NANDHA ENGINEERING COLLEGE

(An Autonomous Institution affiliated to Anna University Chennai and approved by AICTE, New Delhi)
Erode-638 052, Tamilnadu, India, Phone: 04294 – 225585

Curriculum and Syllabus
for
M.E. – Engineering Design [R15]

(This Curriculum and Syllabi are applicable to Students admitted from the academic year 2015-2016 onwards)

JUNE 2015

Approved by third Academic council

NANDHA ENGINEERING COLLEGE
(Autonomous Institution Affiliated to Anna University, Chennai)
DEPARTMENT OF MECHANICAL ENGINEERING

M.E. ENGINEERING DESIGN
(For the students admitted during 2015-2016 and onwards)

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The following Programme Educational Objectives are designed for M.E. Engineering Design programme in Mechanical Engineering based on the Department Mission to provide higher engineering education and motivate research in the field of Mechanical Engineering

PEO1 Technical knowledge and skills in mathematics and engineering to recognize, and solve problems, and to apply these skills to the generation of new knowledge, ideas in industry; and for implement these solutions in practice.

PEO2 Apply the principles of manufacturing and materials with the aid of computer in order to develop the products and techniques.

PEO3 Produce postgraduates are competent engineers and work is notable for its breadth and its technical excellence.

PEO4 Provide a "hands-on" approach to engineering so that the postgraduates develop an understanding of engineering judgment and practice.

PROGRAMME OUTCOMES (POs)

The students of M.E. Engineering Design programme in the Department of Mechanical Engineering should at the time of their graduation, are in possession of:

PO1. ability to work effectively in a team, exercise initiative, and function as a leader.
PO2. ability to design and conduct experiments to analyze the data
PO3. ability to design a system or process to meet the desired needs and solving engineering problems.
PO4. ability to identify potential changes in behavior and properties of materials as they are altered and influenced by manufacturing processes
PO5. ability to research concepts, simulate, test working conditions and application of modeling methods and their impact on the designed systems
PO6. ability to solve open-ended engineering problems in Engineering Design areas including the design and realization of such systems.
PO7. the attitudes, abilities and skills required to adapt to rapidly changing technologies and the ability to pursue life-long learning
PO8. an understanding of all aspects of the design process including functional, creativity in the design of systems, processes and esthetic considerations.
PO9. ability to identify engineering problems, and to carry out the engineering design of a system or component to meet desired needs, using modern tools for complex design
PO10. an understanding of contemporary issues and the ability to assess the impact of engineering solutions on the community.

NANDHA ENGINEERING COLLEGE, ERODE-52

REGULATION 2015

M.E. (Engineering Design)

I TO IV SEMESTERS (FULL TIME) CURRICULUM AND SYLLABUS

SEMESTER I

THEORY					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED101	Applications of Numerical Methods	3	2	0	4
15ED102	Concepts of Engineering Design	3	0	0	3
15ED103	Vibration Analysis and Control	2	2	0	3
15ED104	Computer Applications in Design	3	0	0	3
15ED105	Advanced Mechanics of Materials	2	2	0	3
E1	Elective I (PE)	3	0	0	3
PRACTICAL					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED111	Computer Aided Modeling Lab	0	0	4	2
15ED121	Technical Seminar-I	0	0	2	1
	TOTAL	**16**	**6**	**5**	**22**

SEMESTER II

THEORY					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED201	Optimization Techniques in Design	2	2	0	3
15ED202	Mechanisms Design and Simulation	3	2	0	4
15ED203	Mechanical Behavior of Materials	3	0	0	3
15ED204	Advanced Finite Element Methods	3	2	0	4
E2	Elective II (PE)	3	0	0	3
E3	Elective III (PE)	3	0	0	3
PRACTICAL					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED211	Analysis and Simulation Lab	0	0	4	2
15ED221	Technical Seminar-II	0	0	2	1
	TOTAL	**17**	**6**	**5**	**23**

