

CURRICULUM AND SYLLABUS (R2015)
CHOICE BASED CREDIT SYSTEM

M.TECH – INDUSTRIAL BIO TECHNOLOGY – FULL TIME
SEMESTERS I - IV

SEMESTER I						
SUB. CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY						
MBT101	PC	Principles of Process Engineering	3	0	0	3
MBT102	PC	Advanced Biochemistry	3	0	0	3
MBT103	PC	Industrial Microbiology and Fermentation Technology	3	0	0	3
MBT104	PC	Plant and Animal Biotechnology	3	0	0	3
MBT105	PC	Enzyme Engineering	3	0	0	3
MBT1E1	PE	Professional Elective I	3	0	0	3
PRACTICAL						
MBT1L1	PC	Plant and Animal Biotechnology Lab	0	0	6	2
MBT1S1	PR	Technical Seminar-I	0	0	2	1
TOTAL HOURS: 26			CREDITS: 21			

SEMESTER II						
SUB. CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY						
MBT201	PC	Immunotechnology	3	0	0	3
MBT202	PC	Recombinant DNA technology	3	0	0	3
MBT203	PC	Bioprocess Engineering and Plant Design	3	0	0	3
MBT204	PC	Stem cell and Tissue Engineering	3	0	0	3
MBT205	PC	Downstream Processing	3	0	0	3
MBT2E2	PE	Professional Elective II	3	0	0	3
PRACTICAL						
MBT2L1	PC	Bioprocess engineering and downstream processing Lab	0	0	6	2
MBT2S1	PR	Technical Seminar-II	0	0	2	1
TOTAL HOURS: 26			CREDITS: 21			

SEMESTER III						
SUB. CODE	CATEGORY	COURSE TITLE	L	T	P	C
THEORY						
MBT3E3	PE	Professional Elective III	3	0	0	3
MBT3E4	PE	Professional Elective IV	3	0	0	3
MBT3E5	OE	Open Elective	3	0	0	3
PRACTICAL						
MBT3P1	PR	Project phase I	0	0	12	6
MBT3V1	PR	In-plant Training Note: Students to get trained in an industry for a period of two weeks at the end of II semester)	0	0	0	1
TOTAL HOURS: 21			CREDITS: 16			

SEMESTER IV						
SUB. CODE	CATEGORY	COURSE TITLE	L	T	P	C
MBT4P1	PR	Project phase II	0	0	35	12
TOTAL HOURS: 35			CREDITS: 12			
OVERALL CREDITS FOR THE PROGRAMME : 70						

LIST OF ELECTIVE SUBJECTS

PROFESSIONAL ELECTIVE (PE) I

MBTE01	Biopharmaceutical Technology	3	0	0	3
MBTE02	Food Process Engineering	3	0	0	3
MBTE03	Medical Biotechnology	3	0	0	3
MBTE04	Waste Management Technology	3	0	0	3

PROFESSIONAL ELECTIVE (PE) II

MBTE05	Developmental Biology	3	0	0	3
MBTE06	Dairy Technology	3	0	0	3
MBTE07	Cancer biology	3	0	0	3
MBTE08	Biofuel Technology	3	0	0	3

PROFESSIONAL ELECTIVE (PE) III

MBTE09	Metabolic Engineering	3	0	0	3
MBTE10	Food industry waste management	3	0	0	3
MBTE11	Nanobiotechnology	3	0	0	3
MBTE12	Alternate energy	3	0	0	3

PROFESSIONAL ELECTIVE (PE) IV

MBTE13	Proteogenomics and Bioinformatics	3	0	0	3
MBTE14	Food safety and quality control	3	0	0	3
MBTE15	Biosensor Technology	3	0	0	3
MBTE16	Industrial Safety Engineering	3	0	0	3

OPEN ELECTIVE (OE)

MMA01	Biostatistics	3	0	0	3
MBTE17	Bio entrepreneurship development	3	0	0	3
MBTE18	Research Methodology for Bioengineering	3	0	0	3

MBT101	PRINCIPLES OF PROCESS ENGINEERING				L	T	P	C
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: chemical engineering, bioprocess engineering, thermodynamics, heat and mass transfer							
	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 and energy balance for a process						
CO3		to get an idea about fluid mechanics						
CO4		to know about agitation and the types of agitators						
CO5		to know about mass transfer and drying 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	H	H	H				
	CO2	L		H		M		
	CO3		M		H			
	CO4	H		M	L			
	CO5		M			H		
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
		√						
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016						

UNIT I OVERVIEW OF PROCESS INDUSTRY

9

Unit operations & Process - Conservation of mass & Energy -Stoichiometry- SI units & Conversion **Material Balances:** Overall and component material balances - Conversion -Yield - Selectivity -Material balances without chemical reactions and with chemical reactions

UNIT II ENERGY BALANCES

9

Energy- Forms of energy- Energy balances - Entropy - Latent heat -Hess's law- Standard heat of Reactions. Fluid Mechanics-Fluids-Types- Nature of flow-Bernoulli's Equation – Manometers - Pressure losses in flow systems.

UNIT III AGITATION AND TRANSPORTATION OF FLUIDS**9**

Mixing and Agitation – Flow patterns- prevention of swirling- types of impellers- Power consumption - Pumps –Reciprocating: Single acting and double acting pump Centrifugal pump- Work of consumption.

UNIT IV HEAT TRANSFER**9**

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- Derivation of Overall heat transfer coefficient - LMTD. Evaporator- Types: falling film- Climbing film-Forced circulation and Agitated film evaporator-Methods of feeding.

UNIT V MASS TRANSFER**9**

Diffusion: Outline of Mass transfer operations-Diffusion in Gases, Liquids and Solids. Distillation: Theory of Simple, Flash, Steam and Azeotropic distillation-McCabeThiele method. Drying: Drying equipment: Tray, Screen-conveyor, Rotary and Spray dryer-Selection of drying equipment- Time of drying.

TEXT BOOK:

1. K.A.Gavhane, 2009, "Introduction to process calculations stoichiometry" Nirali Prakasham Publications 25th Ed.

REFERENCE BOOKS:

1. K.A. Gavhane, 2009, "Fundamentals of chemical engineering" Nirali Prakasham Publications 25th Ed.,
2. McCabe and Smith, 2002, "Unit operations in Chemical Engineering", Tata McHraw Hill Publications, 6th Ed.
3. Bhat & Vora,2001, 'Stoichiometry', Tata McGraw Hill Ltd, III Ed

	ADVANCED BIOCHEMISTRY	L	T	P	C
MBT102	Total Contact Hours: 45	3	0	0	3
	Prerequisite: General biochemistry				
	Course Designed by : Dept of Industrial Biotechnology				
OBJECTIVES: To provide a knowledge of biochemical components and its functions and their applications from the perspective of engineers					
COURSE OUTCOMES (COs)					
CO1	to understand the fundamentals of carbohydrates and lipids, their classification structure and functions				
CO2	to apply the basic concept of, proteins and nucleic acids				
CO3	to get an idea about photosynthesis and its mechanism				
CO4	to know about enzymes and its applications				
CO5	to get a basic knowledge of hormones				

Mapping of Course Outcomes with 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	H	H	H		
	CO2	H		H		M
	CO3		M		H	
	CO4	H		M	L	
	CO5		M			H
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
		√				
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I BIOMOLECULES I 9

Carbohydrates: structure, classification, Biological role, metabolism- glycogenesis, glycogenolysis- gluconogenesis- glycolysis- Krebs cycle- HMP shunt pathway.

