GENERATION 9

Properties of random numbers – Generation of Pseudo – random numbers – techniques of generating pseudo random numbers; Test for random numbers: the Chisquare test-the kolmogrov Smirnov test – Runs test – Gap test – poker test.

UNIT III RANDOM – VARIATE GENERATION 9

Inverse transform technique for Exponential, Uniform, triangular, weibull, empirical, uniform and discrete distribution, Acceptance rejection method for Poisson and gamma distribution; Direct Transformation for normal distribution.

UNIT IV DATA ANALYSIS 9

Analysis of simulated Data – Data collection, identifying the distribution, Parameter estimation, goodness of fit tests, verification and validation of simulation models.

UNIT V SIMULATION CASE STUDIES 9

Comparison and selection of GPSS, SIMSCRIPT, SLAM Arena simulation languages: Development of simulation models using Arena simulation package for queuing system, Production system, inventory system, maintenance system.

TEXT BOOKS:

1. Banks J., Carson J.S. and Nelson B.L., ―Discrete – Event System Simulation‖, 5th Edition, Pearson Education, Inc 2006 (ISBN 81-7808-505-4).

REFERENCES:

1. Geoffrey Gorden, ―System Simulation‖, Prentice Hall of India, 2003.
2. Narsingh Deo., ―System Simulation with Digital Computer‖, Prentice Hall of India, 2003.

Web REFERENCES

1. www.arenasimulation.com
2. www.gpss.co.uk
3. www.caciasl.com
4. Other useful sites can be found in the text book recommended for this course.

BMT701	**ROBOTICS &MACHINE VISION SYSTEM**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Electrical Machines and Drives ,Applied Hydraulics and Pneumatics, Sensors and signal Processing				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the basic concepts and components of robotics .To learn the machine vision concepts based on Image Processing Techniques

COURSE OUTCOMES (COs)

CO1	To introduce the automation, robotics and its components
CO2	To explain the various methods of forward kinematics and reverse kinematics

CO3	To explain the various end effectors and sensors used in robot
CO4	To explain the machine vision technique
CO5	To explain the image processing technique and application of MV
CO6	To learn about the various applications of Vision System

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H							
	CO2	M			M	H							
	CO3				M	H							
	CO4				M	H							
	CO5				M	H							
	CO6			M	M	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I ROBOTICS INTRODUCTION 9

Robotics – Introduction–Basic Structure– Classification of robot and Robotic systems –laws of robotics – robot motions – work space, precision of movement.

Drives and control systems: Hydraulic systems, power supply – servo valve – sump – hydraulic motor – DC servo motors – stepper motors – operation.

Mechanical Components of Robots: Power transmission systems: Gear transmission. Belt drives, cables, Roller Chains, Link – Road Systems, Rotary to linear motion conversion, Rack and pinion drives, ball bearing screws, speed reducers, Harmonic drives.

UNIT II KINEMATICS OF ROBOT 10

Introduction, Matrix Representation, Homogeneous transformation, forward and inverse Kinematics, Inverse Kinematics Programming, Degeneracy, dexterity, velocity and static forces, velocity transformation force control systems, Basics of Trajectory planning.

UNIT III ROBOT END EFFECTORS 8

Types of end effectors – Mechanical grippers – Types of Gripper mechanisms – Grippers force analysis – Other types of Grippers – Vacuum cups – Magnetic Grippers – Adhesive Grippers – Robot end effector interface.

Sensors: Position sensors – Potentiometers, encoders – LVDT, Velocity sensors, Acceleration Sensors, Force, Pressure and Torque sensors, Touch and Tactile sensors, Proximity, Range and sniff sensors, RCC, VOICE recognition and synthesizers.

UNIT IV MACHINE VISION 9

Introduction – Image processing Vs image analysis, image Acquisition, digital Images – Sampling and Quantization – Image definition, levels of Computation.

Image processing Techniques: Data reduction – Windowing, digital conversion. Segmentation – Thresholding, Connectivity, Noise Reduction, Edge detection, Segmentation, Region growing and Region Splitting, Binary Morphology and grey morphology operations.

UNIT V FEATURE EXTRACTION 9

Geometry of curves – Curve approximation, Texture and texture analysis, Image resolution – Depth and volume, Color processing, Object recognition by features, Depth measurement, specialized lighting techniques. Segmentation using motion – Tracking. Image Data Compression, Real time Image processing, Application of Vision systems.

TEXT BOOK:

1. M.P. Groover, Industrial Robotics – Technology, Programming and Applications, McGraw-Hill, USA, 2008. 2nd Edition.

REFERENCES :

1. Saeed B. Niku, Introduction to Robotics: Analysis, Systems, Applications, 2nd edition, Pearson Education India, PHI 2003 (ISBN 81-7808-677-8)
2. Ramesh Jam, Rangachari Kasturi, Brain G. Schunck, Machine Vision, Tata McGraw-Hill, 1991. 1st Edition.
3. Yoremkoren, Robotics for Engineers, McGraw-Hill, USA, 1987.
4. P.A. Janaki Raman, Robotics and Image Processing, Tata McGraw-Hill, 1991.

BAM705	**AUTOMOTIVE ELECTRONICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Sensors and Signal Processing				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To understand the evolution of electronics in automobile and the various sensors and ECUs used in vehicle

COURSE OUTCOMES (COs)

CO1	To understand the working of charging and starting systems
CO2	To study about the engine basics and various types of ignition systems
CO3	To gain knowledge on different types of injection systems
CO4	To know the characteristics of various sensors and actuators.
CO5	To understand the concept of engine management system and CAN standard
CO6	To learn the safety system in automotive electronics

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H							
	CO2				M	H				L			
	CO3				M	H		M					
	CO4				M	H							
	CO5				M	H							
	CO6			M	M	H				L			
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION 8

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Charging systems – working and design of charging circuit diagram – starter motors and starter circuits.

UNIT II BASICS OF ENGINES 10

Operating principles of IC engine – major engine components – engine cylinder arrangements – the ignition systems – Electronic ignition, direct ignition, injection systems – working of the carburetor – throttle body injection – Multipoint fuel injection – sequential fuel injection.

UNIT III SENSOR AND ACTUATORS 7

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

UNIT IV ENGINE CONTROL SYSTEMS 10

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU‘s used in the engine management – block diagram of the engine management system – In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V CHASSIS AND SAFETY SYSTEMS 10

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems – centralized door locking system – climate control of cars.

TEXT BOOK :

1. Tom Denton, ‒Automobile Electrical and Electronics Systems‖, Edward Arnold Publishers, 2000. 4th Edition.

REFERENCES :

1. William B. Ribbens, –Understanding Automotive Electronics‖, 7th edition, Newnes Publishing, 2000.
2. Barry Hollembeak, –Automotive Electricity, Electronics & Computer Controls‖, Delmar Publishers, 2001.
3. –Fuel System and Emission controls‖, Check Chart Publication, 2000.
4. Ronald. K. Jurgon, –Automotive Electronics Handbook‖, McGraw-Hill, 1999. 2nd edition.

BME7L3	**CAD/CAM LAB**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	0	0	3	2
	Prerequisite – CNC Lab, Finite element Analysis, Computer Aided Machine Drawing				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

To impart knowledge about various software tools in CAD to design and model different products

COURSE OUTCOMES (COs)

CO1	To learn to design components like screw jack using Pro E
CO2	To learn to design components like Knuckle joint using Creo software
CO3	To learn to design products using Pro E &CATIA
CO4	To learn to analyze engineering problems using FEA package
CO5	To study about operations like drilling, boring in lathe using Precut software
CO6	To study about operations like milling in lathe using Precut software

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	M	H							
	CO2			H	L	H							
	CO3			H	M	H							
	CO4				M	H							
	CO5					H							
	CO6				L	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

LIST OF EXPERIMENTS

1. Solid modeling using Ideas / Pro Engineering / CATIA software of gives components / products such as (at least 3 components)
2. Analysis of engineering problems using FEA package (at least 3 problems)
3. Exercise in surface machining – Multi Axis Machining and software Development for manufacturing. (at least 3 jobs)
4. Computer assisted part programming using Master Computer Software for various internal and external curved surface machining.

LIST OF EQUIPMENT (for a batch of 30 students)

1. Any CAD software – 10 licenses
2. Any FEA software – 5 licenses
3. Any CAM software – 10 licenses

BMT7L3		**ROBOTICS LAB**									**L**	**T**	**P**	**C**
		Total Contact Hours - 45									0	0	3	2
		Prerequisite – Sensors and Signal Processing Lab, Microcontroller Lab												
		Course Designed by – Dept of Mechatronics												
OBJECTIVES: To impart knowledge on building robots and practice exercises on Robot.														
COURSE OUTCOMES (COs)														
CO1	To understand different types of robots based on configuration and application													
CO2	To study of different type of links and joints used in robots													
CO3	To study about various end effectors used in robots													
CO4	To learn about the different types of drive system													
CO5	Verification of transformation (Position and orientation) with respect to gripper and world coordinate system													
CO6	To practices on programming exercises on Robot													
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low														
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l	
2	CO1			H	M	H								
	CO2			H	M	H								
	CO3			H	M	H								
	CO4			H	M	H								
	CO5			H	M	H								
	CO6			H	M	H								
3	Category	Humanities & Social Studies		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective	Project/Term Paper Seminar/ Internship (PR)		
							√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016												

LIST OF EXPERIMENTS

1. Study of different types of robots based on configuration and application.
2. Study of different type of links and joints used in robots
3. Study of components of robots with drive system and end effectors.
4. Determination of maximum and minimum position of links.
5. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system
6. Estimation of accuracy, repeatability and resolution.
7. Robot programming exercises

(Point-to-point and continuous path programming)

LIST OF EQUIPMENT (for a batch of 30 students)

S.No	Name of the Equipment/components	No. of Items
1	Any one type of robot configuration with at least five degree of freedom.	1 set
2	Robot programming software inclusive of computer system.	10 licenses
3	Models of different types of end effectors drive systems Links and Joints.	5 each
4	Models of different configuration robots	5 each

	TERM PAPER	L	T	P	C
BMT7P1	Total Contact Hours - 45	0	0	3	2
	Prerequisite –Professional Courses				
	Course Designed by – Dept. of Mechatronics.				

OBJECTIVES

- Learn to work as a member of a project team.
- Understand project management tasks.
- Develop a hardware / software solution for a real-time, industry relevant problem.

COURSE OUTCOMES (COs)

CO1	Apply knowledge of basic science and engineering to Mechatronics problems
CO2	Implement the simple applications and verify using modern simulation tools.
CO3	Identify, formulate, and model engineering equipment
CO4	Recognize the real world applications and to solve with core engineering knowledge.
CO5	Analyze and work on multidisciplinary tasks
CO6	Choose latest tools, software and equipment to solve real world problems

	COMPREHENSION II	L	T	P	C
BMT8C1	Total Contact Hours : Test will be conducted at the end of the semester	0	0	0	1
	Prerequisite – All the courses upto eighth semester				
	Course Designed by – Dept. of Mechatronics				

OBJECTIVES

- To provide a complete review of Electrical &Electronics engineering topics covered up to eighth semesters, so that a comprehensive understanding is achieved.
- It will also help students to face job interviews, competitive examinations and also to enhance the employment potential.
- To provide overview of all topics covered and to assess the overall knowledge level up to eighth semester.