SEMESTER III

THEORY					
Course code	**Course Title**	**L**	**T**	**P**	**C**
E4	Elective IV (PE)	3	0	0	3
E5	Elective V (PE)	3	0	0	3
E6	Elective VI (OE)	3	0	0	3
PRACTICAL					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED331	Project Work (Phase I)	0	0	12	6
	TOTAL	**9**	**0**	**12**	**15**

SEMESTER IV

PRACTICAL					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED431	Project Work (Phase II)	0	0	24	12
	TOTAL	**0**	**0**	**24**	**12**

TOTAL CREDITS: 22+23+15+12=72

NANDHA ENGINEERING COLLEGE, ERODE-52

REGULATION 2015

M.E. (Engineering Design)

I TO VI SEMESTERS (PART TIME) CURRICULUM AND SYLLABUS

SEMESTER I

THEORY					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED101	Applications of Numerical Methods	3	2	0	4
15ED102	Concepts of Engineering Design	3	0	0	3
15ED103	Vibration Analysis and Control	2	2	0	3
	TOTAL	**8**	**4**	**0**	**10**

SEMESTER II

THEORY					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED201	Optimization Techniques in Design	2	2	0	3
15ED202	Mechanisms Design and Simulation	3	2	0	4
15ED203	Mechanical Behavior of Materials	3	0	0	3
	TOTAL	**8**	**4**	**0**	**10**

SEMESTER III

THEORY					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED104	Computer Applications in Design	3	0	0	3
15ED105	Advanced Mechanics of Materials	2	2	0	3
E1	Elective I (PE)	3	0	0	3
PRACTICAL					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED111	Computer Aided Modeling Lab	0	0	4	2
15ED121	Technical Seminar-I	0	0	2	1
	TOTAL	**8**	**2**	**5**	**12**

SEMESTER IV

THEORY					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED204	Advanced Finite Element Methods	3	2	0	4
E2	Elective II (PE)	3	0	0	3
E3	Elective III (PE)	3	0	0	3
PRACTICAL					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED211	Analysis and Simulation Lab	0	0	4	2
15ED221	Technical Seminar-II	0	0	2	1
	TOTAL	**9**	**2**	**5**	**13**

SEMESTER V

THEORY					
Course code	**Course Title**	**L**	**T**	**P**	**C**
E4	Elective IV (PE)	3	0	0	3
E5	Elective V (PE)	3	0	0	3
E6	Elective VI (OE)	3	0	0	3
PRACTICAL					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED331	Project Work (Phase I)	0	0	12	6
	TOTAL	**9**	**0**	**12**	**15**

SEMESTER VI

PRACTICAL					
Course code	**Course Title**	**L**	**T**	**P**	**C**
15ED431	Project Work (Phase II)	0	0	24	12
	TOTAL	0	0	24	12

TOTAL CREDITS: 10+10+12+13+15+12=72

LIST OF ELECTIVES

M.E. ENGINEERING DESIGN

Professional Electives

Course code	Course Title	L	T	P	C
	Elective for E1				
15EDX01	Design of Fluid Power systems	3	0	0	3
15EDX02	Composite Materials and Mechanics	3	0	0	3
15EDX03	Rapid Prototyping and Tooling	3	0	0	3
15EDX04	Creativity in Design	3	0	0	3
	Elective for E2 and E3				
15EDX05	Maintenance Engineering	3	0	0	3
15EDX06	Design of Material Handling Equipment	3	0	0	3
15EDX07	TRIZ for Product Innovation	3	0	0	3
15EDX08	Advanced Tool Design	3	0	0	3
15EDX09	Experimental Stress Analysis	3	0	0	3
15EDX10	Computer Integrated Manufacturing Systems	3	0	0	3
15EDX11	Bearing Design and Rotor Dynamics	3	0	0	3
15EDX12	Mechatronics in Manufacturing Systems	3	0	0	3
	Electives for E4 and E5				
15EDX13	Design for Manufacture, Assembly and Environments	3	0	0	3
15EDX14	Computational Fluid Dynamics	3	0	0	3
15EDX15	Design of Pressure Vessel and Piping	3	0	0	3
15EDX16	Design of Heat Exchangers	3	0	0	3
15EDX17	Productivity Management and Re-Engineering	3	0	0	3
15EDX18	Reverse Engineering	3	0	0	3
15EDX19	Design for Six Sigma	3	0	0	3
15EDX20	Engineering Fracture Mechanics	3	0	0	3
15EDX21	Tribology in Design	3	0	0	3
15EDX22	Design Paradigm	3	0	0	3
15EDX23	Micro Electro Mechanical Systems	3	0	0	3
15EDX24	Nanomaterials and Nano Technology	3	0	0	3