Lipids: classification, structure, functions, metabolism, biosynthesis and degradation (β -oxidation) of fatty acids and cholesterol biosynthesis-biological role of cholesterol derivatives.

UNIT II BIOMOLECULES II 9

Proteins: building blocks of proteins- classification and properties- classification, biological functions and structure of proteins, protein denaturation-protein oxidation –urea cycle.

Nucleic acids: purine and pyrimidine nucleotides- structure and biosynthesis- DNA double helical structure and its biological significance.

UNIT III BIOENERGETICS OF PHOTOSYNTHESIS AND RESPIRATION 9

Photosynthesis: raw materials, photosystem I and II, mechanism, light and dark reaction, photophosphorylation.

Respiration: oxidative phosphorylation- bioenergetics of respiration with reference to glucose-high energy compounds and free energy change of hydrolysis.

UNIT IV ENZYMES 9

Nomenclature and classification- active site- mode of action- enzyme kinetics- factors affecting enzyme activity- Michaelis- Menten equation- Line Weaver Burk representation- enzyme inhibition (reversible and irreversible) kinetics.

UNIT V HORMONES 9

Endocrine system, an overview - fat soluble hormones: structure, biosynthesis, function and general mode of action of thyroid and steroid hormones- Water soluble hormones: hypothalamic, pituitary and pancreatic hormones, biological role, signal transduction and secondary messenger system.

TEXT BOOK

1. 'Glaw A, 2008, "Clinical biochemistry" Elsevier Health Sciences, 4th edition.
2. J.L. Jain, 2004, "Fundamentals of biochemistry" S. Chand.

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

MBT103		INDUSTRIAL MICROBIOLOGY AND FERMENTATION TECHNOLOGY				L	T	P	C
		Total Contact Hours: 45		3	0	0	3		
Prerequisite: General microbiology									
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 microscope								
CO4	to know the cause, symptoms, diagnosis and treatment of diseases caused by pathogens								
CO5	to get a basic knowledge of the microbial nutrition and 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			
2	CO1	H	H	H					
	CO2	M		H	L	M			
	CO3	H	M		H	L			
	CO4	H		M	L				
	CO5	H	M			H			
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)				
		√							
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UNIT I INTRODUCTION

9

History and scope of Microbiology, Identification of Microorganisms, Prokaryotes and Eukaryotes, Bacterial Taxonomy, Microscopy, Bright Field, Phase contrast, Fluorescence and Electron Microscope, Specimen Preparation for Microscopy, General Structural organization of Bacteria and other microorganisms, Archaea bacteria.

UNIT II CULTURE MEDIA

9

Microbial nutrition, Growth of Microorganisms in different Media, Isolation of Pure culture, Growth curve of Microbes, Culture of Microorganisms-continuous and synchronous culture, Enumeration of Microorganisms, Preservation of Microbial Culture, Mode of Nutrition Transport in Microbes, Effect of pH, temperature, osmotic Pressure on Growth of Microbes, antimicrobial agents and disinfectants.

UNIT III FERMENTATION PROCESS

9

Historical view of Fermentation Process and products, Outline of various unit operation involved in integrated bioprocesses, Isolation, Preservation and improvement of Industrial Microorganisms, Medium Requirement for Fermentation processes, Carbon, Nitrogen, Minerals, Vitamins and Other Nutrients.

UNIT IV PRIMARY METABOLITES

9

Production of primary metabolites, organic acids (citric acid, itaconic acid, acetic acid, gluconic acid), Amino acids (glutamic acid, lysine, aspartic acid, phenylalanine), alcohols (Ethanol, 2,3-butanediol). Production of secondary metabolites-antibiotics-beta lactams (penicillin-cephalosporin)- Aminoglycosides (streptomycin, kanamycin)-Macrolides (erythromycin)-Vitamins, Production of Vaccines and Recombinant Proteins-Proteases, Amylases, Lipases.

UNIT VI INDUSTRIAL APPLICATIONS

9

Microorganisms in waste water treatment, Bio-fertilizers and Bio-Pesticides, Recycling of biomaterials, production of biogas, plant growth factors. Natural Bio preservatives (nisin), Bio-Polymers (Xanthan gum and PHB), Single Cell Protein

TEXT BOOKS:

1. Michael J. Peleazar, J.R.E.C.S Chan, Noel R. Erieg, 2005, "Microbiology "TATA McGraw Hill, 5th Ed.

REFERENCE BOOKS:

1. Anantha Narayan, C.K. Jayaram Paniker, 2009, "Text Book of Microbiology" Orient Blackswan, 7th Ed.
2. Prescott and Dunn, 2006, "Industrial Microbiology" CBS Publishers & Distributors.

MBT104	PLANT AND ANIMAL BIOTECHNOLOGY	L	T	P	C
	Total Contact Hours: 45	3	0	0	3

		Prerequisite: Introduction to Biotechnology, Genetic engineering				
		Course Designed by : Dept of Industrial Biotechnology				
OBJECTIVES: To provide a basic knowledge about plant and animal 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 understand the fundamentals of animal cells and culture				
CO4		to know the large scale of cell cultures in a bioreactor				
CO5		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
2	CO1	H	H	H		
	CO2	M		H	L	M
	CO3	H	M		H	L
	CO4	M		M	L	
	CO5	H	M			H
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)	
		√				
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UNIT I INTRODUCTION

9

Biotechnology: Definition and scope- global impact of biotechnology in agriculture, health care and environment- potentials in modern biotechnology- achievements in biotechnology.

UNIT II PLANT TISSUE CULTURE

9

Tissue culture as a source of genetic variability: Introduction-Variation: somaclonal and gametoclonal variation, sources and causes of variation, selection of variants, application in crop improvement- Protoplast: isolation, culture and fusion, selection of hybrid cells, regeneration of hybrid plants-Somatic hybridization and Cybridization- Micropropagation as a tool of in vitro multiplication- production of pathogen free plants through virus elimination- secondary metabolite production through plant cell cultures.

UNIT III TRANSGENIC TECHNOLOGY IN PLANTS

9

Genetic Transformation methods for production of transgenic plants: Direct Gene Transfer Methods, Agrobacterium mediated genetic transformation (Indirect), Chloroplast transformation,

transplantomics. Production of genetically modified plants/crops: transgenic plants for biotic and abiotic stress tolerance, transgenic plants for quality traits, herbicide and pest resistance, Industrial enzymes, Molecular farming for therapeutic protein: Plantibodies, Plantigens and Edible Vaccines.

UNIT IV ANIMAL CELL CULTURE

9

Animal cell culture: history- requirements for animal cell and organ culture-culture media: natural and synthetic media-sterilization of glassware, equipment and culture media-maintenance of different cell lines-characteristics of animal growth in culture-Cultivation of animal cells in bioreactor-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-stem cell culture

UNIT V TRANSGENIC TECHNOLOGY IN ANIMALS

9

Basic steps in gene cloning-methods of gene transfer: calcium phosphate co precipitation, electroporation and microinjection-Screening of recombinants: marker inactivation technique. Cloning strategies: genomic and cDNA cloning (basic concepts)-Cloning of insulin gene-Development of transgenic animals and applications- DNA finger printing techniques-Biopharming- xenotransplantation- genetically engineered animals- mapping of human genome-ethical issues in animal biotechnology- Intellectual property rights- patenting.