	PROJECT WORK	L	T	P	C
BMT8P1	Total Contact Hours - 45	0	0	18	9
	Prerequisite –Term paper				
	Course Designed by – Dept. of Mechatronics.				

OBJECTIVES

- Learn to work as a member of a project team.
- Understand project management tasks.
- Develop a hardware / software solution for a real-time, industry relevant problem.

COURSE OUTCOMES (COs)

CO1	Apply knowledge of basic science and engineering to Mechatronics problems
CO2	Implement the simple applications and verify using modern simulation tools.
CO3	Identify, formulate, and model engineering equipment
CO4	Recognize the real world applications and to solve with core engineering knowledge.
CO5	Analyze and work on multidisciplinary tasks
CO6	Choose latest tools, software and equipment to solve real world problems

CORE ELECTIVE – I

	INTEGRATED CIRCUITS	L	T	P	C
BMT001	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Basic Electronic Engineering, Power Electronics.				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the concept of Integrated Circuits and Various new technology in Integrated Circuits. To acquaint the student with various concepts used in integrated circuits.

COURSE OUTCOMES (COs)

CO1	To learn the characteristics of op-amp & its fundamentals.
CO2	To understand the various application of op-amp.
CO3	To learn the various types of digital to analog and analog to digital converters.
CO4	To learn the concept of Special IC‘s and Voltage regulator.
CO5	To learn the concept of phase logged loop and function generator.
CO6	To Study Analog Multiplier and PLL.

Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	L			H							
	CO2	H	L			H		L					
	CO3	H	L			H							
	CO4	H	L			H							
	CO5	H	L			H							
	CO6	H	L			H							
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)				
						√							
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I CHARACTERISTICS OF OPAMP & ITS FUNDAMENTALS9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, offset voltage and current: voltage series feedback and shunt feedback amplifiers, differential amplifier; frequency response of OP-AMP; Basic applications of opamp - summer, differentiator and integrator, V/I &I/V converter.

UNIT IIAPPLICATIONS OF OPAMP 9

Sign Changer, Scale Changer, Phase Shift Circuits, Logarithmic amplifier, Precision rectifier, Instrumentation amplifier, Comparators, multivibrators, Schmitt trigger, waveform generators, clippers, clampers, peak detector, S/H circuit, First and Second order active filters, Low-pass, high-pass and band-pass Butterworth filters

UNIT III ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS 9

Analog and Digital Data Conversions, D/A converter – specifications – weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode R - 2R Ladder types - switches for D/A converters, high speed sample-and-hold circuits, A/D Converters – specifications – Flash type – Successive Approximation type – Single Slope type – Dual Slope type – A/D Converter using Voltage-to- Time Conversion – Over-sampling A/D Converters.

UNIT IV SPECIAL ICs & VOLTAGE REGULATORS 9

555 Timer circuit - Functional block, characteristics & applications; 566-voltage controlled oscillator circuit, OP-Amp Voltage regulator-Series, Shunt and switching regulator.

UNIT V ANALOG MULTIPLIER AND PLL 9

Analog Multiplier using Emitter Coupled Transistor Pair – Gilbert Multiplier cell – Variable transconductance technique, analog multiplier ICs and their applications, Operation of the basic PLL, Closed loop analysis, Monolithic PLL IC 565, application of PLL for AM detection, FM detection, FSK modulation and demodulation and Frequency synthesizing.

TEXT BOOKS

1. Ramakant AGayakward, ―Op-amps and Linear Integrated Circuits‖, IV Edition, Pearson Education/ PHI 2003.
2. Roy Choudhary.D, Sheil BJani, ―Linear Integrated Circuits‖, II edition, New Age, 2003.
3. Morris Mano.M, ―Digital Logic and Computer Design‖ Published byDelhi Pearson,2009.
4. Robert FCoughlin, Fredrick F.Driscoll, ―Op-amp and Linear ICs‖, Pearson Education, 4th edition, / PHI 2002.
5. https://zawequbipy.files.wordpress.com

REFERENCES

1. David A.Bell, ―Op-amp & Linear ICs‖, Prentice Hall of India, 4th edition,2002.
2. Charles H.Roth, ―Fundamentals Logic Design‖, Jaico Publishing, 6th edition, 2006.
3. Floyd, ―Digital Fundamentals‖, 10th edition, Pearson Education, 2008.

BMT002	**VIRTUAL INSTRUMENTATION**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Fundamentals of computing and programming, Design of Mechatronics System.				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the Virtual Instrument. To study of LABVIEW software andabout image processing

COURSE OUTCOMES (COs)

CO1	To introduce the virtual instrumentation
CO2	To learn about LABVIEW
CO3	To learn array operation
CO4	To learn basic DAQ hardware and software
CO5	To learn image acquisition
CO6	To learn Computer based instruments, Image acquisition and Motion Control.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M						
	CO2			H							H	H	
	CO3		M		H								
	CO4					M	H					H	
	CO5							H	H			H	
	CO6		M	H			M	H	H		H	H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO VIRTUAL INSTRUMENTS 9

Historical perspective and traditional bench-top instruments - General functional description of a digital instrument- Block diagram of a Virtual Instrument – Physical quantities and analog interfaces- Hardware and Software – User Interfaces –Advantages of Virtual Instruments over conventional instruments – Architecture of a Virtual Instruments and its relation to the operating system.

UNIT II LABVIEW GRAPHICAL PROGRAMMING 9

LabVIEW – graphical user interfaces- controls and Indicators – ‗G' programming –data types – data flow programming –Editing Debugging and Running a Virtual Instrument –Graphical programming palettes and tools – Front panel objects – Function and Libraries.

UNIT III LABVIEW BASIC PROGRAMMING 9

FOR Loops, WHILE loops, Shift Registers, CASE structure, formula nodes-Sequence structures-Arrays and Clusters- Array operations – Bundle, Unbundle – Bundle/Unbundle by name, graphs and charts – string and file I/O – High level and Low level file I/Os – attribute nodes local and global variables.

UNIT IV BASICS OF DAQ 9

Basics of DAQ Hardware and Software – Concepts of Data Acquisition and terminology – Installing Hardware, Installing drivers -Configuring the Hardware – addressing the hardware in LabVIEW- Digital and Analog I/O function – Buffered I/O – Real time Data Acquisition.

UNIT V VI COMMUNICATION 9

Simple programs in VI- Advanced concepts in LabVIEW- TCP/IP VI's, Synchronization – other elements of Virtual Instrumentation – Bus extensions – PXI - Computer based instruments - Image acquisition –Motion Control.

TEXT BOOKS :

1. Garry M. Johnson –Lab VIEW Graphical Programming‖, Tata McGraw-Hill, 5th Edition, 2009
2. Lisa.K.Wills, –LabVIEW for Everyone‖ Prentice Hall of India, 2009.

REFERENCES :

1. Labview Basics I and II Manual, National Instruments, 2009
2. Barry Paton, ―Sensor, Transducers and Lab VIEW‖, Prentice Hall, 2007.

BME001	INDUSTRIAL ENGINEERING	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Basic Mechanical Engineering, Manufacturing Technology.				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the production and industrial process.To study of various industrial engineering process and productivity

COURSE OUTCOMES (COs)

CO1	To learn about Production and Productivity
CO2	To learn about plant layout
CO3	To learn about work-study
CO4	To understand the concept of industrial psychology
CO5	To learn about statistical quality control
CO6	To Study Tolerance Percent Defective and Average Outgoing Quality

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H		H	M						
	CO2			H		H					H	H	
	CO3				H								
	CO4					M	H					H	
	CO5					M					L	H	H
	CO6			H			H					H	H

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I PRODUCTION AND PRODUCTIVITY 9

Definitions-Productivity, Effectiveness, and Types-Factors Influencing Productivity-Techniques To Improve Productivity, Technology Based Techniques and material Based Productivity Improvement-Inventory Control-M.R.P-Quality Circles-Brainstorming-Pareto Analysis-Cause And Effect Analysis-TQM-Zero Defects-Flextime-Just In Time-Ergonomics-Reliability Improvement-Modular Design-Maintainability**.**

UNIT II PLANT LAYOUT /LOADING AND SCHEDULING 9

Types of Layout, Its Advantages and Disadvantages-Preference of Different Types of Layout, Plant Location and Decision-Definitions: Group Technology-Principles of Material Handling. Loading Master Scheduling- Perpetual Loading-Order Scheduling-Loading By Scheduled Method-Index Method Of Scheduling-Factors Influencing Scheduling-Production Planning And Control-Routing And Dispatching-Job Card-Job Order-Order Control And Machine Load Chart.

UNIT III WORKSTUDY 9

Techniques of Work Study-Procedure-Method Study,Types of Process Charts and Diagrams-Multiple Activity Chart-Utility-Time Study-Micro Motion Time Study-PMTS-Work Sampling-Job Analysis-Job Evaluation and Merit Rating-Wage and Wage Incentive.

UNIT IV INDUSTRIAL PSYCHOLOGY 9

Introduction-Nature And Scope-Objectives-Hawthorne Studies And Its Conclusion-Individual Behaviour-Group Behaviour,Types Of Groups-Formal And Informal Organizations-Fatigue – Accident,Major Factors,Prevention-Importance And Methods Of Training To The Employees, Methods And Aids-Leadership And Leadership Styles-Communication And Its Importance.

UNIT V STATISTICAL QUALITY CONTROL 9

Introduction to Quality Control-Statistical Measures-Control Chart-Types –Control Chart for Attributes-Control Chart for Number of Defects per Unit-Acceptance Sampling-Basic Probability-Normal Distribution-Acceptable Quality Level-Lot Tolerance Percent Defective-Average Outgoing Quality

TEXTBOOKS:

1. Khanna.O.P. Industrial Engineering and Management, Khanna Publishers, New Delhi, 2012.
2. B.Kumar, Industrial Engineering, Hanna Publishers,2014

REFERENCES

1. Gupta And Petal, Work Study- Khanna Publishers, 2011.

CORE ELECTIVE – II

BMT003	**COMPUTER INTEGRATED MANUFACTURING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – CNC Technology, Manufacturing Technology				
	Course Designed by – Dept ofMechatronics				

OBJECTIVES

To understand the various concepts of CAD,CAM and Computer Integrated Manufacturing

COURSE OUTCOMES (COs)

CO1	To introduce the CAD and its element.
CO2	To explain the elements of cad systems and design using computers.
CO3	To explain the various component design using computer.
CO4	To explain the computer aided manufacturing.
CO5	To explain the computer integrated manufacturing.

CO6	To Understand the concept of CAD systems and computer aided manufacturing from Detailed Design and Documentation and Group Technology.												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H		M					
	CO2	M			M	H							
	CO3				M				H				
	CO4					H					L		M
	CO5				M	H							
	CO6			M									
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)
									√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION TO CAD AND ITS ELEMENTS 9

Principles of Computer hardware, Software and Operating System, application Programs, Data Handling and File Structures, Computer aid in Phases of design- Development of Design Database using CAD Systems- Conceptual Design Process Analysis Optimization- Detailed Design and Documentation.

