CURRICULUM AND SYLLABUS (R 2016)

CHOICE BASED CREDIT SYSTEM

M.TECH – CAD
(FULL TIME)
I- IV SEMESTERS

SEMESTER – I							
S.NO.	**CODE**	**CATEGORY**	**SUBJECT NAME**	**L**	**T**	**P**	**C**
1	MMA105	PM	Applied Mathematics	3	2	0	4
2	MMD101	PC	Mechanical Vibrations	3	0	0	3
3	MMD102	PC	Advanced Strength of Materials	3	0	0	3
4	MCD101	PC	Integrated Product Design & Development	3	0	0	3
5	MCD102	PC	Computer Graphics	3	0	0	3
6	MMD104	PC	Finite Element Analysis	3	0	0	3
7	MCD1L1	PC	CAD Laboratory	0	0	4	2

TOTAL CONTACT HOURS-22 **TOTAL CREDIT: 21**

SEMESTER – II							
S.NO.	**CODE**	**CATEGORY**	**SUBJECT NAME**	**L**	**T**	**P**	**C**
1	MCD201	PC	Optimization in Mechanical Engg.	3	0	0	3
2	MCD202	PC	Computer Aided Manufacturing	3	0	0	3
3	MCD203	PC	Computer applications in design	3	0	0	3
4	MCD204	PC	Computer Aided Machine element Design	3	0	0	3
5	MCD2E1	PE	Professional Elective – I	3	0	0	3
6	MCD2E2	PE	Professional Elective – II	3	0	0	3
7	MMD2L1	PC	Design and Analysis Lab	0	0	4	2

TOTAL CONTACT HOURS-22 **TOTAL CREDIT: 20**

SEMESTER – III							
S.NO.	CODE	**CATEGORY**	SUBJECT NAME	L	T	P	C
1	MCD3E3	PE	Professional Elective – III	3	0	0	3
2	MCD3E4	PE	Professional Elective - IV	3	0	0	3
3	MCD3E4	OE	Open Elective	3	0	0	3
4	MCD3P1	PR	Project Work Phase I	0	0	12	6

TOTAL CONTACT HOURS-21 **TOTAL CREDIT: 15**

SEMESTER – IV							
S.NO.	CODE	**CATEGORY**	SUBJECT NAME	L	T	P	C
1	MCD4P2	PR	Project Work Phase II	0	0	24	12

TOTAL CONTACT HOURS-24 **TOTAL CREDIT: 12**

TOTAL PROGRAMME CREDITS: 68

SUMMARY OF CURRICULUM STRUCTURE AND CREDIT & CONTACT HOUR DISTRIBUTION

S.NO	Sub Area	Credit As per Semester				No. of Credit	% of credit
		I	II	III	IV		
1	Professional Mathematics (PM)	4	-	-	-	4	5.88%
2	Professional Core (PC)	17	11	-	-	28	41.476 %
3	Professional Electives (PE)	-	9	6	-	15	22.051%
4	Open Electives (OE)	-	-	3	-	3	4.410%
5	Project Work, Seminar, Internship, etc. (PR)	-	-	6	12	18	26.42%
	Total Credit	21	20	15	12	68	100%
	Total Contact Hour	22	22	21	24	89	

LIST OF ELECTIVES

Professional Elective –I

S.NO.	CODE	SUBJECT NAME	L	T	P	C
1	MCD001	Rapid Prototyping	3	0	0	3
2	MMD 001	Vibration Control And Condition Monitoring	3	0	0	3
3	MMD 201	Advanced Design Of Transmission System	3	0	0	3
4	MME203	Computational Fluid Dynamics.	3	0	0	3
5	MMD 205	Machine Tool Design	3	0	0	3

Professional Elective –II

S.NO.	CODE	SUBJECT NAME	L	T	P	C
1	MCD 002	Concurrent Engineering	3	0	0	3
2	MMD 003	Tool Design	3	0	0	3
3	MMD202	Tribology	3	0	0	3
4	MMD203	Design of Pressure Vessels and Piping	3	0	0	3
5	MMD206	Design Of Hydraulic And Pneumatic System	3	0	0	3

Professional Elective –III

S.NO.	CODE	SUBJECT NAME	L	T	P	C
1	MCD 003	Design For Manufacturing	3	0	0	3
2	MCD 004	Production And Operation Management	3	0	0	3
3	MMD 004	Design of jigs and fixtures	3	0	0	3
4	MMD 103	Design Of Mechanism-I	3	0	0	3

Professional Elective –IV

S.NO.	CODE	SUBJECT NAME	L	T	P	C
1	MMD105	Engineering Design	3	0	0	3
2	MMD004	Design Of Material Handling Equipments	3	0	0	3
3	MMD006	Composite Materials And Mechanics	3	0	0	3
4	MMD 005	Engineering Fracture Mechanics	3	0	0	3

Open Elective

S.NO.	CODE	SUBJECT NAME	L	T	P	C
1	MAE002	Robotics	3	0	0	3
2	MCS157	System Modeling And Simulation	3	0	0	3
3	PCD 005	Mechatronics	3	0	0	3
4		Research Methodology				
5	MMD 007	Advanced Material Science ,Failure Analysis And Design	3	0	0	3

Course Code MMA105	**Course Name:APPLIED MATHEMATICS**	**L**	**T**	**P**	**C**
	Total Contact Hours:45	3	0	0	4

	Prerequisite: Engineering mathematics
	Course Designed by :

OBJECTIVESThe main objectives of the course are to enhance the knowledge of various meth in finding the Eigen values and Eigen vectors of matrix, and also to evaluate differentiation complex functions with a greater accuracy to formulate Problems in engineering and solve th analytically and numerically

COURSE OUTCOMES (COs)

CO1	Compute Eigen vectors for given matrix by different methods
CO2	Solve vibrational problem by different methods.
CO3	Convert boundary value problems into integral equations and find solutions.
CO4	Apply probability concepts to arrive engineering solutions
CO5	Understand concepts of applied mathematics

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

UNIT I : MATRIX THEORY 9

EigenvaluesusingQRtransformation–GeneralizedEigenvectors–canonicalforms–singular valueddecompositionandapplication–matrixnormsandinduced norms– Pseudoinverse – Least approximations.

UNIT– II: CALCULUSOFVARIATIONS 9

Variationanditsproperties–Euler'sEquation–Functionaldependentonfirstandhigherorder derivatives –Functionaldependent on functions ofseveral independent variables – Constraints in the formof afunctionalisoperimetric problems–Directmethods– RitzKantorovichmethods– Boundaryvalueproblems.

UNIT– III :TRANSFORMMETHOD 9

Laplacetransformmethodsfor onedimensionalwaveequation–displacementina line string– Longitudinalvibrationsof elastic bar –Fouriertransformmethodsforone dimensionalheat conduction problems in infinite and semi infinite rod.

UNITIV: PROBABILITY 9

Probabilityconcepts–RandomVariables– Estimation - Hypothesis Testing - Analysis ofVariance-Discreteandcontinuousdistributions— Oneway, two wayclassifications.

UNITV : CURVEFITTING 9

Correlations-Partial,Multiple, Rank – Regression–Multiple regressions- Trend analysis– Polynomialfitting- Estimation – Point and interval Estimates – Probability – Distributions – Estimation – Hypothesis Testing – Annova Classification – Correlation and Regression – Trend Analysis.

Total Periods:45

TEXTBOOKS:

1. SankaraRaoK. "IntroductiontoPartial Differential Equation"PrenticeHallofIndia, New Delhi 1995.
2. Curtis F. Gerald. "Applied Numerical Analysis" 7thEdn. Pearson Education, Chennai-600113. 2007.
3. Gupta, A.S. "Calculus of Variations with Applications", Prentice Hall of India Pvt. Ltd., New Delhi, 1997.

REFERENCE BOOKS:

1. Douglas C.Montgomory and George C.Runger. "Applied Statistics and Probability for Engineers" 5thEdn. Wiley India Pvt Ltd., New Delhi. 2010.
2. FreundJE andMillerJR, "Probabilityand Statistics forEngineers" 5thEdn. PrenticeHall ofIndia, New Delhi. 1994.
3.DennisG.Zill and Warren S.Wright. "Advanced Engineering Mathematics". 3rdEdn. Jones & Bartlett Publishers, UK. 1992.

Course Code	Course Name: MECHANICAL VIBRATIONS	L	T	P	C

MMD101	Total Contact Hours: 45	3	0	0	3
	Prerequisite: GENERAL MATHEMATICS				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVESThe course should enable the students to:

1. Understand the sources of vibration and noise in automobiles and make design modifications
2. Learn to reduce the vibration and noise and improve the life of the components

COURSE OUTCOMES (COs)

CO1	Understand the causes and effects of vibration in mechanical systems .
CO2	Understand the Classification.
CO3	Develop schematic models for physical systems and formulate governing equations of motion.
CO4	Understand the role of damping, stiffness and inertia in mechanical systems
CO5	Analyze rotating and reciprocating systems and design machine supporting structures, vibration isolators and absorbers

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

UNIT I

ONE DEGREE OF FREEDOM SYSTEMS

Vibration principle-Equilibrium & Energy methods- free vibrations – Viscous & coulomb damping – Forced vibration – Base excitation – Transmissibility – Resonance – Characteristics.

UNIT II **9**

TWO DEGREE TO FREEDOM SYSTEMS

Two degrees of freedom – Matrix form –Undamped free vibration- Principal modes – Co-ordinate coupling – Principal Co-ordinates – Torsional vibrations – Hoizer method – Work & Energy approach.

UNIT III **9**

TRANSIENT VIBRATIONS

Transient vibration – Time dependency – Laplace transforms – Step inputs - Pulse inputs – Impulse function – Duhamel's integral – Phase plane method – Shock spectrum.

UNIT IV **9**

MULTI DEGREE OF FREEDOM SYSTEMS

Multi degree of freedom – Equations of motions – Solution – Orthogonality of normal modes – Continuous Systems – Free & forced vibrations – Vibration analysis by FEW.

UNIT V **9**

VIBRATION MEASURING SYSTEMS

Vibration instruments – Vibration absorber – Elastically supported dampers –Seismic instruments – Vibrometres – Pickups – Accelerometers – Mounting instruments – Amplitude & Phase distortions .

Total Periods: 45

TEXTBOOKS :

1.G.K.Grover-Mechanical vibrations Namchand& Bros. 1996.

2.V.P.Singh-Mechanical Vibrations-DhanpatRai& Co.2000.
3.S.S. Rao Mechanical Vibrations, Pearson Education 1995.