TEXT BOOKS:

1. Adrian Slater, 2006, "Plant biotechnology", 3rd Ed,.
2. Fr. S. Ignacimuthu, 2000 Plant biotechnology IV ed.
3. R.C. Dubey, 2004, "Text book of Biotechnology" 3rd Ed.

REFERENCE BOOKS:

1. C. B. Nirmala, G. Rajalakshmi, Chandra Karthick. 2009," Plant Biotechnology"
2. Sudha Gangal , 2002, "Principles and Practice of Animal tissue culture", IV Ed
3. P. Ramadass , 2008, " Animal Biotechnology" MJP pub

		ENZYME ENGINEERING			
MBT105		L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: Introduction to Biotechnology, Biochemistry				
	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 kinetics of enzyme				
CO3	to know about the applications of enzymes				
CO4	to know about immobilization and its applications				

CO5		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
2	CO1	H	H	H		
	CO2	H		H	L	M
	CO3	H	M		H	L
	CO4			M	L	
	CO5	H	M			H
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
		√				
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UNIT I INTRODUCTION

9

Introduction to Enzyme Technology, Definition of Biochemical process, Application to pharmaceutical, medical, fine chemicals and herbal, food Industries, comparison of chemical and biochemical process, scope of chemical Engineering operations, Microbial strain cultivation, synthesis of typical biologicals.

UNIT II ENZYME KINETICS

9

Introduction to Enzyme Kinetics, Nature and Function of Enzymes, Coenzymes and cofactors **Classification of Enzyme, Practical application of Enzyme in bioprocess of Industrial importance**, Mechanism of Enzymatic Reaction-Michaelis Menten Equations for Non inhibiting and inhibiting reaction substrate, product inhibition classification of inhibition and their Mechanisms.

UNIT III MICROBIAL ENZYME KINETICS

9

Fundamentals of Microbial Kinetics, Growth curve of microbial cells, Factors affecting growth, Monod Model, Modelling of Continuous and Batch growth, immobilization of cells and Mechanisms with rate equations.

UNIT IV TRANSPORT PHENOMENA

9

Microbial Transport, Introduction to factors influencing transport phenomena, Newtonian and Non Newtonian behaviour of broth. Agitation and Mixing, Power consumption, Gas/Liquid transportation in cells, mass transfer coefficients and their role in scale up of Equipments, Enhancement of Oxygen transfer, Heat transport in Microbial systems, Sterilization cycle and Examples of Heat addition and removal in process

UNIT V BIOREACTORS

9

Bioreactors: Classification, Batch and continuous types, High performance bioreactors, Sterile

and Non sterile operations, Reactors in series, Recycle Reactors. Applications of Enzyme technologies in Effluent treatment, downstream operation with reference to membrane separations and fermentation methods in waste treatment, waste treatment and disposal.

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 Mansi, 2006 “Fermentation microbiology and biotechnology” IV Ed,

MBT1L1		PLANT AND ANIMAL BIOTECHNOLOGY LAB			L	T	P	C
		Total Contact Hours: 60			0	0	6	2
		Prerequisite: Introduction to Biotechnology, genetic engineering						
		Course Designed by : Dept of Industrial Biotechnology						
OBJECTIVES: To provide a basic knowledge of plant biotechnology and genetic engineering, its functions and their Applications from the perspective of engineers								
COURSE OUTCOMES (COs)								
CO1		to understand the fundamentals of plant tissue culture						
CO2		to apply the basic concept of recombinant DNA						
CO3		to know the application of genetic engineering techniques						
CO4		to understand the fundamentals of animal cell cultures						
CO5		To know basic concepts of transformation						
Mapping of Course Outcomes with 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	H	H	H				
	CO2				L	M		
	CO3	H	M		H	L		
	CO4			M	L			
	CO5	H	M				H	
3	Category	Professional Core (PC)		Professional Elective (PE)		Open Elective (OE)		Project/ Term Paper Seminar/ Internship (PR)
		√						
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April						

	2016
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List of Experiments

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|--|--|
| <ol style="list-style-type: none"> 1. Sterilization techniques. 2. Plant tissue culture techniques. 3. Preparation of culture medium 4. Callus induction in <i>Daucus carota</i>. 5. Nodal bud culture. 6. Micropropagation of rose. 7. Rooting and hardening of regenerated shoots. 8. Isolation, purification and determination of viability of protoplast from <i>Aloe vera</i> leaf mesophyll cells. 9. Protoplast fusion using PEG. 10. Preparation of synthetic seeds. 11. Isolation of Rhizobium from ground nut nodules and preparation of biofertilizer. | <ol style="list-style-type: none"> 12. Isolation of plant genomic DNA from leaf sample. 13. Agarose gel electrophoresis of the DNA sample. 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. 18. Subculture of semi-adherent cell lines. 19. Subculture of suspension cell lines. 20. Cell quantification. 21. Cryopreservation of cell lines. 22. Isolation of bacteriophage particles. |
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	TECHNICAL SEMINAR I	L	T	P	C
MBT1S1	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)					

<ul style="list-style-type: none"> • It is a one credit course offered in the I Semester • Each student will be allocated topics for presentation • There are 2 hours allocated per week for the students to 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. 					
1	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√
2	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016			

MBT201	IMMUNOTECHNOLOGY				L	T	P	C
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Immunology, Life Science							
	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							
Mapping of Course Outcomes with 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	H	H	H				
	CO2	M	L		L		M	
	CO3	H	M	M	H		L	
	CO4	H		M	L			
	CO5	H	L	H				H

3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
		√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016			

UNIT I INTRODUCTION

9

Introduction-cells and organs of the immune system, origin of immune system, types of immune system, - Antigens – antigenicity, antigenic determinants, haptens and epitopes, Antibodies-Structure, **Classification, allotypes and idiotypes.**

UNIT II THE IMMUNE RESPONSE

9

Immune Response – primary and secondary-humoral and cell mediated immunity, antibacterial and antiviral immunity, Mechanism of antigen recognition by T and B-lymphocytes, Functions and synthesis of lymphokines, **importance of antigen presentation and MHC class II molecules in T – cell cloning.**

UNIT III ANTIGEN-ANTIBODY INTERACTIONS

9

Immune techniques- antigen-antibody reactions, cross reactivity, precipitation I actions, agglutination reactions, RIA, ELISA, Immuno-precipitation, Immuno-flourescence, synthetic vaccines and recombinant vaccines.