UNIT II ELEMENTS OF CAD SYSTEMS AND DESIGN USING COMPUTERS9

Elements of CAD Systems, Introduction to Graphic Hardware, Software, Details of 2D Software Packages-Layering, Drawing Primitives, Display Techniques, Editing, utilities, Scaling, Dimensioning, 3D Visualization,Geometric Modeling-Wireframe and Solid models.

UNIT III DESIGN USING COMPUTERS 9

Design of Gears, Couplings, Flywheels, Shafts Connecting Rods etc.Software for Vibration Problems Stress Analysis, Kinematic Analysis, Dynamic Analysis.

UNIT IV COMPUTER AIDED MANUFACTURING9

Numerical Control- Modes- NC Elements- NC Machine Tools- CNC Machines- CNC Hardware Basics- CNC Tooling- CNC Machine Tools and Control System- Part Programming- Manual and Computer Aided- Turning Center Programming- Advanced Part Programming- Direct Numerical Control- Adaptive Control- Computer Aided Part Programming, APT, Introduction to Robotics, Group Technology, Computer Aided Process Planning, FMS.

UNIT V COMPUTER INTEGRATED MANUFACTURING 9

CIM as a Concept and a Technology- CASA/SME Model of CIM-Benefits- Communication Matrix in CIM- Fundamentals of Computer Communication n CIM, CIM Data Transmission Method, Serial , parallel, asynchronous, modulation, Demodulation, Simplex and Duplex- Types of Communications in CIM- Point to Point, Star and Multiplexing- CIM for Batch Production-

Group Technology – FMS- Process Control in CIM- Characteristics of Manufacturing Process Data- Continuous, Analog, Discrete Binary and Pulse Data- ADC/DC Multiplexers, Process Monitoring Through Computer- Types of Computer Process Control- Preplanned, Direct Digital Control (DDC)- Regular Control and Feed Forward Control, Requirements of Control Programming Interrupt, Real Time Clock Input.

TEXT BOOK:

1. Radhakrishnan P. CAD/CAM/CIM, 3rd Edition, New central Book Agency, 2008.

REFERENCES

1. Rao P.N. CAD/CAM, Principles and Application, Tata McGraw Hill, 2005.2nd Edition.
2. Mikell P.Groover, Automation, Production Systems and CIM, 4th Edition, Prentice Hall of India,2001.
3. Chris McMahon and Jimmy Browne, CAD/CAM, Pearson Education, 2001.2nd Edition.

BMT004	**NEURAL NETWORK & FUZZY LOGIC SYSTEMS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Maths & fundamentals of Computing				
	Course Designed by – Dept of Computer Science & Engineering				

OBJECTIVES: To introduce the neural network, associative memories and fuzzy logic system.

COURSE OUTCOMES (COs):The Course outcomes of Thermodynamics and Heat transfer

CO1	To learn basics of neural networks.
CO2	To learn about feed forward neural network.
CO3	To learn about associative memories
CO4	To learn about classical and fuzzy sets.
CO5	To learn about application of neural networks and fuzzy logic.
CO6	To know about real time applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M						
	CO2			H							H	H	
	CO3		M		H								
	CO4					M	H					H	
	CO5							H	H			H	
	CO6								M		H		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)

						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO NEURAL NETWORKS 9

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN. Essentials of Artificial Neural Networks. Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Learning Strategy . (Supervised, Unsupervised, Reinforcement), Learning Rules.

UNIT II FEED FORWARD NEURAL NETWORKS: 9

Single Layer Feed Forward Neural Networks- Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Limitations of the Perceptron Model. Multilayer Feed forward Neural Networks- Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements.

UNIT III ASSOCIATIVE MEMORIES `9

Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM TrainingAlgorithms: Storage and Recall Algorithm, BAM Energy Function. Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis.

UNIT IV CLASSICAL & FUZZY SETS 9

Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions. Fuzzy Logic System Components. Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods.

UNIT V APPLICATIONS 9

Neural network applications: Process identification, control, fault diagnosis. Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

TEXT BOOKS:

1. S.Rajasekharan and G. A. Vijayalakshmi pai, –Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications‖, PHI Publication, 2004.
2. John Yen and Reza Langan, –Fuzzy Logic: Intelligence, Control and Information‖, Pearson Education,2004.

REFERENCES:

1. Simon Haykin, –Neural Networks- A comprehensive foundation‖, Pearson Education, 2001.2nd Edition.
2.S.N.Sivanandam, S.Sumathi,S. N. Deepa –Introduction to Neural Networks using MATLAB 6.0‖, TMH, 2006.

3. James A Freeman and Davis Skapura, Neural Networks Pearson Education, 2002.
4. Timothy J. Ross, ― Fuzzy Logic With Engineering Applications‖, McGraw-Hill Inc. 1997.3rd Ed.

BMT005	EMBEDDED SYSTEM AND DESIGN	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Electron Devices & Circuits ,Power Electronics, Control system				
	Course Designed by – Dept of Electronics and communication Engineering				

OBJECTIVES : To study embedded hardware and embedded microcomputer systems

COURSE OUTCOMES (COs) The Course outcomes of Thermodynamics and Heat transfer

CO1	To learn review of embedded hardware
CO2	To learn about microchip PIC micro controller
CO3	To learn embedded microcomputer systems
CO4	To learn about software development
CO5	To understand the real time operating systems
CO6	To know about embedded system applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M						
	CO2			H							H	H	
	CO3		M		H								
	CO4					M	H					H	
	CO5							H	H			H	
	CO6								M			H	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I REVIEW OF EMBEDDED HARDWARE 9

Gates – Timing diagram – Memory – Microprocessors Buses – Direct Memory Access – Interrupts – Built-in functions on the Microprocessor – Conventions used on Schematic – schematic. Interrupts Microprocessor Architecture – Interrupt basics – Shared data Problem – Interrupt latency.

UNIT II MICROCHIP PIC MICRO CONTROLLER 9

Introduction, CPU Architecture – Registers – Instruction sets addressing modes – Loop timing – Timers – Interrupts, Interrupt timing, I/O Expansion, I^2C Bus Operation Serial EEPROM, Analog to Digital converter, UART – Baud Rate – Data Handling – Initialization, special features- Serial Programming – Parallel Slave Port.

UNIT III EMBEDDED MICROCOMPUTER SYSTEMS 9

Motorola MC68H11 Family Architecture, Registers, Addressing modes Programs, Interfacing methods parallel I/O interface, parallel port interfaces, Memory Interfacing, High Speed I/O Interfacing, Interrupts – Interrupt service routine – Features of interrupts – Interrupt vector and Priority, Timing Generation and Measurements, Input capture, Output compare, frequency Measurement, Serial I/O devices RS 232, RS485.

UNIT IV SOFTWARE DEVELOPMENT 9

Round Robin, Round robin with Interrupts, function – Queue – Scheduling Architecture, Algorithms. Introduction to – Assembler – Compiler – Cross Compilers and Integrated Development Environment (IDE) Object Oriented Interfacing, Recursion, Debugging strategies, Simulators.

UNIT V REAL TIME OPERATING SYSTEMS 9

Task and Task States, Tasks and Data, Semaphores and Shared Data Operating System services – Message Queues – Timer function – Events – Memory Management, Interrupt Routines in an RTOS environment, Basic design using RTOS.

TEXT BOOKS :

Jonarthan W. Valvano –Embedded Microcomputer Systems‖, Real Time Interfacing‖, Thomson learning, 2001.3rd Edition.

REFERENCES :

1. David E. Simon, –An Embedded Software Primer‖, Pearson Education Asia, 2001.
2. John B Pitman, –Design with PIC Micro controllers‖, Pearson Education Asia, 1998.
3. Burns, Alan and Wellings, –Real – Time Systems and Programming Languages‖, second edition. Harlow: Addison Wesley – Longman, 1997.
4. Grehan Moore and Cyliax, –Real Time Programming: A guide to 32 bit Embedded Development‖, Addison Wesley – Longman, 1998.
5. Heath Steve, –Embedded Systems Design‖, Newnes, 1997.2nd Edition.

CORE ELECTIVE – III

BMT007	**MICROELECTRONICS AND NANOELECTRONICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engineering Physics I & II,Basic Electronics Engineering				
	Course Designed by – Department of Mechatronics				

OBJECTIVES

To introduce the various concepts about the micro electronics and nano electronics

COURSE OUTCOMES (COs)

CO1	To introduce the semiconductor physics and quantum electronics
CO2	To explain the different types of junctions

CO3	To explain the MOS structure
CO4	To introduce and explain the nano electronics and its structure
CO5	To explain the molecular electronics
CO6	To understand the concept of various application of micro electronics & Nano electronics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		M			H							
	CO2				M	H					M		
	CO3				M	H					M		
	CO4				M	H							
	CO5				M	H							
	CO6		L		M	H					L		

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT-I SEMICONDUCTOR PHYSICS 9

Introduction to semiconductor physics: Review of quantum mechanics, electrons in periodic lattices, E-k diagrams, Quasi-particles in semiconductors, electrons, holes and phonons. Boltzmann transport equation and solution in the presence of low electric and magnetic fields - mobility and diffusivity; carrier statistics; continuity equation, poisson's equation and their solution; high field effects: velocity saturation, hot carriers, avalanche breakdown, punch through and kirk effects.

UNIT-II SEMICONDUCTOR JUNCTIONS 9

Semiconductor junctions: Schottky, homo- and hetero-junction band diagrams and I-V characteristics, small signal switching models; two terminal and surface states devices based on semiconductor junctions. Bipolar transistor working, its charge control, and gummel poon model, structure of graded base, graded emitter transistor, hetro junction transistor.

UNIT-III MOS STRUCTURES 9

MOS structures: Semiconductor surfaces; the ideal and non ideal MOS capacitor band diagrams and CVs; Effects of oxide charges, defects and interface states; characterization of MOS capacitors: HF and LF CVs, avalanche injection; high field effects and breakdown. Long & short channel effects.

NANOELECTRONICS

UNIT-IV MOSFET 9

Shrink-down approaches: Introduction, CMOS scaling, the nanoscale MOSFET, finfets, vertical. MOSFETs, limits to scaling, system integration limits (interconnect issues etc.), resonant tunneling transistors, single electron transistors, new storage, optoelectronic, and spintronics devices.

UNIT-V CARBON NANOTUBE ELECTRONS 9

Atoms-up approaches: Molecular electronics involving single molecules as electronic devices, transport in molecular structures, molecular systems as alternatives to conventional electronics, molecular interconnects; Carbon nanotube electronics, bandstructure & transport, devices, mems applications.