REFERENCES:

1. W.T. Thomson-Theory of Vibration-Uniwin Hyman Ltd/cBS Publishers, 1990.
2.Francis. S. Tse, Iran, E.Morse, Rolland. T.Hinkle-Mechanical Vibrations –CBS Publishers,1983.
3.S.P.Timoshenko-Vibration problems in Engineering-CBS Publishers

Course Code MMD 102	**Course Name: ADVANCED STRENGTH OF MATERIALS**	**L**	**T**	**P**	**C**
	Total Contact Hours:	3	0	0	3
	Prerequisite: MECHANICS OF SOLIDS				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

To understand the strain/displacement and Hooke's law relationships

- To solve torsion problems in bars and thin walled members
- To solve for stresses and deflections of beams under unsymmetrical loading
- To locate the shear center of thin wall beams

COURSE OUTCOMES (COs)	
CO1	Understand and analyze stresses and strains at a point.
CO2	Determine stress-strain relations for linearly elastic members using normal stress, shear stress
CO3	Learn distortion energy theories.
CO4	Model and analyze mechanical structures using energy methods.
CO5	Design straight beams, curved and asymmetrical bending of beams.

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

1	COs/Pos	a	b	c	d	e
2	CO1	L				H
	CO2		H			
	CO3			M		
	CO4		L		M	
	CO5	H				

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

UNIT I
UNSYMMETRIC BENDING AND SHEAR CENTER

Unsymmetric bending of straight beams – Generalized theory –Bending stresses –deflection-Transverse shear stress-Shear centers of thin walled sections.

UNIT II **9**

CURVED FLEXURAL MEMBERS

Circumferential stress-Radial stress and Shear stress – closed rings subjected to concentrate loads-crane hooks – Chain links

UNIT III **9**

TORSION AND CONTACT STRESSES

saintVenant theory –Membrane analogy – thin walled open sections – Thin walled multicell tubes - Warping of thin walled open and closed cross sections – Contact Stresses – Spheres and Cylinders.

UNIT IV **9**

STRESSES DUE TO ROTATION, FLAT PLATES

Spinning disks – Flywheels – Flat disks – variable thickness – Uniform strength – Allowable speeds . Symmetrically loaded circular plate. Circular plate freely supported at its circumference, circular plate with central hole, Freely supported at its circumference, Circular plate clamped at its circumference, Bending of rectangular plates.

UNIT V **9**

THEORY OF ELASTICITY

General Equations of Elasticity- Cartesian and Polar – Equilibrium and stresses – Compatibility of Strains – Boundary conditions – Stress tensors – Saint Venant's Principle – Plane stress – Plane strain – Airy's stress function.

Total periods: 45

TEXTBOOKS :

1. Budynas –advanced Strength and Applied Stress Analysis. Tata McGraw Hill, 1999.
2. . B.C. Punimia –Strength of Materials and Mechanics of Structures, 1996.

REFERENCES :

1. R.D. Cook, W.C. Young –Advanced Mechanics of Materials –Prentice Hall, 1999.
2. S.P. Timoshenko, J.N. Goodier –Theory of elasticity – McGraw Hill, 1987
3. S.P. Timoshenko – Strength of Materials – TMH, 1986.

Course Code MCD101	**Course Name: INTEGRATED PRODUCT DESIGN & DEVELOPMENT**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: MANUFACTURING TECHNOLOGY I & II				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES1. Understand the concept of integrated product and process development that combined the product design process to create a new standard for providing.
2. Gain the knowledge on the product design and development process.

COURSE OUTCOMES (COs)

CO1	Gain knowledge on the various process of design and processes involved in product development
CO2	Can do product analysis

CO3	Can do different economics analysis
CO4	Can do platform planning
CO5	Can do break even analysis

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

1	COs/Pos	a	b	c	d	e
2	CO1	L				
	CO2		H			
	CO3			M		
	CO4	L				
	CO5				H	
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th, 38th& 39thMeeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I FUNDAMENTALS OF DESIGN **9**

Product development – Marketing Design & Production-Design process – Morphology of design – Asimov's Model – Problem statement – Product design specifications – Concept selection techniques.

UNIT II **9**

PRODUCT STRATEGIES

Product strategies – Product analysis – Standardization, Simplification & Specialization – Creativity – Aesthetics – Ergonomics – functional Design – Hierarchy of Needs – Need analysis.

UNIT III **9**

ECONOMIC ANALYSIS

Customers & Competitors – Product value – Economic analysis – Qualitative & Quantitative Analysis – Profit considerations – Break even analysis – Profit volume charts.

UNIT IV **9**

PRODUCT ARCHITECTURE

Product Architecture – Modularity – Product change – Product variety – Component standardization – Performance – Manufacturability – Establishing the architecture – Variety & Supply chain – Platform planning.

UNIT V **9**

INDUSTRIAL PRACTICES

Conventional practices – recent trends – Technology & User driven products – Advertisements – Patents – Case studies.

Total Periods: 45

TEXTBOOK:

1.G.E.Dieter –engineering Design – McGraw Hill, 1991
2.Chitale, Guptha – Product Design & Manufacturing – Prentice Hall 1997.

References:

1.Karl. T.Ulrich, Steven D. Eppinger –ProductDesign &Development -McGraw Hill 2000

Course Code MMD104	**Course Name: FINITE ELEMENT ANALYSIS**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: MATHEMATICS				
	Course Designed by : Dept. of Mechanical Engineering				
OBJECTIVES1. To present the Finite element method (FEM) as a numerical method for					

engineering analysis of continua and structures 2. To present Finite element formulation using variational and weighted residual approaches 3. To present Finite elements for the analysis of bars & trusses, beams & frames, plane stres plane strain problems and 3-D solids, for thermal and dynamics problems

COURSE OUTCOMES (COs)	
CO1	Understand the concept of finite element method for solving machine design problems.
CO2	Formulate and solve manually problems in 1-D structural systems involving bars, trusses, beams and frames.
CO3	Develop 2-D FE formulations involving triangular, quadrilateral elements and higher order elements.
CO4	Apply the knowledge of FEM for stress analysis, model analysis, heat transfer analysis and flow analysis.
CO5	Develop algorithms and write FE code for solving simple design problems and understand the use of commercial packages for complex problems.

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

1	COs/Pos	a	b	c	d	e
2	CO1	L				H
	CO2		H			
	CO3			M		
	CO4	L			M	
	CO5					
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th, 38th& 39thMeeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I

BASIC CONCEPTS

Field problems – elementary treatments – Elements & types – Mathematical modeling –Steady state problems – Propagation problems – Eigen value problems – Differential formulation – Variational methods-Weighted residual methods – Convergence criteria – Error estimation.

UNIT II **9**

PROCEDURES & INTERPOLATIONS

Bar element – Mechanical & Thermal loads – Steps – Discretization – Element formulation-Connectivity-Global equation – Boundary conditions –Essential & Natural b.c -Solution – Post processing – Shape functions – Lagrange interpolation – Temperature & strain distributions, Heat transfer.

UNIT III **9**

ELASTICITY PROBLEMS

Elasticity concepts – Plane stress & strain – Element stiffness matrix – Strain – Displacement relations – Material property matrix – Constitutive relationship – Nodal forces using equilibrium – Euler – Bernoulli beam elements – Trusses & Frames

UNIT IV **9**

ISOPARAMETRIC FORMULATION

Node numbering – Transformation – Natural co-ordinates – Approximation of geometry – Isoparametric formulation – Gauss quadrature –Choice of quadrature rule –Stress calculations – Gauss point.

UNIT V **9**

FE IN STRUCTURAL DYNAMICS

Finite Elements in Structural Dynamics and Vibrations Dynamic equations- stiffness, mass and damping matrices- consistent and diagonal .mass matrices- Extraction of natural frequencies and modes- Reduction of number of degrees of freedom - modal methods - component mode synthesis- harmonic analysis response history- explicit and implicit direct integration- stability and accuracy

Total Periods :45

TEXTBOOKS:

1. K.Senthil- An Introductionto Finite element Analysis- Lakshmi Publication

REFERENCES:

1.J.N. Reddy-An Introduction to Finite Element Methods – McGraw Hill 1993.

2. K.J. Bathe – Finite Element Procedure-Prentice Hall of India 1997

3.O.C. Zienkiewicz-The Finite Element Methods –McGraw Hill 1989

4. T.R. Chandraputla. A.D. Bele-gundu- Introduction to Finite Elements in Engineering – Prentice Hall of India 1997.

Course Code MCD102	**Course Name: COMPUTER GRAPHICS**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: MANUFACTURING TECHNOLOGY				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

To Impart Knowledge Regarding Geometric Transformation, Geometric Modeling etc**.**

COURSE OUTCOMES (COs)

CO1	Understand geometric transformation techniques in CAD
CO2	Develop mathematical models to represent curves
CO3	Design surface models for engineering applications
CO4	Model engineering components using solid modeling techniques.
CO5	Design and analysis of engineering components

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

1	COs/Pos	a	b	c	d	e
2	CO1	M	L	-	-	-
	CO2	H	M	-	-	-
	CO3	H	M	-	L	-
	CO4	H	M	M	H	-
	CO5	H	H	H	H	-

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

UNIT I

BASICS

Graphics & Design-User interfaces – Graphic hardwares-Work stations –Processors-Displays-Input devices-Hard copy devices-graphic software-Co-ordinates – Functions-Standards.

UNIT II **9**

GEOMETRIC TRANSFORMATION

Output primitives-Points & Lines-DDA &Bresenham's algorithms-Circles –Mid point algorithms-Geometric transformations-scaling-Translation-rotation-Shearing-Reflection-concatenation.

UNIT III **9**

GEOMETRIC MODELING

Geometric modeling-Wire frame models-Parametric representation of analytic curves Synthetic curves-Bezier curves-Cubic splines-B-splines –Surface models-Analytic surfaces-Bezier surfaces-Coon surfaces-Triangular patches.

UNIT IV **9**

SOLID MODEL REPRESENTATION

Solid models-Representations-Boundary representation-Constructive Solid Geometry-Analytical solid modeling-Modeling packages.

UNIT V **9**

DATABASE AND DOCUMENTATION

Graphic standards-Graphic Kernel system-Database-Working Co-ordinate system -Model Co-ordinate system-Screen Co-ordinate system –Documentation-IGES-Data representation-File structure & Format-Processors.