UNIT IV COMPLEMENT SYSTEMS

9

Complement Systems – components, nomenclature, activation of complement, complement receptors and alternate pathway, complement fixation test, immunization practices – vaccines, toxoids, killed and attenuated vaccines, Active and passive immunization, monoclonal antibodies production, purification and characterization, application of monoclonal antibodies in biomedical research

UNIT V HYPERSENSITIVITY

9

Hypersensitivity reactions, autoimmunity-organ specific and systemic autoimmune diseases, pathogenesis, diagnostic aspects and treatment, Tumor immunology- Tumor antigens, immune response to tumors, **Approaches to cancer immunotherapy-immunodiagnosis**

TEXT BOOKS:

1. Janis Kuby, 2007, “Immunology” W.H. Freeman & Co. 6th ed.
2. Roitt I, 2001, "Essential Immunology". Blackwell Scientific Publications, Oxford.

REFERENCES BOOKS

1. Tizard, 1992, “Introduction to Immunology” Saunders collage publication, 3rded.
2. Abbas, 2009, “Basic Immunology” W.B. Saunders company, 2nded.

MBT202	RECOMBINANT DNA TECHNOLOGY				L	T	P	C
	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Introduction to Biotechnology							
	Course Designed by : Dept of Industrial Biotechnology							
OBJECTIVES: To provide a basic understanding of recombinant DNA Technology								
COURSE OUTCOMES (COs)								
CO1	to understand the fundamentals of genetic engineering							
CO2	to apply the concept of recombinant DNA in plant, animal and microbial syst 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							
Mapping of Course Outcomes with 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	H	H	H				
	CO2	H	L		L	M		
	CO3	H	M	M	H	L		
	CO4	H		M	L			
	CO5	H	L	H			H	
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
		√						
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016						

UNIT I DNA MODIFYING ENZYMES

9

RDNA technology: Introduction, Basic systems: enzymes in genetic engineering: restriction endonucleases: Types and characteristic features, Nomenclature, Modification of cut ends: linkers, adapters and homopolymers-DNA ligases- methylase-alkaline phosphatase-topoisomerase-Polynucleotide kinase-Exonuclease III-DNase I-DNA polymerase and Klenow fragment- Terminal nucleotidyl transferase- RNA dependent DNA polymerase

UNIT II VECTORS/CLONING VEHICLES

9

Introduction: features of an ideal vector- types of vectors: cloning and expression vectors-

Plasmids: pBR322, pUC18, phage vectors-cosmid vectors-phagemids-YAC vectors-BAC vectors-Shuttle vectors-Yeast vectors-Ti plasmid vector-Plant viral vectors (CaMV)-Animal viral vectors- SV 40 (3 types)- Expression vectors in Prokaryotes and Eukaryotes

UNIT III RDNA TECHNIQUES

9

Genomic DNA libraries-transformation methods-transfection-selection and screening of recombinants-direct and indirect selection methods, blue-white selection-GUS expression-colony hybridization-in vitro translation-blotting techniques: Southern, Northern and Western blotting-PCR-DNA labeling techniques-RFLP and RAPD-DNA sequencing-genome mapping: physical and genetic mapping, chromosome walking and chromosome jumping.

UNIT IV APPLICATIONS OF RDNA TECHNOLOGY IN ANIMALS

9

Animal cloning-Transgenic animals-production of insulin, interferon, vaccines, growth hormones and other pharmaceutical production-IVF-embryo transfer-nuclear transplantation-embryonic stem cells-knockout mice-animal bioreactor and molecular pharming- Gene therapy types; somatic cell and germline gene therapy, applications, problems and prospects

UNIT V APPLICATIONS OF RDNA TECHNOLOGY IN PLANTS

9

Transgenic plants with reference to disease and pest resistances, herbicide tolerance, biotic and abiotic stress tolerance-transgenic plants for crop improvement-cytoplasmic male sterility-delay in fruit ripening-Bio-pharmaceuticals and secondary metabolite production

TEXT BOOK:

1. Brown TA, 2000, "Gene cloning-and introduction" VNR (U.K) Co Ltd.
2. R.C. Dubey, A Textbook of Biotechnology, S. Chand publishers, 2013

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.

BIOPROCESS ENGINEERING AND PLANT DESIGN		L	T	P	C
MBT203	Total Contact Hours: 45	3	0	0	3
Prerequisite: Chemical engineering, principles of Bioprocess engineering					
Course Designed by : Dept of Industrial Biotechnology					
OBJECTIVES: To provide a basic knowledge of bioprocesses and its usage in bioreactors and their design					
COURSE OUTCOMES (COs)					
CO1	to understand the development of bioprocess techniques				
CO2	to know about various unit operations involved in bioprocess				
CO3	to know about the instrumentation and control for bioprocess operations				

CO4		to know about design of bioreactors				
CO5		to develop a pilot plant design and their cost				
Mapping of Course Outcomes with 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	H	H	H	M	
	CO2	H			L	L
	CO3	H	M	M		M
	CO4	H		M	L	
	CO5	H	L	H		M
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)	
		√				
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I BIOPROCESS AND METABOLIC STOICHIOMETRY

9

Introduction to bioprocess – historical development - overview of traditional and modern application of biotechnology industry – unit operations involved in bioprocess – stoichiometry of cell growth and product formation – elemental balances – degree of reduction – maintenance coefficient.

UNIT II KINETICS OF MICROBIAL GROWTH AND PRODUCT FORMATION

9

Phases of cell growth in batch culture – simple unstructured kinetic models for microbial growth, Monod model – growth of filamentous organisms – growth associated and non-growth associated product formation kinetics – substrate and product inhibition on cell growth and product formation - structured models for growth and product.

UNIT III PROCESS PLANT DESIGN

9

General design information – material and energy balance calculation – equipment design and specifications – marketability of the product – availability of technology, raw materials, equipments, human resources, land utilities, site characteristics, waste disposal, government, regulations and other legal restrictions, community factors and other factors affecting investment and production cost.

UNIT IV COST ESTIMATION

9

Capital investment – fixed capital investments including land, building, equipments and utilities, installation cost, working capital investment – manufacturing cost – direct production cost (including raw materials, human resources, maintenance and repair, operating supplies, power and other utilities, etc.), fixed charges (including depreciation, taxes insurance, rental cost etc.)

UNIT V INSTRUMENTATION AND CONTROL

9

Introduction – methods of measuring process variables: T, P, pH measurement analysis, flow measurement, inlet and exit gas analysis – computer based data acquisition – LABVIEW, MATLAB, SIMULINK & ISIM Softwares.

TEXT BOOK:

1. Shuler and Kargi, 2005 "Bioprocess Engineering", Prentice Hall,

REFERENCE BOOKS:

1. Bailey and Ollis, 2000, "Biochemical Engineering Fundamentals", McGraw Hill 3rd ed.
2. Stanbury PF, 1984, "Principles of fermentation technology" SS Hall, 2nd.
3. Dr.Mansi El Mansi.2003 "Fermentation Microbiology & Biotechnology".IVEd.
4. P.T. Kalaichelvan and I. Arul Pandi. 2007 "Bioprocess technology" MJP Pub, 1st ed.

		STEM CELL AND TISSUE ENGINEERING			L	T	P	C
MBT204	Total Contact Hours: 45				3	0	0	3
	Prerequisite: Animal Biotechnology							
	Course Designed by : Dept of Industrial Biotechnology							
OBJECTIVES: To provide a basic understanding of stem cells and their applications								
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							
Mapping of Course Outcomes with 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	H	H	H	M			
	CO2	H	H		L	L		
	CO3		M			M		
	CO4	H		M	H			
	CO5	H	L	H	H	M		
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
		√						
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April						

	2016
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UNIT I INTRODUCTION 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, and Stem cell marker.