TEXTBOOKS:

1. Millman and Grabel, ―Microelectronics‖, 2nd Ed. Tata McGraw-Hill (2004).
2. Hari Singh Nalwa, ―Nanostructured Materials and Nanotechnology‖, Academic Press, 2002

REFERENCE:

1. Sedra A S and Smith K C, ―Microelectronic Circuits‖ 4th Ed., New York, Oxford University Press, New York (1997).
2. Tocci R J and Widmer N S, ―Digital Systems – Principles and Applications‖, 10th Ed., Pearson Education India, New Delhi (2001).
3. Cooper and Helfrick, ―Modern Electronic Instrumentation and Measuring Techniques‖, 4th print Prentice Hall of India, New Delhi (1996).
4. Boylestad and Nashelsky, ―Electronic Devices and Circuit Theory‖, 8th Ed, Pearson Education India, New Delhi (2002).
5. S.M. Kang & Y. Leblibici, ―CMOS Digital Integrated Circuits-Analysis & Design‖, TMH, 3rd Ed. 2003.
6. A.Nabok, ―Organic and Inorganic Nanostructures‖, Artech House, 2000.
7. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: ―Nanotechnologies and Nanophysics‖, Springer-Verlag Berlin Heidelberg, 2007.

BMT008	**MEMS AND NANOTECHNOLOGY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Sensor and Signal Processing, Basic electronics				
	Course Designed by – Department of Mechatronics				

OBJECTIVES

To introduce the various concepts about the micro electronics mechanical system and Nano technology

COURSE OUTCOMES (COs)

CO1	To introduce various micro sensors and emergence of micro machines.
CO2	To study about various materials for micro and Nano fabrication

CO3	To know various micro fabrication methods.
CO4	To understand the concept of Nano scale and technology
CO5	To learn Nano scale manufacturing
CO6	To understand the concepts about various MEMS and nano applications

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H	L						
	CO2				M	H	L						
	CO3				M	H	L						
	CO4				M	H	L						
	CO5				M	H	L						
	CO6				M	H	L						

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION TO MICRO SENSORS 9

Introduction: Historical background development of microelectronics, evolution of micro sensors, MEMS, emergence of micro machines.

Micro sensors: Introduction, thermal sensors, mechanical sensors, flow sensors and Introduction to SAW devices

UNIT II MEMS MANUFACTURING TECHNIQUES 9

MEMS materials and processing: Overview, metals, semiconductors, ceramic, polymeric and composite materials.

Microstereolithography: Introduction, Scanning Method, Projection Method, Applications. LIGA Process: Introduction, Basic Process and Application.

UNIT III MEMS FABRICATION TECHNIQUES 9

Micro System Fabrication Processes: Photolithography, Chemical Vapor Deposition, Etching, Bulk and Surface Micro Manufacturing

UNIT IV INTRODUCTION TO NANOTECHNOLOGY 9

Introduction to Nanotechnology: The nanoscale. Consequences of the nanoscale for technology and society. - Technologies for the Nanoscale, Top-down versus bottom-up assembly. Visualisation, manipulation and characterisation at the nanoscale, Proximal probe technologies. Self-assembly.

UNIT V NANOSCALE MANUFACTURING 9

Nanoscale Manufacturing: Nanomanipulation, Nanolithography - An introduction to tribology and its industrial applications - Nanoscale Materials and Structure, Nanocomposites, Safety issues with nanoscale powders - Applications, Applications in energy, informatics, medicine, etc

TEXTBOOKS:

1. Mark Ratner & Daniel Ratner, Nano Technology, Pearson Education,2003.
2. Tai – Ran Hsu, ―MEMS & MICROSYSTEMS Design and Manufacturing‖, TATA McGRAW- HILL, 2002
3. S.M. Sze, Semiconductor Sensors, John Wiley & Sons, INC., 1994.

REFERENCE:

1. Marc J. Madou, ―Fundamentals of Microfabrication‖, II Edition, CRC Press, 2002.
2. Mohamed Gad-el-Hak, The MEMS Handbook, CRC Press, 2002
3. M.Elwenspoek, R.Wiegerink, Mechanical Microsensors, Springer-Verlag Berlin Heidelberg, 2001.
4. David Ferry, Transport in Nanostructures, Cambridge University Press, 2000.2nd Edition.
5. S.Datta,Electron Transport in Mesoscopic Systems, Cambridge University Press, 1995.
6. Beenaker and Van Houten, Quantum Transport in Semiconductor Nanostructures, in Solid State Physics v. 44, eds. Ehernreich and Turnbull, Academic Press, 1991.
7. P. Rai-Choudhury, Handbook of Microlithography, Micromachining & Microfabrication, SPIE, 1997

BMT009	**RAPID PROTOTYPING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Computer Integrated Manufacturing				
	Course Designed by – Dept of Mechatronics Engineering				

OBJECTIVES

To study about prototyping principles and tools used for prototyping and to learn about the applications of rapid prototyping

COURSE OUTCOMES (COs)

CO1	To learn the basic concepts of product development
CO2	To learn about the various types of RP systems and their applications
CO3	To study about the different types of RP modeling systems and their applications
CO4	To understand the types of solid curing process and its applications
CO5	To learn about the different types 3-Dimensional Printers and their applications
CO6	To understand various Application of Rapid prototyping in Medical field

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M						
	CO2			H		H				M	H	H	
	CO3		M		H	H		H					

	CO4	M	H			M	H					H	
	CO5	L						H	H	M		H	
	CO6											H	
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
										√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION TO RAPID PROTOTYPING 7

Introduction: Need for time compression in product development, Product development-conceptual design – development- detail design-prototype- tooling.

UNIT II RP SYSTEMS CLASSIFICATIONS 9

Classification of RP systems, Stereo lithography systems- Principle- process parameters-process details-machine details, Applications.

Direct Metal Laser Sintering (DMLS) system - Principle process parameters process details-machine details, Applications.

UNIT III RP SYSTEM MANUFACTURING TECHNIQUES 9

Fusion Deposition Modeling - Principle- process parameters-process details-machine details, Applications.Laminated Object Manufacturing - Principle process parameters process details machine details, Applications.

UNIT IV DESIGN 3-DIMENSIONAL PRINTERS 10

Solid Ground Curing - Principle- process parameters-process details-machine details, Applications.3-Dimensional Printers - Principle- process parameters-process details-machine details, Applications, and other Concept Modelers like Thermo jet printers, Sander‘s model maker, JP system 5, Object Quadra system.

UNIT V APPLICATIONS OF RP SYSTEMS 10

Laser Engineering Net Shaping (LENS), Ballistic Particle Manufacturing (BPM)-Principle. Introduction to rapid tooling and rapid manufacturing, software for RP- STL files, Magics, Mimics Application of Rapid prototyping in Medical field.

TEXTBOOKS:

1. Pham D.T & Dimov.S.S, Rapid manufacturing, Springer-Verlag, London, 2001
2. C. K. Chua ,K.F. Leong , C.S. Lim**,** Rapid Prototyping: Principles and Applications (Book & CD Rom),3rd edition ,16 Dec 2008

REFERENCES

1. Terry Wohlers, Wohlers Report 2000, Wohlers Assosiates, USA, 2000.
2. M. Adithan ,Rapid Prototyping,2015

NON MAJOR ELECTIVE-I

BMT010	DESIGN OF MECHATRONICS SYSTEMS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Control system, Instrumentation and control				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To introduce the various Mechatronics system design approaches and its case studies

COURSE OUTCOMES (COs)

CO1	To learn various types of Design processes.
CO2	To understand the concept of Real time interfacing.
CO3	To learn the various case studies on Data Acquisition and control**.**
CO4	To learn the various case studies on Mechatronics Products.
CO5	To learn the concept of advance application in Mechatronics.
CO6	To Understand the concept of Mechatronics systems and Design of the system by the flowchart.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H						L	
	CO2	M			M	H		M					
	CO3				M	H							
	CO4				M	H			M				
	CO5				M	H							
	CO6			M	M	H						L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
					√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Introduction to Mechatronics system – Key elements – Mechatronics Design process – Types of Design – Traditional and Mechatronics designs – Advanced approaches in Mechatronics - Man machine interface, industrial design and ergonomics, safety.

UNIT II REAL TIME INTERFACING 9

Introduction - Elements of data acquisition and control - Overview of I/O process –

Overframing.Selection of interface cards--DAQ card-single channel-multichannal-RS232/422/485communication- IEEE 488 standard interface-GUI card-GPIB-Ethernet switch - Man machine interface

UNIT III CASE STUDIES ON DATA ACQUISITION AND CONTROL 10

Case studies on Data Acquisition: Introduction – Cantilever Beam Force Measurement system– Transducer calibration system for automotive applications – Strain gauge weighing system – Solenoid Force-Displacement calibration system.

Case studies on Data Acquisition and control: Introduction – pH control system – Dc-Icing Temperature Control system – Skip control of a CD player – Auto focus Camera, exposure control.

UNIT IV CASE STUDIES ON DESIGN OF MECHATRONIC PRODUCTS 9

Introduction–Fuzzy based Washing machine – Autofocus Camera, exposure control– Motion control using D.C.Motor & Solenoids – Engine management systems. – Controlling temperature of a hot/cold reservoir using PID- Control of pick and place robot – Part identification and tracking using RFID – Online surface measurement using image processing

UNIT V ADVANCED APPLICATIONS IN MECHATRONICS DESIGN 8

Introduction–Sensors for condition Monitoring – Mechatronic Control in Automated Manufacturing – Artificial intelligence in Mechatronics – Fuzzy Logic Applications in Mechatronics – Microsensors in Mechatronics

TEXT BOOKS:

1. Devdas shetty, Richard A. Kolk, ‒Mechatronics System Design‖, Thomson Learning Publishing Company, Vikas publishing house, 2001.

REFERENCES

1. Bolton, -Mechatronics - Electronic Control systems in Mechanical and Electrical Engineering-, 2nd Edition, Addison Wesley Longman Ltd., 1999.
2. Brian Morriss, Automated Manufacturing Systems - Actuators, Controls, Sensors and Robotics, Mc Graw Hill International Edition, 1995.
3. Bradley, D.Dawson, N.C. Burd and A.J. Loader, Mechatronics: Electronics in Products and Processes, Chapman and Hall, London, 1991.

BMT011	**PRODUCT DESIGN AND COSTING**	**L**	**T**	**P**	**C**
	Total Contact Hours -45	3	0	0	3
	Prerequisite – Operations Research, Industrial Engineering				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To gain knowledge on various aspects of product design and product modeling techniques

COURSE OUTCOMES (COs)	
CO1	To learn the basic concepts used for product design
CO2	To understand the economic necessities of product design
CO3	To study about the techniques of product modeling and types of product models
CO4	To learn the fundamental aspects of product costing

CO5	To study the FEM fundamental regarding product design												
CO6	To learn about the recent advancements of product design												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H										
	CO2	H	M	H	H								
	CO3	M	M		H			M					
	CO4	M		M								M	
	CO5	H		H	M	M							
	CO6											M	
3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)		
							√						
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I PRODUCT DESIGN AND DEVELOPMENT 8

Principles of creativity in design- integrated product development and concurrent engineering – Product analysis – Criteria for product design – Market research – Design for customer and design for manufacture – Product life cycle.