Total Periods:45

TEXTBOOK:

1. M.PaulineBaker,DonaldHrarn-Computer Graphics-Prentice Hall of India 1993.

REFERENCES:

2. Ibrahim Zeid-CAD CAM Theory & Practice-McGraw Hill 1998

Course Code MCD1L1	**Course Name: CAD LABORATORY-1**	**L**	**T**	**P**	**C**
	Total Contact Hours: 60	0	0	4	2
	Prerequisite: CAD LABORATORY (B-TECH)				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

For giving hand on experience of using modeling software's like AUTO CAD,Cre0(Pro-E) etc. and to develop for simple programs.

COURSE OUTCOMES (COs)

CO1	Develop Auto LISP programs for drawing machine elements
CO2	Develop codes for analytical and synthetic curves
CO3	Draw machine elements in sketches
CO4	Drawing the assembly models for machine elements such as Knuckle Joint, Universal Joint, Screw Jack, and plumber block etc
CO5	Validate DXF, IGES and STEP formats for exchange of CAD files

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

1. Creation of working drawings of components and preparation of assembly models of Knuckle joint, Universal joint, screw jack, Plummer Block, Machine vice, Lathe chuck, Connecting rod, piston assembly etc., by using the following techniques.

a. Sketching
   b. Part modeling
   c. Surface modeling
   d. Assembly

2. Generation of solid models using Constructive Solid Geometry(CSG) and Boundary representation (B-rep)

3. Draw the Shear force and Bending moment diagrams for the following beams using ANSYS packages.

a. Simply supported beam (point load & uniformly distributed load)
b. Cantilever beam (point load & uniformly distributed load)

4. Determine the natural frequency using FEA

5. Two-dimensional problems in static & dynamic analysis, Thermal analysis .

6. Working with IGES files and importing solid models from IGES files

7. Exercises in database management , familiarization with multiple file operations and preparation of various reports with respect to CIM.

Course Code MCD201	**Course Name:OPTIMIZATION IN MECHANICAL ENGINEERING**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: MATHEMATICS				
	Course Designed by : Dept. of Mechanical Engineering				
OBJECTIVESTo impart knowledge regarding various parameters of optimization.					
COURSE OUTCOMES (COs)					
CO1	To understand how to optimize functions.				

CO2	Gain knowledge of fundamentals and classification of various optimization techniques.
CO3	Understand the concepts of non-linear programming and various search methods.
CO4	Provide knowledge on geometric programming.
CO5	Understand the knowledge of optimization in designing of various machine elements

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

1	COs/Pos	a	b	c	d	e
2	CO1	M				
	CO2	H	M		M	M
	CO3	H				
	CO4	H	H		H	
	CO5					
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th, 38th& 39thMeeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I **9**

INTRODUCTION

Engineering application of optimization. Statement of an optimization Problem-Design Vector, Design constraints, constraint surface-Objective functions – Objective function Surfaces, Classification of optimization Problems.

UNIT II **9**

NON LINEAR PROGRAMMING

One dimensional minimization Methods – elimination methods – Unrestricted search – Exhaustive Search- Dichotomous search-Interval halving methods-fibonacci method-golden section method-Interpolation methods-quadratic interpolation method, cubic interpolatin method.

UNIT III **9**

NON LINEAR PROGRAMMING ON CONSTRAINED OPTIMIZATION TECHNQIQUES

Random search method-Random jumping method. walk method, walk method with distance, Grid search method, Indirect search method, Steepest descent (Cauchy) method, conjugate method, Newton's method. Quasi-Newton method.

UNIT IV **9**

OPTIMIZATION IN THE DESIGN PARAMETERS

Single response optimization using Taguchi method, Genetic algorithm & simulated Annealing Techniques, Neural Network Based optimization.

Total Period : 45

TEXTBOOK:

1.S.S. Rao, Engg Optimization Theory & Practice, Third Edition, New Age Publication, 1996.

REFERENCE :

2. Kalyanmoy Deb, Optimization for Engg. Design Algorithms & Examples, PHI. 1995.

Course Code MCD202	Course Name: COMPUTER AIDED MANUFACTURIN	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: MANUFACTURING TECHNOLOGY				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

- To understand the management of design of product & processes, facility location & layout, capacity & resource & planning, and the modern trends in operations management
- To understand the construction, working and different controls of Computer Numerical Control machines, basics of manual CNC programming and also of Programmable Logic Controllers

COURSE OUTCOMES (COs)

CO1	Understand the effect of manufacturing automation strategies and derive production metrics
CO2	Analyze automated flow lines and assembly systems, and balance the line
CO3	Design automated material handling and storage systems for a typical production system.
CO4	Design a manufacturing cell and cellular manufacturing system
CO5	Develop CAPP systems for rotational and prismatic parts

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

1	COs/Pos	a	b	c	d	e
2	CO1	M				
	CO2	H	M		M	M
	CO3	H				
	CO4	H	H		H	
	CO5	M	H		M	
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th, 38th& 39thMeeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I
AUTOMATION AND NUMERCAL CONTROL

Types of production – Automation strategies-Numerical control systems –NC Part programming – Manual Part programming – Computer assisted Part programming-Part programming language-APT language.

UNIT II **10**

CNC AND DNC

Computer Numerical Control – Principles of Operation – Features – Developments – After DNC – Direct Numerical Control – Features – Programmable Logic controllers – Communication networks – In process gauging –Configuration of CNC systems.

UNIT III **9**

INDUSTRIAL ROBOTICS

Robots –definition – Basic terminologies – End effectors, sensors used in robots – Robot control systems – Programming of industrial robots – methods – Robot programming languages.

UNIT IV **9**

GROUP TECHNOLOGY AND FLEXIBLE MANUFACTURING SYSTEMS

Part families –classification and coding –Production Flow analysis – Machine cell Design –FMS workstations – analysis methods – Automated material handling - Types – Automated storage and retrieval systems.

UNIT V **8**

MANUFACTURING PLANNING SYSTEMS AND PROCESS CONTROL

Role of computers in Process Planning –CAPP – Computer integrated production planning system-MRP – Computer process interface-Process monitoring –Supervisory computer control specified as Materials requirement planning – Monitoring using computers – Methods and Strategies.

Total Periods:45

TEXTBOOKS:

1.Mikell. P. Groover, "Automation, Production and Systems and Computer Integrated Manufacturing" Prentice Hall of India Pvt. Ltd 2002 Ed.
2.Radhakrishnan P and Subramanyam. S CAD/CAM/CIM Wiley Eastern Ltd., 2000

REFERENCES :

1.YoramKoren, Computer Integrated Manufacturing Systems McGraw Hill 1998.
2.P.N.Rao, Tewari, Kundra Computer Aided Manufacturing Tata McGraw Hill 1993

Course Code MCD204	Course Name:COMPUTER AIDED MACHINE ELEMENT DESIGN	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: MACHINE DESIGN I & II				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

To impart adequate knowledge in designing transmission machine elements such as spur gears, helical gears, worm gears and etc.

The student will also learn some Case studies of Design of Power Transmission System [mechanical and hydraulic systems] to reinforce their concepts

COURSE OUTCOMES (COs)	
CO1	Learn to design machine elements
CO2	Understand the importance of data communications in CIM environment
CO3	Understand the concepts in multiplexing
CO4	Identify the errors in communications and apply correction strategies
CO5	Analyze the role of OSI model in the design of communication protocols

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

1	COs/Pos	a	b	c	d	e
2	CO1	M	L	L		
	CO2	L	M	L	L	
	CO3	L	L	L	L	H
	CO4	L	M	L		H
	CO5	M	L	L		H
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th, 38th& 39thMeeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT I **6**

INTRODUCTION

Design phases-Machine elements terminologies – Standardization, Interchangeability-Tolerances for process and function – Individual and group tolerances – fits –fits for various design situations – Design for assembly – modular constructions – Concepts of integrations.

UNIT II **6**

SHAFTS

Shafts – applications – Design and analysis –Detailed design – Preparation of production drawings-integrated design of shaft, bearing and causing – Design for rigidity.

UNIT III **18**

DESIGN OF MACHINE ELEMENTS USING CAD

Gears – Principles of gear tooth action – Gear correction – Gear tooth failure modes – Loads acting on gears –Stresses – Design of various types of gears – spur, helical, bevel and worm gears – Design of subassembly – Integrated design of speed reducers and multi speed gear boxes – Design using software packages.

UNIT IV **5**

CLUTCHES

Integrated design of automobile clutches – over running clutches

UNIT V **5**

BRAKES

Vehicle braking – Analysis- Dynamic and thermal aspects-Integrated design of brakes for machine tools. Automobiles and mechanical handling equipments.

Total Periods: 45

TEXTBOOKS:

1. T.J. Prabhu "Fundamentals of Machine Design 2002
2.T.J. Prabhu ,Design of Transmission element 2003

REFERENCES :

1.Shigley.J.E.Mechanical Engineering Design "McGraw Hill 1996
2.Juvinall. R.L.C Fundamentals of Machine component Design
John Wiley 1998.
3.Maitra. G.M. ''Hand book for Gear Design'', Tata McGraw Hill, 1998.

4.Newcomb. T.P. and Spur. R. T., ''Automobile brakes and braking system'', chapman and Hall, 2nd edition, 1975.

Course Code MMD2L1	Course Name:DESIGN AND ANALYSIS LAB	L	T	P	C
	Total Contact Hours: 60	0	0	4	2
	Prerequisite: CAD LABORATORY I				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

1. Enhance interest in learning the design and analysis of components using software's such as Pro-E, Ansys and MATLAB etc.
2. Understand the various concepts of analysis of mechanical systems.
3. Understand the concepts of finite element analysis involving mechanical, structural and thermal related problems

COURSE OUTCOMES (COs)

CO1	Develop the concepts and design the machine elements.
CO2	Analyze any mechanical components and visualize the results.
CO3	Take up any FEA related work and can solve it efficiently.
CO4	Can do c-program for different structures truss beam and frame problems.
CO5	Can solve problems using MATLAB.

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

1	COs/Pos	a	b	c	d	e
2	CO1	L				H
	CO2		H			
	CO3			M		
	CO4					
	CO5					
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th, 38th& 39thMeeting of Academic Council, May 2015, Jan 2016 & April 2016				

1. Write a C program for
   (i) Truss problems
   (ii) Beam problems
   (iii) Frame problems
2. Deflection of beams
   (i) Simply supported Beam
   (ii) Cantilever Beam
3. Combined loading problems. Eccentric loading problem.
4. Analysis of frames
5. Moment of Intertia and center of gravity of complex structures
6. Torsion of circular shaft.
7. Stresses and strains for varying sections.
8. Shell problems
9. Vibration problems
10. 3-D problems
11. Using MATLAB
    (i) Find velocity and acceleration for simple mechanisms
    (ii) Solution to the position of a four bar linkage
    (iii) Dynamics simulation of slider crank mechanism
    (iv) Design of four bar mechanism.