UNIT II HUMAN EMBRYONIC STEM CELL 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 hESC cell lines, Developments regarding establishment of human stem cell banks and registries

UNIT III NEURO CULTURE 9

Stem cell biology-Preparation of complete human neuroculture, Culturing and subculturing human neurospheres, Differentiation of cells from human, neurospheres into neurons, astrocytes and oligodendrocytes, Immunolabelling procedures human embryonal stem cell and germ cell culture.

UNIT IV ANTENATAL DIAGNOSIS 9

Antenatal diagnosis- types of gene therapy-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 foetal 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 CULTURE OF CELLS 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 BOOKS:

1. Sudha Gangal , 2002, "Principles and Practice of Animal tissue culture", IV Ed
2. P. Ramadass, 2008, " Animal Biotechnology" MJP pub

MBT205	DOWNSTREAM PROCESSING	L	T	P	C
	Total Contact Hours: 45	3	0	0	3

		Prerequisite: Instrumentation, separation process, chemical 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 the application of centrifugation in product delivery					
CO4	to get a basic knowledge of crystallization					
CO5	to know about the product recovery and purification 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	H	H	H	M	
	CO2	H	H		L	L
	CO3		M			M
	CO4	H		M	H	
	CO5	H	L	H	H	M
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
		√				
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I INTRODUCTION

9

Role of downstream processing in biotechnology-Characteristics of biotechnology products, overview of bioprocess including upstream and downstream process, Cost cutting strategies, characteristics of biological mixtures, process design criteria for various classes of byproducts.

UNIT II SEPARATION TECHNIQUES

9

Physico-chemical basis of bioseparation processes, Cell Disruption; Principle of operation, Types and applications-recent development in product isolations- Removable of insolubles- Filtration & Micro filtration, Centrifugation,

UNIT III EXTRACTION METHODS

9

Membrane separations-Enrichment operations: Precipitation methods (with salts, organic solvents and polymers), ATP method, **Super critical extractions**- Extraction-batch, staged, Differential, Fractional types; Adsorption- Batch, continuous stirred tank, Principles and applications.

UNIT IV CHROMATOGRAPHIC TECHNIQUES**9**

Product resolution and fractionation – chromatographic techniques – Chromatofocusing – electrophoresis of protein and nucleic acids, 1D – 2D gels, types of electrophoretic techniques (capillary and pulse field)

UNIT V CRYSTALLIZATION**9**

New and **emerging technologies: dialysis, Pervaporation,** Polishing techniques – Crystallization, Drying – Various types, principles & applications.

TEXT BOOK:

1. Siva Shankar, 2004, “Bioseparation” III Ed,

REFERENCES BOOKS

1. Raja Ghosh, Principles of Bioseparations Engineering, World Scientific Publications, 2006.
2. P.A. Belter, E.L. Cussler, W.-S. Hu, Bioseparations: Downstream Processing for Biotechnology, John Wiley and Sons, New York (1988).

		BIOPROCESS ENGINEERING AND DOWNSTREAM PROCESSING LAB				L	T	P	C
MBT2L1	Total Contact Hours: 45	0	0	6	2				
	Prerequisite: Instrumentation, separation process, chemical engineering								
	Course Designed by : Dept of Industrial Biotechnology								
	OBJECTIVES: To provide a basic knowledge of bioprocess, its functions and their applications								
COURSE OUTCOMES (COs)									
CO1	to understand the fundamentals of bioprocess techniques								
CO2	to understand the fundamentals of separation methods								
CO3	to know the purification techniques								
CO4	to get a basic knowledge of fermentation								
CO5	to know basic concepts of product 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	H	H	H	M				
	CO2	H	H		L	L			
	CO3	H	M			M			
	CO4	H		M	H				
	CO5	H	L	H	H	M			

3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
		√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016			

List of Experiments

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. Estimation of biomass production. 2. Plate assay 3. Media optimization by Plackett-Burmann method. 4. Effect of temperature on enzyme activity. 5. Effect of pH on enzyme activity. 6. Effect of substrate concentration on growth of <i>E.coli</i>. 7. Immobilization of enzyme. 8. Enzyme kinetics. 9. Estimation of k_{La} by sulphite oxidation method. 10. Thermal death kinetics of yeast. 11. Solid state fermentation. 12. Production of wine 13. Production of soap and analyze its properties. | <ol style="list-style-type: none"> 14. Production of biodiesel and analyze its properties. 15. Isoelectric precipitation 16. Settling characteristics 17. Flocculation (Jar Test) 18. Solids Recovery by Centrifugation 19. Paper chromatography 20. Thin Layer Chromatography 21. Ion –Exchange Chromatography 22. Affinity Chromatography 23. Gel Filtration 24. Sonication 25. Crystallization 26. Aqueous Two Phase Extraction Of Proteins 27. Enzyme Purification by Salt precipitation Method |
|--|---|

MBT2S1	TECHNICAL SEMINAR II	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 II Semester
- Each student will be allocated topics for presentation
- There are 2 hours allocated per week for the students to 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.

1	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√
2	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016			

MBT3P1	PROJECT PHASE I				L	T	P	C
	Total Contact Hours -60				0	0	12	6
	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 six credit course offered in the III Semester
- Each student will be allocated a guide and a research topic at the end of the II semester. This will help them to collect sufficient literature during their vacation. A guide will have a maximum of four students
- Two days are 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					
1	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
					√
2	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016			

MBT4P1	PROJECT PHASE II				L	T	P	C
	Total Contact Hours -35 hrs per week				0	0	35	12
	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)								
<ul style="list-style-type: none"> • It is a 12 credit course offered in the IV Semester • The Project phase I guide continues to guide the students in Project Phase II also. • There is no course work during this semester and the student is free to do the project. • 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. 								
1	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
					√			
2	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016						

ELECTIVES

MBTE01	BIOPHARMACEUTICAL TECHNOLOGY	L	T	P	C
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		Total Contact Hours: 45			3	0	0	3
		Prerequisite: Instrumentation, separation process, chemical engineering						
		Course Designed by : Dept of Industrial Biotechnology						
OBJECTIVES: To provide a basic understanding of pharmaceuticals and their applications								
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						
Mapping of Course Outcomes with 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		H	H	M			
	CO2	H	H		L	M		
	CO3	H	M			M		
	CO4	H		L	H			
	CO5	H	L	H	H	M		
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
			√					
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016						

UNIT I INTRODUCTION

9

Introduction to biopharmaceutics – bioavailability – factors influencing bioavailability: factors influencing drug absorption from the gastrointestinal tract.

UNIT II DRUG FORMULATION

9

Manufacturing Principles – Compressed tablets – wet granulation – Dry granulation or slugging – Direct compression – Table presses formulation – Coating – Pills – Capsules sustained action dosage forms – Parental solutions – Oral liquids – injections – ointments – standard of hygiene and good manufacturing practice.

UNIT III DRUG BINDING

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 organs and enzymes – phase I reactions – phase II reactions – first pass effect – factors affecting biotransformation of drugs – bioactivation and tissue toxicity.