UNIT II ECONOMICS OF DESIGN 9

Breaks even point - Selection of optimal materials and processes – Material layout planning – Value analysis – Re-engineering and its impact on product development.

UNIT III PRODUCT MODELING 9

Product modeling – Definition of concept - fundamental issues – Role and basic requirement of process chains and product models –Types of product models – model standardization efforts – types of process chains – industrial demands.

UNIT IV PRODUCT COSTING 10

Bill of materials – Outline Process charts – Concepts of operational standard time - Work measurement by analytical estimation and synthesis of time – Budgets times – Labor cost and material cost at every stage of manufacture – W.I.P. costing

UNIT V RECENT ADVANCES AND CONCEPTS IN PRODUCT DESIGN 9

Fundamentals of FEM and its significance to product design – Product life cycle management – Intelligent information system – Concept of Knowledge based product and process design.

TEXTBOOKS:

1. Karl T. Ulrich, Stephen D. Eppinger – ―Product Design and Development‖, McGraw-Hill, 2nd Edition 2009.

REFERENCES

1. HARRY NYSTROM, ―Creativity and Innovation‖, John Wiley & Sons, 1979
2. George E. Dieter, ―Engineering Design – Materials and process approach‖, Tata McGraw-Hill, 1991
3. Donald E. Carter, ―Concurrent Engineering‖, Addison Wesley, 1992
4. Sameul Eilon – ―Elements of Production Planning and Control‖, McMillan and Company, 1962
5. Jones S.W., ―Product Dosing and Process Selection‖, Butterworth Publications, 1973

BMT012	**ARTIFICIAL INTELLIGENCE**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Sensor and Signal Processing, Robotic and Machine Vision				
	Course Designed by – Department of Mechatronics				

OBJECTIVES: To introduce the various concepts about the Artificial Intelligence

COURSE OUTCOMES (COs)

CO1	To learn pattern recognition
CO2	To learn about game playing
CO3	To learn knowledge representation
CO4	To learn about knowledge representation using other logic
CO5	To learn structural representation of knowledge
CO6	To understand the various applications of Artificial Intelligence

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M						
	CO2			H							H	H	
	CO3		M		H								
	CO4					M	H					H	
	CO5							H	H			H	
	CO6			H		M						L	

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)

						√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 10

Definition – Pattern recognition – Criteria of success – Production Systems – Control Strategies – Heuristic Search – Problem Characteristics – Production System Characteristics – Forward and backward reasoning – Matching Indexing – Heuristic Functions, Search algorithms.

UNIT II GAME PLAYING 8

Overview – Minimax search procedure – Adding Alpha – Beta cutoffs – Waiting for Quiescence – Secondary search – Using book moves.

UNIT III KNOWLEDGE REPRESENTATION 10

Use of Predicate logic – Introduction to representation – representing simple facts in logic augmenting the representation – resolution – Conversion to clause from – The basis of resolution Unification of algorithm – Question answering – Natural Deduction.

UNIT IV KNOWLEDGE REPRESENTATION USING OTHER LOGICS 8

Nonmonotonic reasoning – Statistical Probabilistic reasoning – Techniques for dealing with a random world and deterministic world – rule based system.

UNIT V STRUCTURAL REPRESENTATIONS OF KNOWLEDGE 9

Common knowledge structures – level of representation – Right structures – Declarative representations – Semantic nets – Conceptual dependency Frames Scripts – Procedural representation – Natural language understanding – Perception – learning – Implementation A.I. Systems.

TEXTBOOKS:

1. ELAINE RICH, Artificial Intelligence, McGraw-Hill Book Co., 3rd Edition, 2008.

REFERENCE:

1. M. W. RICHAUGH, Artificial Intelligence, A. Knowledge Based Approach, PWS Rent Publishing Boston, 1998.

2. CHARNIAC. E and M.C.DERMOTT. Introduction to Artificial Intelligence, Addison Wesley Publishing Company, 2002.

3. ROBERT GOODELL BROWN, Materials Management Systems – A Members Library John Wiely Publishers, 1977.

4. WESTING FINE and ZONE, Purchasing Management Principles, John Wiley Publishers, 1986.

NON MAJOR ELECTIVE-II

	MEDICAL MECHATRONICS	**L**	**T**	**P**	**C**
BMT013	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Instrumentation & Control, Electronic Devices and Circuits				

	Course Designed by – Dept of Mechatronics

OBJECTIVES

To study about transducers. To study about medical support devices. To study about diagnostic instruments.

COURSE OUTCOMES (COs)

CO1	To learn basics about electrodes.
CO2	To learn about transducers in Medical Mechatronics.
CO3	To learn about amplifiers &recorders.
CO4	To learn about medical support devices.
CO5	To understand the biomedical diagnostic instrument.
CO6	To Understand the concept of Medical Instruments and circuits and we know its usage.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H							
	CO2	M			M				H				M
	CO3				M	H		M					
	CO4								H			M	M
	CO5				M	H							
	CO6			M									

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences	Professional Core (PC)	Core Elective	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT 1 INTRODUCTION 9

Cell structure – electrode – electrolyte interface, electrode potential, resting and action potential – electrodes for their measurement, ECG, EEG, EMG – machine description – methods of measurement – three equipment failures and trouble shooting.

UNIT 1I TRANSDUCERS FOR BIO-MEDICAL INSTRUMENTATION 9

Basic transducer principles Types – source of bioelectric potentials – resistive, inductive, capacitive, fiber-optic, photoelectric and chemical transducers – their description and feature applicable for biomedical instrumentation – Bio & Nano sensors & application

UNIT 1II SIGNAL CONDITIONING, RECORDING AND DISPLAY 9

Input isolation, DC amplifier, power amplifier, and differential amplifier – feedback, op-Amp-electrometer amplifier, carrier Amplifier – instrument power supply. Oscillagraphic – galvanometric - X-Y, magnetic recorder, storage oscilloscopes – electron microscope – PMMC writing systems – Telemetry principles – Bio telemetry.

UNIV IV MEDICAL SUPPORT 10

Electrocardiograph measurements – blood pressure measurement: by ultrasonic method – plethysonography – blood flow measurement by electromagnetic flow meter cardiac output measurement by dilution method – phonocardiography – vector cardiography. Heart lung machine – artificial ventilator – Anesthetic machine – Basic ideas of CT scanner – MRI and ultrasonic scanner – Bio-telemetry – laser equipment and application – cardiac pacemaker – DC – defibrillator patient safety - electrical shock hazards. Centralized patent monitoring system.

UNIV V BIO-MEDICAL DIAGNOSTIC INSTRUMENTATION 8

Introduction – computers in medicine – basis of signal conversion and digital filtering data reduction technique – time and frequency domain technique – ECG Analysis.

TEXT BOOKS :

1. Khandpur, R.S., –Handbook of Biomedical Instrumentation‖, TMH, 1989.2nd Edition.
2. Arumugam M., –Bio Medical Instrumentation‖, Anuradha agencies Pub., 2002.2nd Edition.

REFERENCES :

1. Geddes L.A., and Baker, L.E., –Principles of Applied Bio-medical Instrumentation‖, 3rd Edition, John Wiley and Sons, 1995.
2. Cromwell, Weibell and Pfeiffer, –Biomedical Instrumentation and Measurements‖, 2nd Edition, Prentice Hall of India, 1999.
3. Tompkins W.J., –Biomedical Digital Signal Processing: Principles and Techniques‖, Prentice Hall of India, 1998.

BMT014	CONSUMER ELECTRONICS	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Digital Electronics				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES

To understand the operation of audio, video systems. To learn the operation of various memory devices and various switching systems. Able to conduct experiments on electrical machines and analyze the experimental data

COURSE OUTCOMES (COs)

CO1	To learn various sound systems like stereophonic, Quadraphonic, recording
CO2	To learn various video systems like cameras, VCR, VCP, TV etc
CO3	To study various memory devices like CD, HDD etc
CO4	To learn switching system in telephone exchange
CO5	To study the home appliances like oven, Refrigerators, washing machines
CO6	To Understand the concept of various sound systems and various memory devices.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H		M					
	CO2	M			M						H		
	CO3						M		H				

	CO4					H					L		M
	CO5				M						H		
	CO6			M									
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)	
										√			
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I AUDIO SYSTEM 9

Hi-Fi systems, stereophonic sound system, public address systems, Acoustics, Quadraphonic sound systems, Graphics Equalizer, Electronic tuning, Digital sound recording on tape and disc..

UNIT II VIDEO SYSTEMS 9

B & W TV, colour TV and HD TV systems, Electric cameras, VCR, VCP, Block diagram and principles of working of cable TV and DTH, cable TV using internet.

UNIT III MEMORY DEVICES 10

CD systems, Memory diskettes, Discs and drums vide monitoring audio, video recording media & Systems.

UNIT IV SWITCHING SYSTEMS 9

Dolby noise reduction digital and analog recording. Switching Systems: Switching systems for telephone exchange, PAB EPRABX, modular telephones, Telephone message recording concepts, remix controlled systems.

UNIT V HOME APPLIANCES 8

Electronic toys, microwave oven, Refrigerators, washing machines, calculator, data organizers

TEXT BOOKS

1. Gulati.R.R, Monochrome and color television, New age publisher.2nd Edition
2. Encyclopedia of video & TV / Focal press

REFERENCES

1. Complete Satellite & cable Television R.R Gulati New age International Publisher.
2. Handbook of Electronics & Telecommunication.

	DIGITAL SIGNAL PROCESSING	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
BMT015	Prerequisite – Engg Mathematics-I, Engg Mathematics –III& Signals and Systems				

	Course Designed by – Dept of Mechatronics
OBJECTIVES: To learn the operation of various DSP devices. To understand the Design Algorithm of various filters.	
COURSE OUTCOMES (COs)	
CO1	To learn about Characterization and classification of signals
CO2	To learn about Discrete Fourier Transform (DFT)
CO3	To study about Various design method of FIR Filters
CO4	To study about Various design method of IIR Filters
CO5	To Study about Various Digital Signal Processors
CO6	To Understand the concept of Discrete Fourier Transform and various design method of IIR Filters.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1					H		M					
	CO2	M			M			H					
	CO3						M		H				
	CO4					H		M			L		M
	CO5				M		H		M	H			
	CO6			M									

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I CLASSIFICATION OF SIGNALS 9

Characterization and classification of signals – examples of signals – continuous versus discrete – analog versus digital – advantages of digital signal processing compared with analog processing- Sampling of Analog Signals – Aliasing.Linear Time Invariant Systems (LTIS) – Linearity – Time Invariant – Causality – stability – Response of CT – LTI System using Convolution Integral Response of DT – LTI system using convolution SUM – Finding Impulse Response of LTI using Laplace Transform – Z – Transform & its Properties- Finding Impulse Response of DT – LTI system using Z – transform.

UNIT II FAST FOURIER TRANSFORM 9

Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and Laplace Transform in signal analysis. Spectrum of D.T. signals, Discrete Time Fourier Transform (DTFT), Discrete Fourier Transform (DFT) – Introduction to radix – 2 FFT – DIT & DIF radix 2 FFT.