Total Periods: 60

Course Code	**Course Name: VIBRATION CONTROL AND CONDITION MONITORING**	L	T	P	C
MMD001	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

Gain knowledge on fundamentals of various degrees of freedom. Understand the concept of active vibration control. Learn condition based maintenance principles and applications. Gain knowledge on dynamic balancing and alignment of machinery. Gain knowledge on

vibration control.						
COURSE OUTCOMES (COs)						
CO1	Fundamentals of various degrees of freedom.					
CO2	Active vibration control.					
CO3	Condition based maintenance principles and applications.					
CO4	Dynamic balancing and alignment of machinery					
CO5	Vibration 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	L				H
	CO2		H			
	CO3			M		
	CO4		M			
	CO5					H
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/
				√		
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT – I

INTRODUCTION **9**

Fundamentals of single degree of freedom systems – two degree of freedom systems – multi degree of freedom systems – continuous systems – determination of natural frequencies and mode shapes – numerical methods in vibration analysis.

UNIT – II

VIBRATION CONTROL 9

Introduction – reduction of vibration at source – control of vibration – structural design – material selection – located additions – artificial damping – resilient isolation – vibration – isolation – vibration absorbers.

UNIT – III

ACTIVE VIBRATION CONTROL 9

Introductions – concepts and applications – smart materials – types and characteristics smart structures – characteristic active vibration in smart structures.

UNIT – IV

CONDITION BASED MAINTENANCE PRINCIPLES AND APPLICATIONS 9

Introduction – condition monitoring methods – the design of information system, selecting methods of monitoring, machine condition monitoring and diagnosis – vibration severity criteria – machine maintenance techniques – machine condition monitoring techniques – vibration monitoring techniques – instrumentation systems – choice of monitoring parameter.

UNIT – V

DYNAMIC BALANCING AND ALIGNMENT OF MACHINERY 9

Introduction, Dynamic balancing of rotors, field balancing in one plane two planes and in several planes – machinery alignment, "Rough" alignment methods – the face peripheral dial indicator method – reverse indicator method.

Total Periods: 45

References:

1. SINGIRESU S. RAO "Mechanical Vibration' Addison – Wesley publishing co, 1995.
2. RAO. J.S. "Vibratory conditional monitoring of machines" CRC Press 2000.
3. J.O. Den hartog – "Mechanical Vibrations" "McGraw Hill Newyork, 1985.
4. SCIENCE ELSEVIER – "Hand Book of condition monitoring" ELSEVIER SCIENCE 1996.

Course Code	Course Name: ADVANCED DESIGN OF TRANSMISSION SYSTEM	L	T	P	C
MMD201	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

To impart adequate knowledge in designing transmission machine elements such as spur gears, helical gears, worm gears and etc.

The student will also learn some Case studies of Design of Power Transmission System [mechanical and hydraulic systems] to reinforce their concepts.

COURSE OUTCOMES (COs)

CO1	The students will be able to Select / Design of various Mechanical and hydraulic

	Power transmission system in real life industrial environment
CO2	The students will be able to think logically to design the various Mechanical and hydraulic Power transmission system which will enhance the efficiency and effectiveness of the industries.
CO3	: In general the students will be able face the challenges of the industrial environment by Selecting/ using the right drive or transmission element
CO4	After learning this Course the student will understand the Detail Design Procedure the Transmission Systems – Mechanical, Hydraulic, Pneumatic general description and comparison.
CO5	The student will also learn some Case studies of Design Of Power Transmission System [mechanical and hydraulic systems] to reinforce their concepts

Mapping of Course Outcomes with Program outcomes (POs)

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

1	COs/Pos	A	b	c	d	E
2	CO1	H				H
	CO2		H			
	CO3			M		
	CO4					
	CO5				L	
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT – I

Profile correction of gears – Types of corrected gearing – Design of internal spur gears – Design of Epicyclic gears.

UNIT – II

Helical gear terminology and relation – Equivalent spur gear – Profile correction – Contact ratio – Design of Crossed Helical gears – Design of herringbone gears.

UNIT – III

Profile bevel gears – correction – Spiral bevel gear – geometry and basic relations – Different systems – Forces on shaft carrying spiral , bevel gear – Design procedure for spirals bevel gears.

UNIV IV

Design of friction drives - Rating of Spur, Helical and Worm gears.

UNIT – V

Design of Spur helical, bevel and worm gear speed reducers – Design of Bearing and shafts – Layout of the reducer. This unit should carry 40 marks).

References:

1. T.J. Prabhu , Design of transmission Elements 2002
2. Handbook of gear design – MaitraTMH , 1994.
3. PSG Design Data Book 2003.

Course Code MMD205	**Course Name: MACHINE TOOL DESIGN**	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

Understand the importance of tool design for productive manufacturing and the basic procedure of tool design, drafting of tool drawing etc.

Bring in the required properties in the tool material by proper selection and heat treatment appropriate to the cutting process adopted.

Understand the concepts of tolerance and make use of gauges to measure the same Understand the design concepts of Jigs & Fixtures

Get proper knowledge in the latest area of tooling for CNC machines

COURSE OUTCOMES (COs)

CO1	The conventional practice and procedures adopted for tools & Design such as problem statement, Drafting Hole location, Bush installation etc is understood

CO2	The knowledge on materials for cutting tools, heat treatment required for different materials and different types of tools is obtained
CO3	The design of dies, gauges and the importance of tolerance in the manufacturing an inspection of dies & gauges is understood
CO4	Jig & Fixtures design for all type of machine tool is done appropriately.
CO5	Tooling for CNC machine tools and automatic machine are also made effectively

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

UNIT – I **9**

Introduction – working and auxiliary motion in machine tools – parameters defining working motions of a machine tool – machine tool drives – hydraulic transmission and its elements – mechanical transmission and its elements – general requirements of machine tool design – engineering design process applied to machine tool – layout of machine tool.

UNIT – II **9**

Design of feed box – Machine tool driven using multiple speed motors – gearbox design – determining the number of teeth of gears – classification of speed and feed boxes – step less regulation of speed and feed rates.

UNIT – III **9**

Design of machine tool structures – design criteria for machine tool structures – material for machine tool structures – static and dynamic stiffness – profiles of machine tool structures – design procedure of machine structures – design of beds columns, housings, and boss of tables – model techniques in design of machine tool structures.

UNIT – IV **9**

Design of guide ways and slideways power screw, design of rails, arms, saddles and carriage – design of rams.

UNIT – V **9**

Design of spindle spindle supports.

Total Periods: 45

References:

1. N.K. Metha, Machine tool design and Numerical Controls, Tata McGraw Hill, 1998.
2. Sen, Bharracharya, Principles of Machine tools. New Control Book Agency (P) Ltd. Kolkata, 1995.

Course Code MCD002	Course Name: CONCURRENT ENGINEERING	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite: PRODUCT DESIGN AND DEVELOPMENT/ PROCESS PLANNING				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES :

- Market share and profitability are the major determinants of the success of any organization.
- The factors that influence and improve the competitive edge of a company are unit cost of products, quality, and lead time.
- Concurrent engineering (CE) has emerged as discipline to help achieve the objectives of reduced cost, better quality, and improved delivery performance. CE is perceived as a vehicle for change in the way the products and processes are designed, manufactured, and distributed.

COURSE OUTCOMES (COs)

CO1	Concurrent engineering is a management and engineering philosophy for improving quality and reducing costs and lead time from product conception to product development for new products and product modifications
CO2	Understand the need of concurrent engineering and strategic approaches for product design
CO3	Apply concurrent design principles to product design.
CO4	Design assembly workstation using concepts of simultaneous engineering.
CO5	Design automated fabricated systems – Case studies

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

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	M	L	

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

UNIT – 1

INTRODUCTION **6**

Concurrent Engineering – Detailed definition – CE design methodologies – Organization for CE – CE tool box collaborative product development.

UNIT II

INFORMATION TECHNOLOGY AND CONCURRENT ENGINEERING **9**

Use of IT in CE – Solid modeling – Product data management – Collaborative product commerce – Artificial intelligence – Software & hardware- co – design.

UNIT- III

DESIGN STAGE **10**

Life cycle – design of products – Opportunity for manufacturing enterprises – Modality of CE – Automated analysis idealization control – Concurrent engineering in optimal structural design – real time constraints.

UNIT – IV

MANUFACTURING CONCEPTS AND ANALYSIS **10**

Manufacturing competitiveness – Checking the design process – Mechanism of conceptual design – Qualitative physical approach – JIT system – low inventory – Modeling and reasoning for computer based assembly planning – Design of automated manufacturing system.

UNIT – V

PROJECT MANAGEMENT **10**

Life cycle semi realization – Design for economics – Design evaluation for manufacturing cost – Concurrent mechanical design – Decomposition in concurrent design – Negotiation in concurrent engineering design studies – Product realization taxonomy – Plan for project management on new development – Bottleneck technology development.

Total Periods: 45

TEXTBOOK:

1. Prasad, "Concurrent Engineering Fundamentals : Integrated Product Development", Prentice Hall, 1996.

REFERENCES:

1.AndrewKusaik, "Concurrent Engineering : Automation Tools and Technology". Wiley John and Sons Inv., 1992.

2. Anderson MM and Hein. L. Berlin. "Integrated Product Development." Springer Verlog. 1987.

Course Code	Course Name: TOOL DESIGN	L	T	P	C
MMD003	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				
OBJECTIVES	Understand the importance of tool design for productive manufacturing and basic procedure of tool design, drafting of tool drawing etc., Bring in the required propertie the tool material by proper selection and heat treatment appropriate to the cutting proc adopted. Understand the concepts of tolerance and make use of gauges to measure the sa Understand the design concepts of Jigs & Fixtures Get proper knowledge in the latest area				

tooling for CNC machines	
COURSE OUTCOMES (COs)	
CO1	Understand the importance of tool design for productive manufacturing and the basic procedure of tool design, drafting of tool drawing etc.,
CO2	Bring in the required properties in the tool material by proper selection and heat treatment appropriate to the cutting process adopted.
CO3	Understand the concepts of tolerance and make use of gauges to measure the same
CO4	Understand the design concepts of Jigs & Fixtures
CO5	Get proper knowledge in the latest area of tooling for CNC machines

Mapping of Course Outcomes with Program outcomes (POs)

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

1	COs/Pos	a	b	c	d	e
2	CO1	L				H
	CO2		H			
	CO3			M		
	CO4		L			
	CO5					M
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/
				√		
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT – I **8**

Machanics of chip formation – chip control-chip breakers – cutting forces and measurements merchant's theory – specific cutting energy – shear angle – theory of lee and Shaffer – friction in cutting – measurements of cutting temperatures – influence of tool geometry on cutting forces.