UNIT V PRODRUG

9

Bioprecursor prodrugs – carrier prodrugs – application of prodrug design: enhancement of drug stability and dissolution rate – enhancement of bioavailability – **site specific drug delivery** – Imitations of prodrug design.

TEXT BOOK

1. D.M. Brahmkar Sunil B.Jaiswal, 2008, “Biopharmaceutics and Pharmacokinetics” Vallabh Prakashan, 1st Ed.

REFERENCE BOOKS:

1. Remington's Pharmaceutical Sciences, Mack Publishing and Co.,
2. Vyas SP, 2007, “Pharmaceutical biotechnology” CBS Publishers & Distributors.
3. Grovess MJ, 2006, “Pharmaceutical biotechnology” CRC Press, 2nd Ed.

MBTE02	FOOD PROCESS ENGINEERING			L	T	P	C
	Total Contact Hours: 45			3	0	0	3
	Prerequisite: Instrumentation, separation process, chemical engineering						
	Course Designed by : Dept of Industrial Biotechnology						
OBJECTIVES: To provide basic technologies involved in food processing							
COURSE OUTCOMES (COs)							
CO1	to understand basic concepts in sterilization of food products						
CO2	to know about various dryers						
CO3	to know about the mixing equipments for various products						
CO4	to know about various preservation techniques for food products						
CO5	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	
2	CO1		H	H	M		
	CO2	H	H		L	M	
	CO3	H	M			M	
	CO4	H		L	H		
	CO5	H	L	H	H	M	

3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)
			√		
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016			

UNIT I INTRODUCTION 9

Food processing industries in India: status, scope- categorization of food processing industries- food preservation–National food processing policy of India – tenth plan initiatives

UNIT II FOOD SPOILAGE, PREVENTION, FOOD SAFETY 9

Food spoilage causes – biological changes – factors effecting bacterial growth – yeasts – mold – food borne diseases – control of microorganism- prevention of microorganisms sterilization techniques – Thermal death time – food additives: uses, types – HACCP- definition, principle, guidelines.

UNIT III POST HARVEST PROCESSING 9

Perishable foods of fruits & vegetables metabolic inhibitors- preservation – time/temp-tolerance hypothesis- Hicks theory- Ethylene biosynthesis-controlled atmosphere technique- factors effecting food storage-fruit ripening – CA generators-post harvest disease-respiratory gases- preservation of nuts of dried fruits

UNIT IV FOOD PROCESSING TECHNOLOGIES 9

Drying of food-goals-guidelines-pretreatment of fruits of vegetables-drying methods: oven drying, food dryer-sun drying-other drying method-water activity-intermediate moisture food concept-hurdle technology-recommended additives to reduce pH, inhibition microbes to prevent burrowing-thermal treatment-freeze drying-freezing of food-food irradiation food sterilization- Extrusion technology.

UNIT V GRAIN STORAGE 9

Storage types-disinfestation of grains-controlled atmosphere storage-useful of CO₂ in one shot system-control of yeast and mold- seed viability-multiplication of lactic acid bacteria-storage of wet grains-feed back inhibition-grain storage in developing countries.

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, 5th Ed.

- Hamm & Hammilton, 2000, "Edible oil processing" Academic Press 5th Ed.
- Fellows, 2009, "Food processing technology" 21th Ed.
- Heldman, 2007, "Hand book of food engineering" CRC Press 2nd Ed.
- P.G. Smith, 2003, "Food Process Engineering" Academic Plenum Pub, New York 1st Ed.

MBTE03	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								
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							
Mapping of Course Outcomes with 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		H	H	M			
	CO2	H	H		L	M		
	CO3	H	M			M		
	CO4	H		L	H			
	CO5	H	L	H	H	M		
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
			√					
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016						

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 of stem 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 Raneshinde 2009 “Clinical Biochemistry” 7th edition.

REFERENCES

1. Guyton, 2010 “Medical physiology”, 12th edition
2. Devlin, 2005 “Biochemistry with clinical correlation”, 10th edition
3. Weblink: nptel

		WASTE MANAGEMENT TECHNOLOGY			
MBTE04		L	T	P	C
	Total Contact Hours – 45	3	0	0	3
	Prerequisite – Environmental Science				
	Course Designed by – Dept of Industrial Biotechnology				
OBJECTIVES: To give a basic knowledge of waste handling and its management					
COURSE OUTCOMES (COs)					
CO1	to understand the various types of waste				
CO2	to know the technology to handle the waste material				
CO3	to know about waste disposal methods				
CO4	to know the remedial measures for waste disposal				
CO5	to know about applications of waste management 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
2	CO1		H	H	M	
	CO2	H	H		L	M
	CO3	H	M			M
	CO4	H		L	H	
	CO5	H	L	H	H	M
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
			√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

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. Agricultural Waste Management Hand Book by USDA, III Ed,2005

REFERENCE BOOKS

1. Industrial Biotechnology Problems and Remedies by Indu Shekhar Thakur, VI Ed, 2006
2. Wang, Shannmas Hung, 2008, "Advanced hazardous industrial waste treatment" CRC Press.

MBTE05		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									
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								
Mapping of Course Outcomes with 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		H	H	M				
	CO2	H	H		L	M			
	CO3	H	M			M			
	CO4	H		L	H				
	CO5	H	L	H	H	M			
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)				
			√						
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016							

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, spermiotolosis, nuclear control of spermiotolosis, 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

MBTE06	DIARY TECHNOLOGY							
	L	T	P	C				
	Total Contact Hours - 45				3	0	0	3
	Prerequisite – 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					
Mapping of Course Outcomes with 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		H	H	M	
	CO2	H	H		L	M
	CO3	H	M			M
	CO4	H		L	H	
	CO5	H	L	H	H	M
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
			√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I INTRODUCTION

9

Market milk – market milk industry in India – Collection, Transportation of milk- milk reception – Clarification- Chilling – Homogenisation – 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, mozerella 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- Gulab jamun – Rasagolla – preparation of paneer – kulfi – **utilization of skim milk – butter milk – whey.**

UNIT V QUALITY CONTROL & 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” .

REFERENCES

1. Andrews,2004, “Biochemistry of Milk Products” Black rabbit books, 2nded.
2. Ananthkrishnan C P., and Padmanabhan “ The technology of milk processing” Shrilakshmi publications

		CANCER BIOLOGY				L	T	P	C
MBTE07	Total Contact Hours - 45	3	0	0	3				
	Prerequisite – Medical Biotechnology, Animal Biotechnology								
	Course Designed by – Dept of Industrial Biotechnology								
	OBJECTIVES: To provide a basic understanding of cancer and its implications								
COURSE OUTCOMES (COs)									
CO1	to understand the fundamentals of cancer cells and its constituents								
CO2	to know the concept of carcinogenesis and carcinogenic agents								
CO3	to find the environmental factors related to cancer								
CO4	to know the cause, symptoms, diagnosis and treatment of cancer								
CO5	to give a basic knowledge of the different types of cancer								
Mapping of Course Outcomes with 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		H	H	M				
	CO2	H	H		L	M			
	CO3	H	M			M			

	CO4	H		L	H	
	CO5	H	L	H	H	M
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
			√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

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- metastasis, 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 ONCOGENES

9

Molecular Cell Biology of Cancer- Oncogenes, Identification of Oncogenes, Retroviruses and Oncogenes, Growth factors and growth factor receptors as oncogenes.