UNIT III FIR FILTER DESIGN 9

FIR Filters: Design of Filters – Frequency selective filters – Linear filtering – Structures for FIR – Design of FIR Filters – using windows – Frequency Sampling – Linear phase FIR Filters.

UNIT IV DIGITAL FILTER DESIGN 9

Review of design of analogue Butter worth and Chebyshev Filters, Frequency transformation in analogue domain – design of IIR digital filters using impulse invariance technique – Design of digital filters using bilinear transform – Pre warping – Frequency transformation in digital domain – Realization using direct, cascade and parallel forms.

UNIT V DSP PROGRAMMING 9

Effect of Number representation on Quantization – Overflow – Need for scaling – truncation error – coefficient Quantization error – limit cycle oscillations. Multichannel – Multi – dimensional – typical applications of DSP – Introduction to Programmable DSP – Instruction set of TMS 320C50.

TEXT BOOKS :

1. Sanjith K. Mitra –Digital Signal Processing‖, Tata McGraw–Hill, New Delhi, 3rd Edition, 2007.

REFERENCES :

1. Allan V.Oppenheim & Donald W. Schafer, –Digital Signal Processing‖, PHI of India, 1989.
2. Texas Instruments, User Guide TMS 320C50.
3. Ludemann L.C. –Fundamentals of Digital Signal Processing‖, John Wiley Inc., 1992.
4. John G. Proakis and Dimitris G. Manolakis, –Digital Signal Processing, Algorithms and Application‖, PHI of India Ltd., New Delhi 3rd Edition 2000.

OPEN ELECTIVE-I

BMT016	**DIGITAL IMAGE PROCESSING**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Engineering Mathematics-I, Sensors and Signal Processing Lab				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES:

To introduce the basic concepts of Digital Image Processing and various techniques used to resolve the images

COURSE OUTCOMES (COs)

CO1	To learn Fundamentals of Digital Images and the ways to represent it
CO2	To learns the various ways of representing image enhancement in spatial domain
CO3	To learn the concept of image enhancement in frequency domain
CO4	To study about the image compression techniques

CO5	To learn the various methods to specify image boundaries												
CO6	To understand the various techniques to segment the images												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H							
	CO2	L				H							
	CO3				M	H							
	CO4	L			M	H							
	CO5				M	H							
	CO6				H	H					L	L	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)		Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)
									√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I FUNDAMENTALS 8

What is Digital image processing, Examples (Briefly), Components of Image Processing System, Light and electromagnetic spectrum, Image Sensing and Acquisition, Simple Image Formation Model, Image Sampling and Quantization:- Representing Digital Images, Spatial and Grey level Resolution, Basic Relationship Between Pixels.

UNIT II IMAGE ENHANCEMENT IN SPATIAL DOMAIN 9

Background, some Basic Grey Level Transformation:- Image Negatives, Log negatives, Piecewise – Linear Transformation Functions:- Contrast stretching, Grey level Slicing, Bit Plane Slicing, Histogram processing: - Histogram Equalization, Histogram Specification, Local Enhancement.

UNIT III IMAGE ENHANCEMENT IN FREQUENCY DOMAIN 9

Two dimensional DFT and its Inverse, Filtering the frequency domain, Basics of filtering in frequency domain, smoothing and sharpening filters. Color Image Processing:- Color Fundamentals and Color Models.

UNIT IV IMAGE COMPRESSION 9

Fundamentals, Coding Redundancy, Interpixel Redundancy Psycho-Visual Redundancy, Image Compression Models, Error Free Compression, Variable – Length Coding, Huffman Coding, Arithmetic Coding, Run-length coding, Lossy Compression, Transform coding, JPEG.

UNIT V IMAGE SEGMENTATION 10

Detection of Discontinuous, Edge linking and Boundary Detection:- Local Processing, Thresholding:- Basic Global Thresholding, Region Based Segmentation:- Region Growing, Region Splitting and Merging, Use of Motion In Segmentation.

TEXTBOOKS:

1. Digital image processing by Rafael C. Gonzale Z, Richard E.Words, Pearson Education, Asia,3rd Edition, 2008.

REFERENCES

1. Fundamental of Digital Image Processing by Anil. K. Jain, Prentice Hall of India Publishing Ltd., New Delhi, 2002. 7th Edition.

BMT017	**NETWORKING OF COMPUTERS**									**L**	**T**	**P**	**C**
	Total Contact Hours - 45									3	0	0	3
	Prerequisite – Fundamentals Computing &Digital Electronics												
	Course Designed by – Dept of Mechatronics												
OBJECTIVES: To understand the various concepts in computer network protocols													
COURSE OUTCOMES (COs)													
CO1	To understand the concept of networks and its topologies												
CO2	To understand the concept of various types of data communication												
CO3	To learn the concept of various types of network layers												
CO4	To learn the concept of TCP/IP Networking												
CO5	To understand the concept of broad band Network and connectivity												
CO6	To understand the concepts of various application of networking												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1				M	H				L			
	CO2				M	H							
	CO3				M	H				L			
	CO4				M	H							
	CO5				M	H						L	
	CO6				M	H							
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)	
									√				
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I OPEN SYSTEM INTERCONNECTION MODEL 9

Network Goals – uses – network topologies –Network architecture- OSI Reference model services – Network standardization – ARPANET – SNA – USENET

UNIT II DATA COMMUNICATIOM CONCEPTS 9

Guided and unguided Medias – Asynchronous and synchronous transmission – RS232C Interface, X.21 interface switching technologies – Circuit, Message, packet and hybrid switching – Elementary data link protocols – sliding window – Automatic repeat request.

UNIT III MEDIUM ACCESS SUB-LAYER AND NETWORK LAYER 9

Channel allocation methods – ALOHA protocols – Pure ALOHA – Slotted ALOHA – local area networks – IEEE standard 802 for LANS – Wireless LAN IEEE 802.11 FDD1 - Virtual circuits – datagram – comparison – Routing congestion control.

UNIT IV. TCP/IP –AND INTERNETWORKING 9

TCP/IP – architecture and operation – The IP layers and functions – addressing and routing – Internet user services – E-Mail – w.w.w. Internetworking – Bridges – Gateways – Repeaters – Routers – Brouters.

UNIT V BROAD BAND NETWORKS AND CONNECTIVITY 9

ISDN Evolution – structures – Limitation Broad-bannd ISDN, Transfer modes – Asynchronous transfer mode (ATM) – ATM cell format – Traffic Management – SONET – Introduction to VSAT networks.

TEXTBOOKS:

1. Andrew S. Tanenbaum, –Computer Networks‖, Prentice Hall of India, 3rd edition, 1998, (UNITS I to IV)
2. Balaji Kumar, –Broad band Communication‖, McGraw-Hill, 1996. (UNIT V)

REFERENCES :

1. Dimetri Bertsekas and Robert Gallager, –Data Networks‖, PH1, 1994.
2. Hughes.L. –Data Communication A Practical Approach‖, Narosa Publications 1997.

BMT008	**COMPUTATIONAL FLUID DYNAMICS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Mathematics, Mechanics of solids and Fundamentals of Fluids				
	Course Designed by – Dept of Mechatronics				

OBJECTIVES: To understand the various concepts in mathematical models for fluid dynamics.

COURSE OUTCOMES (COs)

CO1	To understand the concept in governing differential equation for fluids
CO2	To understand the concept in various types of discretization method
CO3	To learn the concept of Heat conduction, convection and diffusion in fluids

CO4	To learn the concept of Flow field calculation
CO5	To understand the concept of Turbulence and algebraic models
CO6	To understand the concepts in various application of fluid dynamics

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	M		M	H							
	CO2	H	M		M	H							
	CO3	H	M		M	H							
	CO4	H	M		M	H							
	CO5	H	M		M	H							
	CO6	H	M		M	H							

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
							√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I GOVERNING DIFFERENTIAL EQUATIONS 9

Conservation of chemical species-The energy equation-Momentum equation-time averaged equations for turbulent flow-Turbulence-Kinetic energy equation-The general differential equation-Nature of co-ordination-Independent variable-Choice of co-ordinates-one way and two way coordinates

UNIT II DISCRETIZATION METHODS 9

Nature of numerical methods-Methods of deriving of discretization equations-Taylor series formulation-Variational formulation-Methods of weighted residuals-Control volume formulation

UNIT III HEAT CONDUCTION, CONVECTION AND DIFFUSION 9

Steady One Dimensional Conduction- Two and three dimensional conduction-Steady one dimensional convection and diffusion-Discretization equations for two dimensional convection and diffusion

UNIT IV CALCULATION OF FLOW FIELD 9

Representation of pressure-gradient and continuity equation-stagged grid-momentum equations-pressure and velocity correction-pressure correction equation.Introduction to Finite Element Method-solution of steady heat conduction by FEM-incompressible flow-simulation by FEM.

UNIT V TURBULENCE AND ALGEBRAIC MODELS 9

One, two equation model-high and low Reynolds number models-Reynolds stress models-Prediction of fluid and heat transfer using standard codes.

REFERENCES

1. K.Muralidhar & T.sundarrajan-Computational Fluid Flow and Heat Transfer-Narosa, reprint 2009.
2. P.S.Ghoshdastidar-Computer Simulation of Flow and Heat Transfer-Tata Mcgrawhill Publishing Company Ltd 1998.
3. H.K.Versteeg & W.Malalasekara-An Introduction to Computational Fluid Dynamics-Longman

BBA001	**PRINCIPLES OF MANAGEMENT AND ORGANIZATIONAL BEHAVIOUR**	**L**	**T**	**P**	**C**
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management Studies				

OBJECTIVES

- Familiarize the students with the fundamental concepts of Management and to highlight the approaches in organization behavior

COURSE OUTCOMES (COs)

CO1	Understanding the concepts of Management
CO2	Knowledge on Management Functions
CO3	Understanding the Organization Theory & Approach.
CO4	Knowledge on the Concepts of Motivation
CO5	Clear insight on the factors contributing to discipline
CO6	In-depth Understanding about the concepts of Group Behavior

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	H			M				H	L
	CO2			H	H			M				H	L
	CO3			H	H			M				H	L
	CO4			H	H			M				H	L
	CO5			H	H			M				H	L
	CO6			H	H			M				H	L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)

								√	
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT -I NATURE OF MANAGEMENT 9

Definition – theory and practice – effective management – Management : Science of Art – Management in India. Development of Management thoughts – Taylor‘s – Henry Fayol – Hawthrone experiment – Barnard & Social system – Herbert Simon – Peter Drucker – Various approaches – Management thoughts.

UNIT- II MANAGEMENT PROCESS 9

Co-ordination – Functions of management – Managers and environment – External and internal Business Ethics – Planning – Fundamentals – Definitions & Features – Steps in planning – types of planning – Objectives – Concepts and features – Hierarchy of objectives – role – Process of MBO – Policy & Strategy – Decision making process – Individual Vs Group Decisions.