UNIT – II **8**

Tool materials – composition – selection and treatments – cutting fluids selection and types - tool wear determination – tool life – Taylors formula – feed, speed & depth of cut – life based on volume.

UNIT – III

Design of single point cutting tool – design of multipoint cutting tools – form tools – drills, milling cutters and broaches.

UNIT – IV

Design of simple, progressive compound dies – bending dies – bend allowances – bending pressure – metal flow in drawing – drawing force – single and double section draw dies – forging and dies.

UNIT – V

Design of blanking and piercing Dies – Die cutting operations – press tools power press types – cutting action in punch and die operation – die clearance – die construction centre of pressure – scrap strip layout – pilots – stripers and pressure pads – tooling for piercing.

Total Periods: 45

Reference:

1. Donaldson tool design 3rd edition, TMH, 1973.
2. Sen and Bhattacharya, principles of metal cutting CBS, 1995.
3. Basu, U- Fundamentals of tool engineering design oxford and IBH, 1990.
4. Colei B.C-tool design.
5. Nagpal GR-Tool engineering and design, khanna publication, 1999

Course Code MMD202	**Course Name: TRIBOLGY**	**L**	**T**	**P**	**C**
	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				
OBJECTIVES To provide broad based understanding of the interdisciplinary subject 'tribology' and its technological significanceTo understand the nature of engineering surfaces, their topography					

and learn about surface characterization techniques.Tto learn about the contact of solid surfaces and their interactions.To understand the genesis of friction, the theories/laws of sliding and rolling friction.To learn about consequences of wear, wear mechanisms, wear theories and analysis of wear problems.

COURSE OUTCOMES (COs)

CO1	Will be able to apply the principles of lubrication, lubrication regimes, and theories of hydrodynamic, elastic hydrodynamic and mixed / boundary lubrication
CO2	Will have knowledge of tribo testing and experimental techniques in Tribology.
CO3	Will have knowledge about tribological modeling and simulation
CO4	To understand the genesis of friction, the theories/laws of sliding and rolling friction.
CO5	To learn about consequences of wear, wear mechanisms, wear theories and analysis of wear problems

Mapping of Course Outcomes with Program outcomes (POs)

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

1	COs/Pos	a	b	c	d	E
2	CO1	H				H
	CO2		H			
	CO3			M		
	CO4					
	CO5	H			L	
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
			√			
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT – I

SURFACE FRICTION AND WEAR **11**

Topography of the surfaces, . Surface features, surface interaction , Friction – Sliding and rolling friction – Friction properties of Metallic and non Metallic Materials – Friction in extreme conditions – Wear – Types – Mechanism – Wear resistance Materials – Surface treatment – Surface Modifications – Surface coatings.

UNIT – II

ROLLING ELEMENT BEARINGS **12**

Geometry And Kinematics – Material And Manufacturing Processes – Contact Stress – Hertzian stress equations – stresses and deflections – axial loads and rotational effects, life capacity – variable loads – oil films – effects – Rolling Bearing failure.

UNIT – III

LUBRICATION THEORY **11**

Lubricants and their properties – Reynolds equations – thermal, intertia and turbulent effects – elastoplasto and magneto hydrodynamic lubrication – hydrostatic lubrication – gas lubrication.

UNIT – IV

DESIGN OF FLUID FILM BEARING **11**

Design and performance – thrust and journal bearings – full. Partial, fixed and pivoted. Bearings. Lubrication flow and delivery – power loss – heat and temperatures rotating loads and dynamic loads – hydrostatic bearing design.

Total periods: 45

References:

1. CAMERON, A Basic Lubrication Theory". ELLIS Herward LTD. UK. 1981.
2. WILLIAMS. J.A. "Engineering Tribology" Oxford Univ Press 1994.
3. Hulling.J. (Editor) – 'Principles of Tribology' Macmillan (1984).
4. PSG Design Data Book, 2003.

Course Code	Course Name: **DESIGN OF PRESSURE VESSELS AND PIPING**	L	T	P	C
MMD203	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

To understand the different types of stresses and their effects in pressure vessel.
To understand the piping layout and the stresses acting on it.

COURSE OUTCOMES (COs)

CO1	Will understand the different types of stresses and their effects in pressure vessel.
CO2	Will understand the piping layout and the stresses acting on it.
CO3	To understand the piping layout and the stresses acting on it.
CO4	To understand the different types of stresses and their effects in pressure vessel
CO5	To understand the different types of piping layout

Mapping of Course Outcomes with 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	L				S
	CO2		H			
	CO3			M		
	CO4	H			L	
	CO5					

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

UNIT – I

INTRODUCTION PRESSURE VESSELS & STRESS PATTERNS 9

Methods of determining stress – (1) strain gauges (2) photo elastic method (3) moiré fringe techniques terminology – ligament efficiency – applications.

UNIT – II

STRESSES IN PRESSURE VESSLES 9

Introduction – Hoop, longitudinal & radial stresses – general theory of maintain stresses – thin & thick cylinders – shell components – cylindrical shells – vessel heads – thermal stresses – discontinuity stresses in pressure vessels. Shrink fit – auto fuettage – ultrahigh pressure vessel design. Bursting pressure.

UNIT – III

DESIGN OF VESSELS 9

Design of Tall cylindrical self supporting process column – supports short vertical vessels – stress concentration – variable thickness transition section in cylindrical vessels. Circular hole – elliptical openings – theory of reinforced openings – Bolted & Welded joints – Design criteria & codes.

UNIT – IV

BUCKLING AND FRACTURE ANALYSIS IN VESSELS 9

Buckling phenomenon – Elastic budding of circular ring and cylinders under external pressure – collapse of thick walled cylinders of tubes under external pressure – effect of supports on elastic buckling of cylinders – inelastic collapse – Bulking under combined external pressure and axial loading. Interaction method.

UNIT – V

PIPING **9**

Introduction – Flow diagram – piping layout and piping stress analysis

Total Periods: 45

References:

1. JOHN. F. HARVEY. 'Theory and Design of Pressure Vessels.' CBSD Distribution 1987.
2. HENRY. H. BENDER. "Pressure Vessel Design Hand Book CBSD Publication and distributors 1987.

WILLIAM J. BEES 'Approximate methods design and analysis of pressure vessels and piping'. Piping Conference 1997

Course Code MMD206	**Course Name: DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS**	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

To know the advantages and applications of Fluid Power Engineering and Power Transmission System.

To learn the Applications of Fluid Power System in automation of Machine Tools and otl Equipments

COURSE OUTCOMES (COs)

CO1	Identify hydraulic and pneumatic components.
CO2	Ability to design hydraulic and pneumatic circuits
CO3	Demonstrate good grounding in the subject area of fluid power
CO4	Appreciate the circuits and feel the advantages over the similar mechanical systems
CO5	Gain knowledge regarding the use of special control and regulation element

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

UNIT – I

PUMPS **3**

Hydraulic power generator – selection and specification of pumps, pumps and characteristics.

UNIT – II

HYDRAULIC ACTUATORS **5**

Linear and Rotary Actuators – Selection, specification and characteristics.

UNIT – III

CONTROL AND REGULATION ELEMENT 6

Pressure direction and flow control valves, relief valves, non return and safety valves, actuation systems.

UNIT – IV

HYDRAULIC AND PNEUMATIC CIRCUITS 12

Reciprocation, quick return, sequencing circuits, synchronizing circuits, Accumulator circuits – industrial circuits – press circuits, Hydraulic milling machine, grinding, planning, copying, fork lift. Earth mover circuits – Design and selection of components – safety and emergency mandrels.

UNIT – V

PNEUMATIC SYSTEMS AND CIRCUITS 10

Fundamentals – control elements. Position and pressure sensing – logic circuits – switching circuits, Fringe condition modules and these integration, sequential circuits – casade methods – mapping methods – step counter method – compound circuits design, combination circuit design.

UNIT – VI

INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS 9

Pneumatic equipments – selecting of components – design calculations – application – fault finding – hydro pneumatic circuits – use of microprocessors for sequencing – PLC-low cost automation – Robotic circuits.

Total Periods: 45

References:

1. Antony EspossHo “Fluid Power with Applications” Prentice Hall 1980.
2. DUDLEYT. A Pease and JOHN. J. PIPPENGER “Basic Fluid Power” Prentice Hall 1987.
3. Andrew Parr. “Hydraulic and Pneumatics’ Jai Co Publishing House. 1999
4. Bolton W. ‘Pneumatic and Hydraulic Systems’ Butter Worth – Heinneman – 1997.
5. James L Johnson, Introduction to fluid power, Eswer press 2003

Course Code MCD003	Course Name: DESIGN FOR MANUFACTURING	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite:MANUFACTURING TECHNOLOGY				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

To educate students a clear understanding of factors to be considered in designing parts and components with focus on manufacturability

To know the concept of design for manufacturing, assembly and environment.

To know the computer application in design for manufacturing and assembly

COURSE OUTCOMES (COs)

CO1	To make the students get acquainted with the design for manufacturing, assembly and environment
CO2	Can do design alteration for preparing components based on casting process
CO3	Can do design alteration for preparing components based on forging process
CO4	Can do design alteration for preparing components based on welding process
CO5	Can do design alteration for preparing components based on machining process

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

1	COs/Pos	a	b	c	d	e
2	CO1	L				H
	CO2		H			
	CO3			M		
	CO4		L			
	CO5					L
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)

			√			
4	Approval	37th, 38th& 39thMeeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT-I INTRODUCTION **9**

General design principle for manufacturability – Process capability – Surface finish – Tolerances – Feature tolerance – Cumulative effect of tolerances – Surefit, Normal &Fruncated normal laws – Geometric tolerances.

UNIT -II

FITS AND ASSEMBLIES

Fits – Universal interchangeability – Selective Assembly – control of axial play – Second stage machining - laminated – Automated assemblies – Grouped datum systems Deciding the number of groups, Types.

UNIT –III **9**

POSITION THEORIES

True position theory- Virtual size concept – True position tolerancing – Fixed fasteners – Floating fasteners – Zero true position tolerances – functional gauging – Paper layout gauging.

UNIT-IV **9**

DESIGN

Form design of castings - Redesigning – Parting line consideration – Minimizing core requirements – Economic design of castings – Form design of weldments. – Welding symbols – Redesigning cast members using weldments- Economic weldments.