UNIT IV CANCER TYPES

9

Different sites and forms of cancer, Lung, Liver, Breast, Cervical, Blood, Prostrate, Ovarian cancers – epidemiology, 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

MBTE08	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							
Mapping of Course Outcomes with 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		H	H	M			
	CO2	H	H		L	M		
	CO3	H	M			M		
	CO4	H		L	H			
	CO5	H	L	H	H	M		
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
			√					
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016						

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, 1st.ed.

MBTE09		METABOLIC ENGINEERING				L	T	P	C
		Total Contact Hours - 45				3	0	0	3
Prerequisite – Biochemistry, Microbiology									
Course Designed by – Dept of Industrial Biotechnology									
OBJECTIVES: To give a knowledge of metabolism									
COURSE OUTCOMES (COs)									
CO1	to understand stoichiometry of growth								
CO2	to know about electron balance calculations								
CO3	to know about metabolic energy changes.								
CO4	to know about thermodynamic efficiency								
CO5	to know about applications of kinetics of chemical reactions								
Mapping of Course Outcomes with 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		H	H	M				
	CO2	H	H		L	M			
	CO3	H	M			M			

	CO4	H		L	H	
	CO5	H	L	H	H	M
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
			√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I INTRODUCTION

9

Energetics of metabolism, energy coupling (TP 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 II STOICHIOMETRY

9

Metabolic stoichiometry, Energetics of Batch and continuous process, Stoichiometry of cell growth and product formation, degrees of reduction of substrate and Biomass-Available electron Balances, yield coefficients of biomass and product formation, Maintenance coefficients Energetics analysis of microbial growth and product formation, oxygen consumption and Heat evolution in aerobic and anaerobic cultures.

UNIT III GROWTH AND METABOLISM

9

Thermodynamic efficiency of growth, Thermodynamics and kinetics of cell metabolism Metabolic pathways, modeling of Embden Meyers Parnas pathway. Thermal and Energetic studies, Activation Energies of reaction and Heat of reaction, formation and combustion of biochemical reactions

UNIT IV METABOLIC PATHWAYS

9

Thermodynamic efficiency of glucose catabolic pathways as EMP pathway, TCA cycle, urea cycle, AMP cycle, Analysis of anabolic pathways for synthesis of Metabolites and carbon molecules build, thermodynamic efficiency, Photosynthesis Type I and Type II processes, Thermodynamic and kinetic analysis and Mechanism.

UNIT V SIGNAL TRANSDUCTION

9

Signal transduction –receptors and methods of action –signal amplification and different models, G proteins-phosphatidyl and inositol- cAMP-calcium ions-protein kinase-defects in signaling pathways.

TEXT BOOKS

1. Robertson & Noel, 2004, “Protein Engineering” Elsevier academic press.

- Dugas. H, Bio-Organic Chemistry - A chemical approach to enzyme action, Springer Verlag, 2002, revised edition

REFERENCE BOOKS:

- Cleland & Craik, 1996, "Protein Engineering Principles & Practice" Wiley-Liss.
- Voet & Voet, 2006, "Biochemistry" V Ed,
- Lehninger Nelson & Cox, 2005 "Principles of Biochemistry", 4th Ed

MBTE10		FOOD INDUSTRY WASTE MANAGEMENT				L	T	P	C
		Total Contact Hours - 45				3	0	0	3
		Prerequisite – Food processing							
		Course Designed by – Dept of Industrial Biotechnology							
OBJECTIVES: To provide basic knowledge about waste generated from food industries and their utilization									
COURSE OUTCOMES (COs)									
CO1	to know about the types of food industry waste								
CO2	to know about food industry effluents								
CO3	to know about the types of byproducts from food industries								
CO4	to get ideas about the utilization of waste								
CO5	to learn about value added products from food 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	H	H	H	M				
	CO2	H	H		L	M			
	CO3	H	M	M		M			
	CO4	M		L	H				
	CO5	H	L	H	H	M			
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)				
			√						
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016							

UNIT I INTRODUCTION

9

Sources of food industry waste- nature of different waste-status in India-Basic considerations: Standards for emission or discharge of environmental pollutants from food processing Industries as per the updated provision of Environment (Protection) Act, 1986-legal and statutory

requirements for food waste handling, treatment and disposal

UNIT II FOOD INDUSTRY EFFLUENT

9

Characterization of food Industry effluents, physical and chemical parameters- Oxygen demands and their interrelationships, residues (solids), fats, oils and grease-forms of nitrogen, sulphur and phosphorus-anions and cations, surfactants, colour, odour, taste, Toxicity- treatment of food industry effluent, screening, sedimentation floatation.

UNIT III BYPRODUCTS FROM FOOD INDUSTRY

9

Food wastes and by-products related to specific processing industries like fruit and vegetables (apple, orange, mango, potato etc.), dairy industry, oil and oil seeds industry, sugar industry, grains and milling industry, fermentation (alcohol and beer), livestock, poultry, fish and meat

UNIT IV WASTE UTILIZATION

9

Waste utilization from wheat and rice mills, pulse and oilseeds processing-waste utilization from fruit and vegetable industries-fish industry waste utilization - meat and poultry waste recycling-coconut processing-utilization of by-products from fermented foods, milk- case studies involving utilization of whey from dairy industry, utilization of specific plant byproducts for recovery of proteins, pectins, dietary fibres, antioxidants, colorants etc. utilization of biomass for production of animal feed, compost and bio-gas

UNIT V VALUE ADDED PRODUCTS FROM WASTE

9

Value added products from agri food processing industry- uses of rice husk - pyrolysis and gasification of rice husk-cement preparation and different thermal applications-utilization of rice bran- stabilization-defatted bran utilization-fuel briquettes from coconut waste-

TEXT BOOKS

1. Bor S. Luli (ed), "Rice Production and Utilization"
2. Beagle, "Rice Husk Conversion to Energy"

REFERENCES

1. Chereminnoff P. N. & A.C Morresi, "Energy from Solid Wastes" 1976,
2. Chakravarthy & De, "Agricultural Waste and By Product Utilization".

		NANOBIOTECHNOLOGY			
		L	T	P	C
MBTE11	Total Contact Hours - 45	3	0	0	3
	Prerequisite – Introduction to Biotechnology				
	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 nanoparticles				
CO2	to understand the various nanodevices				
CO3	to know about nanomolecules				
CO4	to know about various techniques for nanoparticle analysis				

CO5		to know about applications of nanomolecules in various fields				
Mapping of Course Outcomes with 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		H	H	M	
	CO2	H	H		L	M
	CO3	H	M			M
	CO4	H		L	H	
	CO5	H	L	H	H	M
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
			√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I INTRODUCTION 9

Definition- bottom up and top down approaches-micro and nano machining-micromachined nanodevices-microprobe arrays-multiple nanoprobes- microfluidic devices.