Open Electives

Course code	Course Title	L	T	P	C
15EDY01	Industrial Robotics and Expert systems	3	0	0	3
15EDY02	Supply Chain Management	3	0	0	3
15EDY03	Enterprise Resource Planning	3	0	0	3

***PE- Professional Electives *OE-Open Electives**

15ED101 APPLICATIONS OF NUMERICAL METHODS

L	T	P	C
3	2	0	4

OBJECTIVES:

- To impart knowledge on numerical methods that will come in handy to solve numerically the problems that arise in engineering and technology.
- Acquire the knowledge to find approximate solution of system of linear and non-linear equation by using computational method.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Get familiarized with the numerical methods which are necessary to solve numerically the problems that arise in engineering.
CO2. Be familiar with the Design and conduct experiments to analyze the data.
CO3. Use the solution of ordinary differential equations in attempting any engineering problem.

UNIT I : ALGEBRAIC EQUATIONS (9+3)

Systems of linear equations: Gauss Elimination method, pivoting techniques, Thomas algorithm for tridiagonal system – Jacobi, Gauss Seidel , SOR iteration methods

UNIT II : ORDINARY DIFFERENTIAL EQUATIONS (9+3)

RungeKutta Methods for system of IVPs, numerical stability, Adams- Bashforth multistep method, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method , Galerkin finite element method.

UNIT III: FINITE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATION (9+3)

Parabolic equations: explicit and implicit finite difference methods, weighted average approximation - Dirichlet and Neumann conditions– Two dimensional parabolic equations – ADI method; First order hyperbolic equations – method of characteristics, different explicit and implicit methods; numerical stability analysis, method of lines

UNIT IV : FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS (9+3)

Finite difference expressions for partial derivatives – Laplace's equation – Liebmann method– Derivative boundary conditions- Poisson equation.

UNIT V : FINITE ELEMENT METHOD (9+3)

Partial differential equations – Finite element method - orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

TOTAL:L: 45 +T:15= 60 PERIODS

REFERENCES :

1. Saumyen Guha and Rajesh Srivastava, "Numerical methods for Engineering and Science", Oxford Higher Education, New Delhi, 2010.
2. Gupta S.K., "Numerical Methods for Engineers", New Age Publishers, 1995.
3. Burden, R.L., and Faires, J.D., "Numerical Analysis – Theory and Applications", Cengage Learning, India Edition, New Delhi, 2009
4. Jain M. K., Iyengar S. R., Kanchi M. B., Jain , "Computational Methods for Partial Differential Equations", New Age Publishers, 1993.
5. Morton K.W. and Mayers D.F., "Numerical solution of partial differential equations", Cambridge University press, Cambridge, 2002.
6. Grewal.B.S.,"Higher Engineering Mathematics", 39th ed., Khanna publishers, New Delhi, 2006.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x	x		x	x			x	
2		x	x						x	x
3			x			x			x	

15ED102 CONCEPTS OF ENGINEERING DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fundamentals of design process for products
- To understand the selection of proper materials
- To understand legal, ethical, environmental and safety issues in design
- To understand the environmental conscious design

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Apply the design concepts in various industrial products based on customer requirements
CO2. Uutilize the statistical tools in monitoring the performance of products
CO3. Be familiar with the design concepts to improve the reliability and productivity.