UNIT- III ORGANIZATION STRUCTURE 9

Organizing – Theory & Approach –Authority & Responsibility – Delegation – Centralization & Decentralization – Line & Staff Relationship – Staffing – Fundamentals – System approach – Manpower Planning – Recruitment & Selection – Training and development – Performance appraisal – Direction – Fundamentals Motivation – Theories of Motivation-Maslow‘s Hersberg‘s MaClelland‘s theory X,Y & Z leadership – Theories and Styles – Communication – Type – Controlling – System and Process.

UNIT- IV ORGANIZATIONAL BEHAVIOUR 9

Definition – Organization – Managerial Role and Functions – Organizational Approaches, Individual behaviour – Causes – Environmental effect – Behaviour and performance, perception – Organizational implications, Personality – Contributing factors – Dimension, Motivation – Need Theories – Process Theories – Job satisfaction, Learning and Behaviour – Learning Curves, Work Design and Approaches.

UNIT -V GROUP BEHAVIOUR 9

Groups – Contributing factors –Group Norms, types – Causes – Intergroup relations – Conflict and Resolution – Change Process –Resistance to change.

TEXT BOOKS:

1. Herald Knootz and Heinz Weihrich, _Essentials of Management‘, McGraw Hill Publishing Company, Singapore International Edition, 2004.
2. Ties AF, Stoner and R. Edward Freeman, –Management‖ Prentice Hall of India Pvt. Ltd., New Delhi -110011, 1995.

REFERENCE BOOKS :

1. Joseph I. Massie _Essentials of Management‘, Prentice Hall of India Pvt. Ltd., New Delhi - 110011, 2004.
2. L.M. Prasad –Principles and Practice of Management‖, Sultan Chand & Sons.2001
3. Uma Sekaran, –Organizational Behaviour‖, Tata McGraw Hill, 2007
4. https://www.extension.harvard.edu

BBA010	**STATISTICAL QUALITY CONTROL**										**L**	**T**	**P**	**C**
	Total Contact Hours - 45										3	0	0	3
	Prerequisite – Basic Mathematics and Mathematics III													
	Course Designed by – Dept of Mathematics													

OBJECTIVES

Familiarize the students with statistical quality control and quality improvement

COURSE OUTCOMES (COs)

CO1	To gain knowledge of probability concepts and distributions
CO2	To gain knowledge in control charts for variables
CO3	To gain knowledge in control charts for attributes
CO4	To gain knowledge in acceptance sampling
CO5	To gain knowledge about IS standards
CO6	To gain knowledge of quality management

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H	H		H			M					
	CO2	H	H		H			M					
	CO3	H	H		H			M					
	CO4	H	H		H			M					
	CO5	H	H		H			M					
	CO6	H	H		H			M					

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I INTRODUCTION 7

Probability concepts, Review of distribution: Normal, Poison‘s, and Binomial, Problems, Measuring of quality and control, Value and quality, Quality costs, Quality assurance.

UNIT II CONTROL CHARTS FOR VARIABLES 10

Chance and assignable causes of quality variation, Control charts for variables, X-bar, R, and σ-charts, Warning and modified control limits, Process capability study, Ranges, Moving Averages, and Six σ- limits, multivariate charts.

UNIT III CONTROL CHARTS FOR ATTRIBUTES 8

Limitation of variable chart, p-chart, problems with variable sample size, np-chart, c- chart, u-chart, and ku-chart, Demerits per unit control chart.

UNIT IV ACCEPTANCE SAMPLING 10

Economics of sampling, Lot formation, OC-Curve-Producer‘s and Consumer‘s risk, Single and double sampling plans, AOQ, AOQL, ATI, ASN, Sequential sampling plan, MIL – STD – 1050 tables, MIL – STD – 414 tables, IS 2500 Standard.

UNIT V QUALITY IMPROVEMENT 10

Zero defects program, Quality circle, Fishbone diagram, scatter diagram, Pareto Analysis, Deming cycle, Introduction to Reliability function, System reliability of series, parallel, and combined configurations, Reliability improvement techniques.

TEXTBOOKS:

1. Grant E.L. and Leavensworth, ―Statistical Quality Control‖, Tata McGraw-Hill Publishing Company, 2008.

REFERENCE:

1 Douglas C. Montgomery, ―Statistical Quality Control‖, John Wiley and Sons, 2012
2 Fiegenbaum, A.V., ―Total Quality Control‖, McGraw-Hill Inc., 1991.
3 Sharma S.C., ―Inspection Quality Control and Reliability‖, Khanna Publishers, New Delhi (1998).
4 Srinath L.S, ―Reliability Engineering‖, Affiliated East west Press, 1998.

BBA002	ENTREPRENEURSHIP DEVELOPMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management studies				

OBJECTIVES

Study of this subject provides an understanding of the scope of an entrepreneur, key areas of development, financial assistance by the institutions, methods of taxation and tax benefits, etc.

COURSE OUTCOMES (COs)

CO1	To gain knowledge of Entrepreneurship
CO2	To gain knowledge of Motivation
CO3	To gain knowledge in Business
CO4	To gain knowledge of Market survey
CO5	To gain knowledge in financing and accounting
CO6	To gain knowledge in support to entrepreneurs

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H	M			H		L	M	H	M
	CO2			H	M			H		L	M	H	M

	CO3			H	M			H		L	M	H	M
	CO4			H	M			H		L	M	H	M
	CO5			H	M			H		L	M	H	M
	CO6			H	M			H		L	M	H	M
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)	Engg Sciences (ES)		Professional Core (PC)	Core Elective (CE)		Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)
											√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I ENTREPRENEURSHIP 8

Entrepreneur- Types of Entrepreneurs - Difference Between Entrepreneur and Interpreneur- Role of Entrepreneurship in Economic Growth- Women and Rural Entrepreneurship - Factors Affecting Entrepreneurial Growth.

UNIT II MOTIVATION 8

Major Motives Influencing Entrepreneur – Achievement Motivation Training, Self Rating – Business Game – Thematic Apperception Test – Stress Management – Entrepreneurship Development Programs – Need, Objectives.

UNIT III BUSINESS 9

Small Enterprise – Definition, Classification – Characteristics- Ownership Structure – Project Formulation – Steps Involved in Setting up a Business – Identifying, Selecting a Good Business Opportunity- Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports- Project Appraisal- Sources of Information- Classification of Needs and Agencies.

UNIT IV FINANCING AND ACCOUNTING 10

Need – Sources of Finance- Terms Loans, Capital Structure- Financial Institutions, Management of Working Capital, Costing, Break Even Analysis, Network Analysis Techniques of PERT/ CPM –Taxation – Income Tax – Excise Duty – Sales Tax.

UNIT V SUPPORT TO ENTREPRENEURS 10

Sickness in Small Business- Concept, Magnitude, Causes and Consequences, Corrective Measures- Government Policy for Small Scale Enterprises- Growth Strategies in Small Industry – Expansion- Diversification, Joint Venture, Merger, Sub Contracting.

TEXTBOOKS:

1. S.S.Khanka, ―Entrepreneurial Development‖, S. Chand & Co. Ltd., Ram Nagar, New Delhi, 1999.
2. Hisrich RD and Peters MP, ―Entrepreneurship‖, 7th Edition, Tata McGraw Hill, 2008.

REFERENCES

1. Rabindra Kanungo, ‐Entrepreneurship and Innovation‖ , Sage Publications, New Delhi, 1999 ED II. Faculty & External Experts-A Hand book for New Entrepreneurs Publishers: Entrepreneurial Development, Institute Of India, and Ahmedabad, 1986

BBA009	**INTELLECTUAL PROPERTY RIGHTS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Value Education and Professional Ethics & Professional Courses				
	Course Designed by – Dept of Management Studies				

OBJECTIVES

Strong intellectual property rights (IPR) protection is crucial to fostering trade, and achieving the goals and benefits of global integration. Countries with high standards of IPR protection tend to attract more investment, stimulate more innovation, thereby developing more rapidly. Countries with inadequate protection are often vulnerable to infringements of intellectual property rights that hinder trade flow and economic development.

Hence, the objective is to introduce IPR to the UG Engineering and Technology students.

COURSE OUTCOMES (COs)

CO1	Understand the principles, function and basic legal rules of IP Law.
CO2	Recognize the relevant criteria for generating and protecting intellectual works.
CO3	Recognize the intellectual property likely to be produced in the academic and professional environment.
CO4	Demonstrate appreciation and critical awareness of pertinent IP issues in the academic and professional lives.
CO5	Understand the relevance and impact of IP Law on academic/scientific works/studies.
CO6	Understand the different forms of infringement of intellectual property rights.

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	H					H					H	
	CO2		H		M					H			
	CO3	M							M		H		
	CO4			M	H							H	
	CO5							M					
	CO6	H			H					M			L

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	

4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016

UNIT I PROPERTIES AND TYPES 9

Introduction – Invention and Creativity – Intellectual Property (IP) – Importance – Protection of IPR – Basic types of property (i). Movable Property ii.Immovable Property and iii.Intellectual Property.

UNIT II PATENTS AND RIGHTS 9

IP – Patents – Copyrights and related rights – Trade Marks and rights arising from Trademark registration – Definitions – Industrial Designs and Integrated circuits – Protection of Geographical Indications at national and International levels – Application Procedures..

UNIT III INTERNATIONAL TRADE 9

International convention relating to Intellectual Property – Establishment of WIPO – Mission and Activities – History – General Agreement on Trade and Tariff (GATT).

UNIT IV WTO 9

Indian Position Vs WTO and Strategies – Indian IPR legislations – commitments to WTO-Patent Ordinance and the Bill – Draft of a national Intellectual Property Policy – Present against unfair competition.

UNIT V CASE STUDIES 9

Case Studies on – Patents (Basumati rice, turmeric, Neem, etc.) – Copyright and related rights – Trade Marks – Industrial design and Integrated circuits – Geographic indications – Protection against unfair competition.

TEXT BOOKS:

1. Subbaram N.R. –Handbook of Indian Patent Law and Practice –, S. Viswanathan Printers and Publishers Pvt. Ltd., 1998.

REFERENCES:

1. Eli Whitney, United States Patent Number: 72X, Cotton Gin, March 14, 1794.
2. Intellectual Property Today: Volume 8, No. 5, May 2001, [www.iptoday.com].
3. Using the Internet for non-patent prior art searches, Derwent IP Matters, July 2000.
4. www.ipmatters.net/features/000707_gibbs.html.
5. http://www.metastudio.org/Science%20and%20Ethics/file/readDoc/535a76367d9d331598f49e2d/34_Hb_on_IPR.pdf

OPEN ELECTIVE-II

BBA003	**MARKETING MANAGEMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management Studies				
OBJECTIVES: Study of this subject provides an understanding of the marketing, supply and demand, pricing, marketing research, advertising, sales promotion and distribution.					
COURSE OUTCOMES (COs)					
CO1	To introduce the supply and demand and selling Vs Marketing				
CO2	To understand the buying behavior and marketing segmentation				

CO3	To understand the product pricing and marketing research												
CO4	To understand the marketing planning and strategy formulation												
CO5	To gain knowledge about advertising and sales												
CO6	To gain knowledge about distribution of the product												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1		L	H	M			H	M				
	CO2		L	H	M			H	M				
	CO3		L	H	M			H	M				
	CO4		L	H	M			H	M				
	CO5		L	H	M			H	M				
	CO6		L	H	M			H	M				

3	Category	Humanities & Social Studies (HS)	Basic Sciences	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Definition- Marketing Process- Dynamics- Needs- Wants and demands-Marketing Concepts- Environment- Mix- Types- Philosophies- Selling Vs Marketing- Organizational- Industrial Vs Consumer Marketing- Consumer Goods- Industrial Goods- Product Hierarchy.