UNIT-V **9**

DESIGN FOR MACHINING/ASSEMBLY & INSPECTION

Design for assembly – Design for inspection – Design for machining – Redimensioning based on manufacturing datums – Design to reduce value addition – Parts cut to length – Machined round holes – Blind & Through holes – Design consideration for various machining operations.

Total Periods: 45

TEXTBOOKS :

1. M.F. SPOTTS- " Dimensioning &tolerancing for quantity production" – Prentice Hall
2. HARRY PECK- " Designing for manufacture" – Pitman publications, 1973.

REFERENCES:

1.JAMES G. BRALLA – " Hand Book of Product Design for Manufacturing."

Course Code	Course Name: **PRODUCTION AND OPERTIONS MANAGEMENT**	L	T	P	C
MCD004	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

To impart knowledge regarding trends in operation management, layout planning,Scheduling system

COURSE OUTCOMES (COs)

CO1	an forecast trends in operation management**.**
CO2	Can do layout planning**.**

CO3	Can do project management**.**
CO4	Capable of inventory control
CO5	Capable doing of master scheduling etc.

Mapping of Course Outcomes with Program outcomes (POs)

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

1	COs/Pos	a	b	c	d	e
2	CO1	L				H
	CO2		H			
	CO3			M		
	CO4	L				
	CO5				M	
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/
				√		
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT –I **9**

Introduction – trends in operation management – careers in production management – planning productivity and quality – fore casting.

UNIT – II **9**

Layout planning – types – developing the layouts – manufacturing cellular layout – improved performances – job design – production and operation standards – work measurement.

UNIT – III **9**

Project management – project planning project scheduling models – pert – CPM – solooting a port personal computer package

UNIT – IV **9**

Scheduling systems – Aggregate planning process – master scheduling – rough cut capacity planning – implementing Aggregate plans and master schedules.

UNIT – V **9**

Inventory control fundamentals – control application – material requirements planning – manufacturing resource planning – quality analysis and control

Total periods: 45

References:

1. Everff e Adam Jr. Ronald.J Ebert "production and operation management "PHI fifth edition 1992

2. Chary S.N "theory and problems in production and operation management "TMH 1997.

3. Panneerselvam.R."Productions and operations management "PHI, 1999

4. Buffa.E. "Modern production / operational management "John Wiley & Sons, 7th edition

5. Saravanavel .P. and Sumathi.S "production and materials management "Margham publications, Chennai-2000

Course Code	Course Name: **DESIGN OF JIGS AND FIXTURES**	L	T	P	C
MMD004	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

1. Understand the importance of tool design for productive manufacturing and the basic procedure of tool design, drafting of tool drawing etc.,

2. Bring in the required properties in the tool material by proper selection and heat

treatment appropriate to the cutting process adopted.

3. Understand the concepts of tolerance and make use of gauges to measure the same

4. Understand the design concepts of Jigs & Fixtures

5. Get proper knowledge in the latest area of tooling for CNC machines.

COURSE OUTCOMES (COs)

CO1	**CO1:** Understand the importance of tool design for productive manufacturing and the basic procedure of tool design, drafting of tool drawing etc.
CO2	: Bring in the required properties in the tool material by proper selection and heat treatment appropriate to the cutting process adopted
CO3	Understand the concepts of tolerance and make use of gauges to measure the same
CO4	Understand the design concepts of Jigs &Fixtures .
CO5	: Get proper knowledge in the latest area of tooling for CNC machines

Mapping of Course Outcomes with Program outcomes (POs)

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

1	COs/Pos	a	b	c	d	e
2	CO1	L				H
	CO2		H			
	CO3			M		
	CO4	L				
	CO5					M
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/
				√		

4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016

UNIT - I

Location and clamping devices – principles – need – types of location devices – types of clamping devices – clamping forces – hydraulic and pneumatic clamping systems.

UNIT – II

Fixtures – design principles – types of fixtures – fixtures for machine tools – lathe , milling, boring , and broaching.

UNIT - III

Fixtures for grinding, assembly, shaping, welding and inspection – clamping & other forces – designing.

UNIT – IV

Jings – objectives – design principles – types of drill jigs – clip control – drill bushing – advantages and limitations.

UNIT – V

Calculation of forces – design of drill jigs – leaf, box, plate – indexing and universal jigs.

Total periods: 45

References:

1. DONALDSON .C. Tool Design – Tata McGraw Hill Col Ltd, 1973.
2. KEMPSTER .Introduction of tool design and Jigs And Fixtures, ELBS, 1974.
3. Hiram .E. Grant – Jigs and Fixtures, TMH, 1971.
4. Korakow – fundamentals of jigs and fixtures, MIR publication, 1985.
5. Joshi .P.H. Jigs and fixtures TMH, 1990

Course Cod MMD103	Course Name: DESIGN OF MECHANISMS – I	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				

	Course Designed by : Dept. of Mechanical Engineering

OBJECTIVES

To include dynamics considerations in the design of mechanisms for engineering applications is the objective of this course.

COURSE OUTCOMES (COs)

CO1	Understand basic principles of Mechanism and machines.
CO2	Develop schematic models for physical systems and formulate governing equations of motion
CO3	Understand the three dimensional linkages and coupler curves
CO4	Understand and Analyze the various gear trains
CO5	Understand the principles of cam design

Mapping of Course Outcomes with Program outcomes (POs)

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

1	COs/Pos	a	b	c	d	e
2	CO1	L				S
	CO2		H			
	CO3			M		
	CO4					L
	CO5				H	
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/
				√		
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT – I

MECHANISMS & MACHINES BASIC CONCEPTS **9**

Mechanism – Tools for design of linkages & other mechanism – DOF (moblility) - transmission angle – Grash off criterion – Quick return mechanism – Limiting positions – Mechanism for specific applications.

UNIT – II

ANALYSIS OF MECHNISMS **9**

Displacement analysis of linkages – Complex number methods applied to velocity analysis – Analyzing combinations of basic linkages – Trial solutions & inverse methods – Acceleration analysis – Analysis of a four bar linkage using analytical vector method – Spatial linkage – Types – Analysis of four link spatial linkages.

UNIT – III
3D GEOMETRY & SPATIAL MECHANISM **9**

Three dimension & its Cartesian system – Algebraic Surfaces & Special curves – Algebraic special linkages – Quadratic surfaces – Ruled surfaces – Degree of ruled surfaces – Curvature of surface & spatial curves – Special coupler curves.

UNIT – IV

DRIVE TRAINS – DESIGN & ANALYSIS **9**

Velocity ratios for Spur & Helical gear trains – Speed ratio – Planetary gear trains – Other gear train elements – Velocity & Acceleration a planetary train – Forces ,forque& Transmitted power in gear trains.

UNIT – V

CAMS & GEARS – DESIGN & ANALYSIS **9**

Graphical cam design – Analysis of cam follower motion – Analytical cam design – Practical considerations in cam design – Fundamental law of gearing – Sliding action of gear tooth forces.

Advanced cam profile techniques – Graphical & Analytical cam profile synthesis – Cam modulated linkages.

Total Periods: 45

References:

1. Arthur G. Erdman, Goerge N. Sanctor – Mechanism Design Vol I & II Prentice Hall – 1997.
2. Charies E. Wilson J. Peter Seidler – Kinematics & Dynamic of Machinery, Second Edition.
3. K H. Hurt – Kinematic Geometry of Mechanisms, Oxford University Press 1978.

Course Code	Course Name: ENGINEERING DESIGN	L	T	P	C
MMD105	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

This course enables the student to identify failure modes and evolve design by analysis methodology. Design against fatigue failure is given explicit attention.

COURSE OUTCOMES (COs)

CO1	Understand the ethics followed during Engineering Design process.
CO2	Illustrate the methods to define the customer needs
CO3	Identify the sources of information to support and accelerate Engineering design process
CO4	Understand the intuitive and advanced methods used to develop and evaluate a concept
CO5	Express the basic concept of Embodiment Design to translate conceptual designs to Engineering designs

Mapping of Course Outcomes with 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	L				H
	CO2		H			
	CO3			M		
	CO4		H			

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

UNIT – I
MATERIALS SELECTION **9**

Mathematical modeling – Dimensional Analysis – Simulation – Material Selection – Methods of Material Selection Process – Selection with Computer Aided databases – Material performance indices – Decision matrices – Material selection by Expert systems – Value analysis – Recycling – Materials in design – Design for Fatigue failure – Brittle fracture – Corrosion resistance – Brittle materials – Plastics.

UNIT – II
PROCESS SELECTION **9**

Role of processing in design o Design for Manufacturability & Assembly – Computer methods for DFM and DPA – Design for Casing – Forging- Sheet metal forming – Machining – powder Metallurgy – Welding Design for Heat treatment – Plastics processing – Residual stresses in design .

UNIT – III
STATISTICS AND DESIGN **9**

Engineering statistics & design – Probability – Errors & samples – Frequency distribution – Measure of central Tendency and Dispersion – Normal distribution – Weibull and other frequency distributions – Sampling distributions – Statistical tests of Hypotheses – Statistical intervals – Analysis of variance – Statistical design of experiment – Regression analysis .

UNIT – IV
RELIABLILITY AND QUALITY OF DESIGN **9**

Reliability theory – Design for reliability – FMEA – Fault free analysis – Defects and failure modes – Failure analysis – Design for safety – Quality control and assurance – Quality improvement – Statistical process control – Taguchi method – Design optimization.

UNIT – V

COSTING IN DESIGN **9**

Decision making – Time value of Money – cost comparison – inflation – Sensitivity & Break even analysis – Categories of costs – Methods Costirntexes – Cost capacity factors – Estimating plant cost – Design to cost – Manufacturing costs – Value analysis in costing - over head costs – cost models – Life cycle costing.

Total Periods: 45

References:

1. GEORGEE.DIETER Engineering Design '3rd Edition – McGraw Hill international Editions-2000.

2. Michel F. Ashby. "Materials Selection in Machine Design ". II edition

3. AchinyaHalder, SomkasamMahadeven, "Probability, Reliability and "Statistical Methods in Engineering "', John Wiley and Sons.

4. YousufHaik, Engineering Design Process ", First Print 2003.

Course Code MMD002	Course Name: DESIGN OF MATERIAL HANDLING EQUIPMENTS	L	T	P	C
	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

To impart adequate knowledge regarding the design of material handling equipments such hoist conveyor, elevators etc

COURSE OUTCOMES (COs)

CO1	Can design material handling equipments
CO2	Can design drives of hoisting gears
CO3	Can design conveyors
CO4	Can design elevators
CO5	Can design different brakes for material handling equipments.