UNIT II MANIPULATION OF DNA 9

Stretch and positioning of DNA- molecular surgery of DNA-microfabricated probes-manipulation of giant DNA molecules- globular transition- laser trapping of single DNA-globule coil transformation- mapping and cutting of stretched DNA- recovery of DNA fragments- microreactors for DNA manipulation

UNIT III NEAR FIELD OPTICS 9

Diffraction barrier- SNOAM probe design, configuration, imaging-applications- vibrational spectroscopy- scanning near field optical microscopy.

UNIT IV ATOMIC FORCE MICROSCOPY 9

Principles- applications- nanotribology- scanning force microscopy- control and fabrication of nanometric oscillators- nanometric parallel leaf springs, cantilevers- nano oscillators- scanning tunneling microscopes: operating principles, structure, surface and bulk micromachining- micro STM fabrication technology- characterization and application of fabricated micro STM.

UNIT V NANOSCALE CHARACTERIZATION 9

Semiconductor nanostructures- STM and spectroscopy for semiconductors- scanning tunneling spectroscopy-ballistic electron emission microscopy- STM/STS and laser illumination- scanning capacitance microscopy- electrostatic force detection- Kelvin probe force microscopy.

TEXT BOOK:

1. K.K. Jain , 2006, “Nanotechnology in molecular diagnostics – current techniques & applications”

REFERENCE BOOKS:

1. Microbial bionanotechnology edited by Bernard H.A. Relim
2. Applications of nanoparticles in biology & medicine O.V. Salate. Journal of nanobiotechnology (2004), 2:3

MBTE12		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								
Mapping of Course Outcomes with 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		H	H	M				
	CO2	H	H		L	M			
	CO3	H	M			M			
	CO4	H		L	H				
	CO5	H	L	H	H	M			
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)				
			√						
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016							

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

- Osamu Hirao and Richard Pefley (1988), Present and Future Automotive Fuels, Wiley Interscience Publication, New York.

REFERENCE BOOKS

- R.L. Bechtold (1997), Alternative Fuels Guidebook, SAE
- Nick Wagoner and Sheryl Wagoner (2006), Alternate Fuels: An Overview, ThomsonDelmar Learning.
- Reda Mohamed Bata (1994), Alternate Fuels: A Decade of Success and Promise(Progress in Technology), SAE International

MBTE13	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					
Mapping of Course Outcomes with 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		H	H	M	
	CO2	H	H		L	M
	CO3	H	M			M
	CO4	H		L	H	
	CO5	H	L	H	H	M
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
			√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

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

		FOOD SAFETY AND QUALITY CONTROL				L	T	P	C
MBTE14	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								
Mapping of Course Outcomes with 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		H	H	M				
	CO2	H	H		L	M			
	CO3	H	M			M			
	CO4	H		L	H				
	CO5	H	L	H	H	M			
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)				
			√						
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016							

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 alimentarius 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. Yasmine Motarjemi (2013), Food Safety Management, 1st Edition, Elsevier

MBTE15	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					
Mapping of Course Outcomes with 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		H	H	M	
	CO2	H	H		L	M
	CO3	H	M			M
	CO4	H		L	H	
	CO5	H	L	H	H	M
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
			√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

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	
UNIT III 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 Bioanalytical Sensors", 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

		INDUSTRIAL SAFETY ENGINEERING				L	T	P	C
MBTE16		Total Contact Hours - 45				3	0	0	3
		Prerequisite –Basic biotechnology, Bioprocess Engineering, Environmental science							
		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 know about safetyguards and application								
CO5	to understand various personal protective equipments and first aid								
Mapping of Course Outcomes with 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		H	H	M				
	CO2	H	H		L	M			
	CO3	H	M			M			
	CO4	H		L	H				
	CO5	H	L	H	H	M			
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)				
			√						
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016							

UNIT I INTRODUCTION

9

Safety in Process Plants – Hazard Analysis – Types of Hazard – hazard Identification techniques
Hazard Evaluation – Important Factories Act.

UNIT II TYPES OF HAZARDS**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 & 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 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 equipments- Respiratory type-First aid – principles and methods – First aid training – Scope of first aid – Golden rules– First aid treatment : for wounds and Hemorrhage , 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. Prof.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.

		BIOSTATISTICS			
		L	T	P	C
MMA01	Total Contact Hours - 45	3	0	0	3
	Prerequisite –Maths I and II				
	Course Designed by – Dept of Industrial Biotechnology				
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 understand the concepts of various problems in probability				

CO3	to know basic concepts random variables					
CO4	to know about sampling concepts					
CO5	to know about design of experiments using various tests					
Mapping of Course Outcomes with 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		H	H	M	
	CO2	H	H		L	M
	CO3	H	M	M		M
	CO4	M		L	H	
	CO5	H	L	H	H	M
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper/ Seminar/ Internship (PR)	
			√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I INTRODUCTION

9

Probability concepts- Baye's theorem – One dimensional two dimensional random variable – Marginal and conditional distribution- Correlation and Regression-Distributions, Binominal, Poisson Normal uniform-Exponential

UNIT II SAMPLING METHODS

9

Methods of sampling- Population – Sample- Simple random sampling- Stratified and systematic sampling-Point and Interval estimates-Sampling errors-Simple size determination- Data types.

UNIT III STATISTICAL PROCESSES

9

Classification of Random processes- Stationary processes- Poisson processes- Binomial processes- Sine wave processes- Markov processes- Markov processes- Markov chains- Auto correlation – properties.

UNIV IV TEST OF SIGNIFICANCE

9

Parametric test: T test-Normal test – Test for proportion- F test – Chi square test – test for contingency table. Non parametric test: Sign test of paired date- Kruskal Wallis test- Rank correlation – Kotroprov Smirov test.

UNIT V DESIGN OF EXPERIMENTS

9

Completely Randomized Design- Randomized block design-Latin Square design-Factorial

designs.

TEXT BOOK:

1. Kapur J. N and Saxena H. C, "Mathematical Statistics", S. Chand and Co., New Delhi

REFERENCES

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

MBTE17		BIO ENTREPRENEURSHIP DEVELOPMENT			L	T	P	C
		Total Contact Hours - 45			3	0	0	3
		Prerequisite –Bioprocess, genetic engineering, TQM						
		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 and decision making							
CO3	to explore the avenues for financing a business venture							
CO4	to know about various company laws							
CO5	to understand Entrepreneurship in 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		
2	CO1		H	H	M			
	CO2	H	H		L	M		
	CO3	H	M	M		M		
	CO4	M		L	H			
	CO5	H	L	H	H	M		
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)			
			√					

4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016
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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 ENTREPRENEURSHIP – 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 companies– 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, Tennessee State University, 2006

REFERENCES

1. Entrepreneurship fundamentals by Zobias Kollmann International journal of Zechnology management,2007

MBTE18	RESEARCH METHODOLOGY FOR BIOENGINEERING				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					
Mapping of Course Outcomes with 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		H	H	M	
	CO2	H	H		L	M
	CO3	H	M	M		M
	CO4	M		L	H	
	CO5	H	L	H	H	M
3	Category	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)	
			√			
4	Approval	37 th , 38 th & 39 th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

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 – Electron 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 – immunoprecipitation 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. Dr. N. Gurumani, 2006, Research methodology for biological sciences, MJP publishers.

REFERENCES

1. Dr. P. Ramadass, 2009, Research and writing: Across the disciplines, MJP publishers.