UNIT II BUYING BEHAVIOUR & MARKET SEGMENTATION 9

Cultural- Demographic Factors- Motives- Types- Buying Decisions- Segmentation factors- Demographic- Psychographic & Geographic Segmentation- Process- Patterns.

UNIT III PRODUCT PRICING AND MARKETING RESEARCH 9

Objectives- Pricing- Decisions & Pricing Methods- Pricing Management- Introduction- Uses- Process of Marketing Research.

UNIT IV MARKETING PLANNING AND STRATEGY FORMULATION 9

Components of marketing plan- Strategy formulation and marketing process- Implementation- Portfolio analysis- BCG- GEC grids.

UNIT- V ADVERTISING, SALES PROMOTION AND DISTRIBUTION 9

Characteristics- Impact- Goals- Types- Sales promotion- Point of Purchase- Unique selling proposition- Characteristics- Whole selling- Retailing- Channel Design- Logistics- Modern trends in retailing

TEXTBOOKS:

1. Ramasamy and Nama kumari, ―Marketing Environment: Planning, implementation and control the Indian context‖,5th Edition, 2014
2. Govindarajan.M, ―Industrial marketing management:‖, Vikas Publishing Pvt. Ltd, 2009

REFERENCES

1. Philip Kotler, Marketing Management, Analysis, Planning, Implementation and control, 1998.
2. Khanna O.P. – Industrial Engineering and Management, Khanna Publishers, New Delhi, 2000.
3. Green Paul.E and Donald Tull, ―Research for marketing decisions‖, Prentice Hall of India. 1995
4. Donald S. Tull and Hawkins, ―Marketing Research‖, Prentice Hall of India- 1997

BBA008	TOTAL QUALITY MANAGEMENT	L	T	P	C
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Dept of Mechanical Engineering				

OBJECTIVES

1. To introduce to the student about the basic terms related to quality and concepts of quality management
2. To familiarize the student about the basic principles of total quality management
3. To acquaint the student with the basic statistical tools used in process control
4. To introduce to the student about the various tools used in implementing and checking total quality management
5. To familiarize the student about the different quality systems used in auditing the quality of a company/industry/organization

COURSE OUTCOMES (COs)

CO1	By understanding about various quality terms, it will be helpful for the student to maintain quality in his/her organization
CO2	The student will be able to formulate new plans/procedures to be implemented to achieve the desired quality status by knowing about the various principles of quality management
CO3	The student will be able to analyze the periodical data in quality control using statistical tools
CO4	The total quality management tools will help the student to understand the procedures in measuring the quality of the organization/process and will also enable him/her to identify the parameters that are improving/depriving the quality
CO5	By knowing about the quality ISO systems, the student will be maintain processes/documentation properly so that the quality maintained by his/her organization gets recognized
CO6	To understand the concept about ISO standards

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l

2	CO1			M		H		M	H	M	L	L	M
	CO2			M		H		M	H	M	L	L	M
	CO3			M		H		M	H	M	L	L	M
	CO4			H		H		M	H	M	L	L	M
	CO5			H		H		M	H	M	L	L	M
	CO6			H		H		M	H	M	L	L	M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016							

UNIT I INTRODUCTION 9

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs – AnalysisTechniques for Quality Costs, Basic concepts of Total Quality Management, HistoricalReview, Principles of TQM, Leadership – Concepts, Role of Senior ManagementQuality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers toTQM Implementation

UNIT II TQM PRINCIPLES 9

Customer satisfaction – Customer Perception of Quality, Customer Complaints, ServiceQuality, Customer Retention, Employee Involvement – Motivation, Empowerment,Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership –Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development,Performance Measures – Basic Concepts, Strategy, Performance Measure.

UNIT III STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality, Statistical Fundamentals – Measures of central Tendencyand Dispersion, Population and Sample, Normal Curve, Control Charts for variables andattributes, Process capability, Concept of six sigma, New seven Management tools.

UNIT IV TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality FunctionDeployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality LossFunction, Total Productive Maintenance (TPM) – Concept, Improvement Needs, and FMEA –Stages of FMEA.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2000 Quality System –Elements, Implementation of Quality System, Documentation, Quality Auditing, TS16949, ISO 14000 – Concept, Requirements and Benefits

TEXTBOOKS:

1. Dale H.Besterfiled, et al., ‐Total Quality Management‖, Pearson Education, Inc.2003. (Indian

reprint 2004). ISBN 81-297-0260-6.

REFERENCES :

1.Evans. J. R. & Lindsay. W,M ―The Management and Control of Quality‖, (5th Edition),South-Western (Thomson Learning), 2002 (ISBN 0-324-06680-5).
2. Feigenbaum.A.V. ―Total Quality Management‖, McGraw-Hill, 1991.
3. Oakland.J.S. ―Total Quality Management‖, Butterworth Heinemann Ltd., Oxford, 1989.
4. Narayana V. and Sreenivasan, N.S. ―Quality Management – Concepts and Tasks‖, New Age International 1996.
5. Zeiri. ―Total Quality Management for Engineers‖, Wood Head Publishers, 1991.

BBA006	**INDIAN CONSTITUTION AND SOCIETY**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management studies				

OBJECTIVES

To know about Indian constitution. To know about central and state government functionalities in India. To know about Indian society.

COURSE OUTCOMES (COs)

CO1	To understand the historical background and fundamental rights
CO2	To understand the structure and functions of governments
CO3	To understand the Indian social structure
CO4	To gain knowledge in Indian federal system
CO5	To gain knowledge Indian social structure
CO6	To gain knowledge the right of women, children and SC&ST

Mapping of Course Outcomes with Program outcomes (POs)
(H/M/L indicates strength of correlation) H-High, M-Medium, L-Low

1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1			H			M	M			L		M
	CO2			H			M	M			L		M
	CO3			H			M	M			L		M
	CO4			H			M	M			L		M
	CO5			H			M	M			L		M
	CO6			H			M	M			L		M

3	Category	Humanities & Social Studies (HS)	Basic Sciences (BS)	Engg Sciences (ES)	Professional Core (PC)	Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)	Project/Term Paper Seminar/ Internship (PR)
								√	
4	Approval	37th Meeting of Academic Council, May 2015							

UNIT I HISTORY 9

Historical Background – Constituent Assembly of India – Philosophical foundations of the Indian Constitution – Preamble – Fundamental Rights – Directive Principles of State Policy – Fundamental Duties – Citizenship – Constitutional Remedies for citizens.

UNIT II CENTRAL STRUCTURE 9

Union Government – Structures of the Union Government and Functions – President – Vice President – Prime Minister – Cabinet – Parliament – Supreme Court of India – Judicial Review.

UNIT III STATE STRUCTURE 9

State Government – Structure and Functions – Governor – Chief Minister – Cabinet – State Legislature – Judicial System in States – High Courts and other Subordinate Courts.

UNIT IV PARLIMENTARY SYSTEM 9

Indian Federal System – Center – State Relations – President‘s Rule – Constitutional Amendments – Constitutional Functionaries - Assessment of working of the Parliamentary System in India.

UNIT V SOCIAL STRUCTURE 9

Society : Nature, Meaning and definition; Indian Social Structure; Castle, Religion, Language in India; Constitutional Remedies for citizens – Political Parties and Pressure Groups; Right of Women, Children and Scheduled Castes and Scheduled Tribes and other Weaker Sections.

TEXTBOOKS:

1. Durga Das Basu, ‒ Introduction to the Constitution of India ‒, Prentice Hall of India, New Delhi.
2. R.C.Agarwal, ‒ (1997) Indian Political System ‒, S.Chand and Company, New Delhi.

REFERENCES:

1. Sharma, Brij Kishore, ‒Introduction to the Constitution of India:, Prentice Hall of India, New Delhi.
2. U.R.Gahai, ‒(1998) Indian Political System ‒, New Academic Publishing House, Jalaendhar.
3. R.N. Sharma, ‒Indian Social Problems ‒, Media Promoters and Publishers Pvt. Ltd.
4. Yogendra Singh, ‒(1997) Social Stratification and Charge in India ‒, Manohar, New Delhi
5. Maciver and Page, ‒Society: An Introduction Analysis ‒, Mac Milan India Ltd., New Delhi.
6. K.L.Sharma, ‒ (1997) Social Stratification in India: Issues and Themes ‒, Jawaharlal Nehru University, New Delhi.

BBA007	**ENGINEERING ECONOMICS AND COST ANALYSIS**	**L**	**T**	**P**	**C**
	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Professional Courses				
	Course Designed by – Department of Management Studies				

OBJECTIVES

The main objective of this subject is to make the engineering student know about the basic law of economics, how to organize a business, the financial aspects related to business, different methods of appraisal of projects and pricing techniques. At the end of this course the student shall have the knowledge of how to start a construction business, how to get finances, how to

account, how to price and bid and how to access the health of a project.													
COURSE OUTCOMES (COs)													
CO1	To understand the Economics												
CO2	To understand the value engineering												
CO3	To gain knowledge in cash flow												
CO4	To gain knowledge replacement and maintenance analysis												
CO5	To gain knowledge depreciation												
CO6	To gain knowledge inflation												
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low													
1	COs/POs	a	b	c	d	e	f	g	h	i	j	k	l
2	CO1	M		H	L		M	H					L
	CO2	M		H	L		M	H					L
	CO3	M		H	L		M	H					L
	CO4	M		H	L		M	H					L
	CO5	M		H	L		M	H					L
	CO6	M		H	L		M	H					L
3	Category	Humanities & Social Studies (HS)		Basic Sciences (BS)		Engg Sciences (ES)	Professional Core (PC)		Core Elective (CE)	Non-Major Elective (NE)	Open Elective (OE)		Project/Term Paper Seminar/ Internship (PR)
											√		
4	Approval	37th - 40th Meetings of Academic Council, May 2015 - Sept 2016											

UNIT I INTRODUCTION TO ECONOMICS 8

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics- Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT II VALUE ENGINEERING 10

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW 9

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash

flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION 9

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TEXT BOOKS :

1. Panneer Selvam, R, Engineering Economics, Prentice Hall of India Ltd, New Delhi, 2001.

REFERENCES :

1. Chan S.Park, Contemporary Engineering Economics, Prentice Hall of India, 2002.
2. Donald.G. Newman, Jerome.P.Lavelle, –Engineering Economics and analysis‖ Engg, Press, Texas, 2002
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, Engineering Economy, Macmillan, New York, 1984.
4. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, Principles of Engineering Economy, Ronald Press, New York,1976.
5. Smith, G.W., Engineering Economy, Lowa State Press, Iowa, 1973.