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

1	COs/Pos	a	b	c	d	e
2	CO1	L				H
	CO2		H			
	CO3			M		
	CO4	L				
	CO5					M
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT – I

MATERIAL HANDLING EQUIPMENT **4**

Types, selection and applications

UNIT – II

DESIGN OF HOISTS **15**

Hoisting, elements – wheeled and roller chains – hemp and wire ropes – factors to be considered in design of ropes. Pulleys, pulley system, sprockets and drums – load handling attachments – design of forged hooks and eye hooks – crane grabs – lifting magnets – grabbing attachments – design of arresting gear – brakes shoe, band and cone types.

UNIT – III

DRIVES OF HOISTING GEAR **6**

Hand and power drives – travelling gear – rail traveling mechanisms – cantilever and monorail canes – slewing, jib and fluffing gear – cog wheel drive motor rating selection.

UNIT – IV

CONVEYORS **10**

Types – description – design and application of belt conveyors – apron conveyors and escalators – pneumatic, screw & vibratory conveyors.

UNIT – V

ELEVATORS **10**

Types – description – bucket elevators – arrangements – cage elevators – shaft ways guides counter weighty – hoisting machine – safety devices – forms lift trucks.

Total Periods: 45

References:

1. Rudenko N Material handling equipment, Elnvee Publishers 1981
2. Spivakovsy A.O. and Dyachkov V.K. Conveying machines, volume I and II, MIR Publishers , 1985.

3. Alexandrov M. Material Handling Equipment, MIR Publisher, 1981.

Bolizharol. A. Material handling handbook, The Ronald Press Company, 1958.

Course Code	Course Name: COMPOSITE MATERIALS AND MECHANICS	L	T	P	C
ED7003	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVESTo understand the fundamentals of composite material strength and its mechanical behavi

Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber. Thermo-mechanical behavior and study of residual stresses in Laminates during processing.Implementation of Classical Laminate Theory (CLT) to study and analysis for residualStresses in an isotropic layered structure such as electronic chips

COURSE OUTCOMES (COs)

CO1	1. To understand the fundamentals of composite material strength and its mechanical behavior

	Stresses in an isotropic layered structure such as electronic chips.
CO2	Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
CO3	Thermo-mechanical behavior and study of residual stresses in Laminates during processing
CO4	Implementation of Classical Laminate Theory (CLT) to study and analysis for residual Stresses in an isotropic layered structure such as electronic chips.
CO5	At the end of the course the students will be in position to understand the mechanics and design related to layered components such as fiber reinforced polymer composites, isotropiclayered structures (example electronic chips) etc and its manufacturing methodologies.

Mapping of Course Outcomes with Program outcomes (POs)

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

1	COs/Pos	a	b	c	d	e
2	CO1	L				H
	CO2		H			
	CO3			M		
	CO4	L				
	CO5					
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)
				√		
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

.

UNIT I INTRODUCTION TO COMPOSITE MATERIALS 10

Definition-Matrix materials-polymers-metals-ceramics - Reinforcements: Particles, whiskers,inorganic fibers, metal filaments- ceramic fibers- fiber fabrication- natural composite wood, Jute - Advantages and drawbacks of composites over monolithic materials. Mechanical properties and applications of composites, Particulate-Reinforced composite Materials, Dispersion-Strengthened composite, Fiber-reinforced composites Rule of mixtures-Characteristics of fiber-Reinforcedcomposites, Manufacturing fiber and composites,

UNIT II MANUFACTURING OF COMPOSITES 10

Manufacturing of Polymer Matrix Composites (PMCs)-handlay-up, spray technique, filament winding, Pultrusion, Resin Transfer Moulding (RTM)-, bag moulding, injection moulding, Sandwich Mould Composites (SMC) - Manufacturing of Metal Matrix Composites (MMCs) - Solid state, liquid state, vapour state processing, Manufacturing of Ceramic Matrix Composites (CMCs) –hot pressing-reaction bonding process-infiltration technique, direct oxidation-interfaces

UNIT III INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS 12

Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Qij), Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT IV LAMINA STRENGTH ANALYSIS AND ANALYSIS OF

LAMINATED FLAT PLATES 8

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

UNIT V THERMAL ANALYSIS 5

Assumption of Constant Co-efficient of Thermal Expansion (C.T.E.) - Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

TOTAL: 45 PERIODS

REFERENCES

1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994,

Second Edition - CRC press in progress.

2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw-Hill, 1998

3. Issac M. Daniel and OriIshai, "Engineering Mechanics of Composite Materials",

Oxford University Press-2006, First Indian Edition - 2007

4. Mallick, P.K., Fiber –"Reinforced Composites: Materials, Manufacturing and Design", Maneel

Dekker Inc, 1993.

5. Halpin, J.C., "Primer on Composite Materials, Analysis", Techomic Publishing Co., 1984.

6. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John

Wiley and Sons, New York, 1990.

7. Mallick, P.K. and Newman, S., (edition), "Composite Materials Technology: Processes and

Properties", Hansen Publisher, Munish, 1990.

8. MadhujitMukhopadhyay, "Mechanics of Composite Materials and Structures", University Press

(India) Pvt. Ltd., Hyderabad, 2004 (Reprinted 2008)

9. Chung, Deborah D.L., "Composite Materials: Science and Applications", Ane Books Pvt.

Ltd./Springer, New Delhi, 1st Indian Reprint, 2009

Course Code	Course Name:ENGINEERING FRACTURE MECHANICS	L	T	P	C
	Total Contact Hours: 45	3	0	0	3

MMD005	Prerequisite:
	Course Designed by : Dept. of Mechanical Engineering

OBJECTIVESTo impart knowledge on mechanics of cracked components of different modes by which these components fail under static load conditions. To impart knowledge on mechanics of cracked components of different modes by which these components fail under fatigue load conditions.

COURSE OUTCOMES (COs)

CO1	It helps the engineers to get familiarized with the design of components that contain crack under static load condition
CO2	Identify and formulate the stress intensity factor ((K) for typical crack configurations
CO3	Define the near field equations to determine the stress-strain and load-displacement fields around a crack tip for linear elastic cases.
CO4	Identify and formulate the strain energy release rate (G).Identify and formulate J-integral and the stress and strain fields around a crack tip for non linear
CO5	Employ the standard and non standard fracture mechanics tests to determine the fracture Toughness of materials.

Mapping of Course Outcomes with 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	L				H
	CO2		H			
	CO3			M		
	CO4	L				
	CO5					

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

UNIT I ELEMENTS OF SOLID MECHANICS 9

The geometry of stress and strain, elastic deformation, plastic and elastic-plastic deformation - limit Analysis – Air's function – field equation for stress intensity factor.

UNIT II STATIONARY CRACK UNDER STATIC LOADING 9

Two dimensional elastic fields – Analytical solutions yielding near a crack front – Irwin's Approximation - plastic zone size – Dugdaale model – determination of J integral and its relation to crack opening displacement.

UNIT III ENERGY BALANCE AND CRACK GROWTH 9

Griffith analysis – stable and unstable crack growth –Dynamic energy balance – crack arrest mechanism –K1c test methods - R curves - determination of collapse load.

UNIT IV FATIGUE CRACK GROWTH CURVE 9

Empirical relation describing crack growth law – life calculations for a given load amplitude – effects of changing the load spectrum -- rain flow method– external factors affecting the K1c values.- leak before break analysis.

UNIT V APPLICATIONS OF FRACTURE MECHANICS 9

Crack Initiation under large scale yielding – thickness as a design parameter – mixed mode fractures - crack instability in thermal and residual stress fields - numerical methods

TOTAL: 45 PERIODS

REFERENCES:

1. David Broek, "Elementary Engineering Fracture Mechanics ", Fifthoff and Noerdhoff International Publisher, 1978.

2. KareHellan, "Introduction of Fracture Mechanics", McGraw-Hill Book Company, 1985.

3. Preshant Kumar, "Elements of Fracture Mechanics", Wheeler Publishing, 1999.

4. John M.Barson and StanelyT.Rolfe Fatigue and fracture control in structures Prentice hall Inc. Englewood cliffs. 1977

5. TribikramKundu, "Fundamentals of Fracture Mechanics", Ane Books Pvt. Ltd. New Delhi/ CRC Press, 1st Indian Reprint, 2012

Course Code	Course Name: **ROBOTICS**	L	T	P	C
MAE002	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				
OBJECTIVESTo study robot organizations.To study basics of artificial intelligence. To study ab robotic vision systems.					
COURSE OUTCOMES (COs)					

CO1	Define basic concepts in modeling and simulation (M&S)
CO2	Classify various simulation models and give practical examples for each category
CO3	Construct a model for a given set of data and motivate its validity
CO4	Generate and test random number varieties and apply them to develop simulation models.
CO5	Analyze output data produced by a model and test validity of the model.

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

.

UNIT-I ROBOT ORGANIZATION 9

Coordinate transformation, kinematics and inverse kinematics, Trajectory planning and remote manipulation

UNIT-II ROBOT HARDWARE 9

Robot sensors, proximity sensors, Range sensors, visual sensors, Ausitory sensors, Robot manipulators, Manipulator dynamics , Manipulator control, acts, end efforts, Robot grippers.

UNIT III ROBOT AND ARTIFICFAL INTELLIGENCE 9

Principles of Al , Basics of learning, planning movement, Basics of knowledge presentations, Robot programming languages.

UNIT IV

ROBOTIC VISION SYSTEMS 9 Principles of edge detection, Determining optical flow and shape, Image presentation, pattern recognition, Model directed scene analysis

UNIT V ROBOT CONTROL AND APPLICATION 9

Robot control using voice and infrared, overview of robot applications, prosthetic devices, Robots in material handling, processing assembly and storage.

Total Periods: 45

.

Text Books:

1. Koren,"Robtics for Engineers", MC Graw Hill International company, Tokyo, 1995
2. Vokopravotic, "Introduction to Robotics", Springer, 1998
3. Rathmill K, "Robet Technology and Application", Springer, 1985

Course Code	Course Name: SYSTEM MODELLING AND SIMULATION	L	T	P	C
MAE002	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

COURSE OUTCOMES (COs)

CO1	Classify various simulation models and give practical examples for each category
CO2	Construct a model for a given set of data and motivate its validity
CO3	Generate and test random number varieties and apply them to develop simulation models.
CO4	Analyze output data produced by a model and test validity of the model.
CO5	Explain the concept of output analysis of single model.

Mapping of Course Outcomes with Program outcomes (POs)

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

1	COs/Pos	a	b	c	d	e
2	CO1	H	H	H	M	H
	CO2		M	H	H	H
	CO3	M		M	M	M
	CO4	M	H	H	H	H
	CO5					M
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/ Internship (PR)

					√	
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT -I **12**

INTRODUCTION TO SIMULATION

Advantages and disadvantages of simulation, areas of application, System environment, Components of a system. Discrete and continuous systems, model of a system. Types of models. Steps in a simulation study, simulation examples: simulation of queuing systems, simulation of inventory systems. Discrete event simulation, general principles and computer simulation languages. FORTRAN, SIMSCRIPT, GPSS.

UNIT-II **12**

STATISTICAL MODELS IN SIMULATION

Review of terminology and concepts. Useful statistical models, discrete distributions, continuous distributions. Poisson process, Empirical distributions, Queuing models: Characteristics of queuing systems, queuing notations. Transient and steady state behaviour of queues, steady-state behaviour of infinite population, Markovan models, Steady state behaviour of finite population models.

UNIT-III **12**

INVENTORY SYSTEMS

Measures of effectiveness, inventory policies, deterministic systems probabilistic systems, simulation in inventory analysis.Random number generation. Properties of random numbers. Generation of pseudo-random numbers. Tests for random numbers. Random variate generation: Inverse transform technique, Direct transform for the normal distribution, convolution method. Acceptance-Rejection technique.

UNIT-IV **12**

INPUT DATA ANALYSIS

Data Collection, Identifying the distribution, Parameter estimation, Goodness-of-fit tests, Verification and validation of simulation models: Models Building, calibration and validation of models.

UNIT-V **12**

OUTPUT ANALYSIS FOR A SINGLE MODEL

Stochastic nature of 0/1 data, types of simulations with respect to O/P analysis, Measures of performance and their estimation, O/P analysis for terminating simulations, O/P analysis for steady-state simulations.

TOTAL NO OF PERIODS: 60

TEXT BOOKS

1) Jerry Banks, Carson. J.S., and Nelson B.L., "Discrete Event System Simulation", Prentice Hall of India, New Delhi, 2006.

2) Karian, Z. A., Dudewicz, E. J. (112121), "Modern statistical systems, and GPSS simulation: the first course", W. H. Freeman and Company, New York, 2005.

REFERENCES

1. System Modelling and Simulation, V.P.Singh, New Age International Publishers,2009.

2. Https://Shamsulsarip.Files.Wordpress.Com/2015/07/System-Modelling-And-Simulation.Pdf

3 0 0 3

Course Code	Course Name: RESEARCH METHODOLOGY	L	T	P	C
MMD205	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES To Get adequate knowledge about research concepts**.** To describe mathemat modeling and simulation**.** To understand experimental modeling**.** To get knowledge about interpretation of result**.**

COURSE OUTCOMES (COs)

CO1	To describe research concepts.
CO2	To Get adequate knowledge about mathematical modeling
CO3	To describe experimental modeling
CO4	To understand analysis of results.
CO5	To know about report writing

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

1. RESEARCH CONCEPTS 9

Concepts, meaning, objectives, motivation, types of research, approaches, research (Descriptive research, Conceptual, Theoretical, Applied & Experimental).
Formulation of Research Task – Literature Review, Importance & Methods, Sources, quantification of Cause Effect Relations, Discussions, Field Study, Critical Analysis of Generated Facts, Hypothetical proposals for future development and testing, selection of Research task.

2. MATHEMATICAL MODELING AND SIMULATION 9

Concepts of modeling, Classification of Mathematical Models, Modeling with Ordinary differential Equations, Difference Equations, Partial Differential equations, Graphs, Simulation, Process of formulation of Model based on Simulation.

3 EXPERIMENTAL MODELING 9

Definition of Experimental Design, Examples, and Single factor Experiments, Guidelines for designing experiments. Process Optimization and Designed experiments, Methods for study of response surface, determining optimum combination of factors, Taguchi approach to parameter design.

4 ANALYSIS OF RESULTS 9

Parametric and Non-parametric, descriptive and Inferential data, types of data, collection of data (normal distribution, calculation of correlation coefficient), processing, analysis, error analysis, different methods, analysis of variance, significance of variance, analysis of covariance, multiple regression, testing linearity and non-linearity of model.

5 REPORT WRITING 9

Types of reports, layout of research report, interpretation of results, style manual, layout and format, style of writing, typing, references, tables, figures, conclusion, appendices.

TOTAL: 45

TEXT BOOKS

1. Wilkinson K. L, Bhandarkar P. L, „Formulation of Hypothesis", Himalaya Publication.
2. SchankFr.,"Theories of Engineering Experiments", Tata McGraw Hill Publication.

REFERENCE BOOKS

1. Douglas Montgomery, "Design of Experiments", Statistical Consulting Services, 1990.
2. Douglas H. W. Allan, "Statistical Quality Control: An Introduction for Management", Reinhold Pub Corp, 1959.
3. Cochran and Cocks, „Experimental Design", John Willy & Sons.
4. John W. Besr and James V. Kahn, „Research in Education", PHI Publication.
5. Adler and Granovky, "Optimization of Engineering Experiments", Meer Publication.
6. S. S. Rao, „Optimization Theory and Application", Wiley Eastern Ltd., New Delhi, 1996

Course Code	Course Name: **Advanced Material Science and Failure Analysis In Mechanical Design**	L	T	P	C
ED7003	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES To understand the fundamentals of composite material strength and its mechan behavior Understanding the analysis of fiber reinforced Laminate design for different combination

plies with different orientations of the fiber. Thermo-mechanical behavior and study of resid stresses in Laminates during processing. Implementation of Classical Laminate Theory (CLT) to st and analysis for residual Stresses in an isotropic layered structure such as electronic chips

COURSE OUTCOMES (COs)

CO1	1. To understand the fundamentals of composite material strength and its mechanical behavior Stresses in an isotropic layered structure such as electronic chips.
CO2	Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
CO3	Thermo-mechanical behavior and study of residual stresses in Laminates during processing
CO4	Implementation of Classical Laminate Theory (CLT) to study and analysis for residual Stresses in an isotropic layered structure such as electronic chips.
CO5	At the end of the course the students will be in position to understand the mechanics and design related to layered components such as fiber reinforced polymer composites, isotropic layered structures (example electronic chips) etc and its manufacturing methodologies.

Mapping of Course Outcomes with Program outcomes (POs)

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

1	COs/Pos	a	b	c	d	e
2	CO1	L				S
	CO2		S			
	CO3			M		
	CO4	L				
	CO5					

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

UNIT I. STRUCTURE, PROPERTIES AND APPLICATION OF ENGG. MATERIALS 9

Metals, Alloys, Ceramics & Glasses, Organic Polymers, Smart materials, Super alloys,

Shape memory alloys, Nano materials, Super hard cutting tool materials, Crystalline and Non crystalline states.

UNIT II ELASTIC & PLASTIC DEFORMATION OF MATERIALS 9

Point imperfection, Dislocations, Surface imperfection, Stress-Strain curve, Dislocation motion analysis.

UNIT III. FAILURE ANALYSIS OF MATERIALS 9

Types of failure of materials, Creep, Fatigue, Fracture analysis. Mechanism of failure and

Methods of protection against failure. Failure resistant materials.

UNIT IV DESIGN AGAINST STATIC LOAD 9

Factor of safety, Principal plane and principal stresses, Theories of failures, Stress concentration factors.

UNIT V DESIGN AGAINST FLUCTUATION LOAD 9

Endurance limits, S-N curve, Types of variable stresses, Soderberg equation, Goodman equation,

Gerber equation.

BOOKS:

1. Failure of materials in Mechanical designby J.A.Collins, A Wiley - Interscience publication.

copyright@1981 by John Wiley & Sons, Inc.

2. Material science and Engineering by V.Raghavan, 5th edition, 2012,

published by AsokeK.Ghush, PHI Learning pvt. Ltd.

3. Design of Machine elements, 3rd edition by V.B.Bhandari,

Tata.McGraw Hill education pvt. Ltd., New Delhi.

4. The Science and Engineering of materials, SI Edition, Donald R. Askeland, Pradeep P. Fulay, Wendelin J.

Course Code	Course Name: MECHATRONICS	L	T	P	C
MCD005	Total Contact Hours: 45	3	0	0	3
	Prerequisite:				
	Course Designed by : Dept. of Mechanical Engineering				

OBJECTIVES

To enable the students to understand the fundamental concepts of Semi-Conductors, Transistors, Rectifiers, Digital Electronics .

COURSE OUTCOMES (COs)

CO1	Understand the fundamentals of mechatronic systems in a synergistic framework
CO2	Design and develop intelligent engineered products and processes to solve challenging technological problems.
CO3	Design and simulate mechatronic systems using microcontrollers and programmable logic controllers
CO4	Develop innovative approaches and an entrepreneurial mind set to problem

	solving					
CO5	Can develop data handling and data acquisition system etc.					
Mapping of Course Outcomes with Program outcomes (POs) (H/M/L indicates strength of correlation) H-High, M-Medium, L-Low						
1	COs/Pos	a	b	c	d	e
2	CO1	L				S
	CO2		H			
	CO3			M		
	CO4	L			M	
	CO5					
3	Category	Professional Mathematics (PM)	Professional Core (PC)	Professional Elective (PE)	Open Elective (OE)	Project/ Term Paper Seminar/
					√	
4	Approval	37th , 38th& 39th Meeting of Academic Council, May 2015, Jan 2016 & April 2016				

UNIT – I

Introduction – systems – Measurement systems – Control system Microprocessor – Based controllers & problems.

UNIT – II

Sensors and transducers – performance – terminology – Displacement – position and proximity – velocity and motion – force – fluid pressure liquid flow – liquid level – temperature – light sensors – selection of sensors.

UNIT – III

Signal conditioning – The operational amplifier protection – filtering – wheat stone bridge – Digital signals – multiplexes – data acquisition – digital signal processing – pulse – modulation.

UNIT – IV

Data presentation system – displays – data presentation elements – magnetic recording – Displays – data acquisition systems – Measurement system – testing and calibration.

UNIT – V

Pneumatic & hydraulic system – Mechanical actuation systems.

Reference:

1. W.Bolton, Mechatronics Electronics control system in Mechanical & Electrical Engg. Addison 1999.
2. Michael – B. Histland, David. G.Aliatoce – Introduction to Mechatronics and measurement system – McGraw Hill International Edition.