UNIT I : DESIGN FUNDAMENTALS (9)

Importance of design- The design process-Considerations of Good Design – Morphology of Design – Organization for design – Designing to codes and standards – Product and process cycles – Technological innovation.

UNIT II : CUSTOMER ORIENTED DESIGN (9)

Identification of customer needs - customer requirements - Bench marking Quality Function Deployment - Product Design Specifications- Human Factors in Design – Ergonomics and Aesthetics - Contracts – Product liability – Protecting intellectual property – Legal and ethical domains – Codes of ethics – Ethical conflicts.

UNIT III : DESIGN METHODS (9)

Creativity and Problem Solving – Creative thinking methods- Theory of Inventive Problem Solving (TRIZ)– Decision making -Embodiment Design-Product Architecture - Configuration Design- Parametric Design. Role of models in design-Rapid prototyping- Finite Element Analysis – Optimization.

UNIT IV : MATERIAL SELECTION PROCESSING AND DESIGN (9)

Material Selection Process – Economics – Weighted property Index – Classification of Manufacturing Process – Design for Manufacture – Design for Assembly–Designing for castings, Forging, Metal Forming, Machining and Welding – Residual Stresses.

UNIT V : PROBABILITY CONCEPTS IN DESIGN & GREEN DESIGN PROCESS (9)

Probability – Distributions – Test of Hypothesis – Design of Experiments – Reliability Theory – Design for Reliability – Robust Design -Failure Mode Effect Analysis. Design for Environment - Green Design Process: Material life cycle, embodied energy, carbon footprint, green design in industry, sustainability.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Dieter George E., "Engineering Design - A Materials and Processing Approach", 4th ed., Tata McGraw Hill Education, 2013.
2. Pahl, G, and Beitz, W., "Engineering Design", 3rd ed., Springer – Verlag, NY. 2007.
3. Ray, M.S., "Elements of Engineering Design", Prentice Hall Inc. 1985.
4. Suh, N.P., "The Principles of Design", Oxford University Press, NY.1990.
5. Karl T. Ulrich and Steven D. Eppinger, "Product Design and Development" , 4th ed., McGraw Hill, 2009

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x	x	x	x			x		
2		x	x	x	x		x			x
3		x		x	x					x

15ED103 VIBRATION ANALYSIS AND CONTROL

L	T	P	C
2	2	0	3

OBJECTIVES:

- To understand the fundamentals of vibration and its practical applications.
- To understand the working principle and operations of various vibration measuring instruments.
- To expertise in vibration measurement and control.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Become proficient in the modeling and analysis of vibrations.

CO2. Be familiar with vibration control and analysis techniques.

CO3. Gain knowledge about Vibration Measuring Instruments.

UNIT I : FUNDAMENTALS OF VIBRATION (10)

Undammed Free Vibrations: Single Degrees of Freedom Systems - D Alembert's Principle, Energy method, Rayleigh method, simple applications, equivalent spring stiffness.

Damped Free Vibrations: Single Degrees of Freedom System -different types of damping, Viscous damping, sub-critical, critical and over damping, logarithmic decrement, and frequency of damped oscillations.

Forced Vibrations: Single Degrees of Freedom System - Solution for simple harmonic excitation, steady state vibrations, Rotating and reciprocating unbalance, base excitation, vibration isolation and transmissibility, whirling of shaft without friction.

UNIT II : TWO DEGREE OF FREEDOM SYSTEM (7)

Introduction-Free vibration of undamped and damped systems - Forced vibration with Harmonic excitation System –Coordinate couplings and Principal Coordinates.

UNIT III : MULTI-DEGREE OF FREEDOM SYSTEMS (9)

Lagrange's equation, Dunkerley's approximation method, Rayleigh method, matrix method, matrix iteration, orthogonality principle, modal analysis, Stodola method, Holzer method, Galerkin method, Rayleigh- ritz method.

UNIT IV : CONTINUOUS SYSTEMS AND VIBRATION CONTROL (9)

Continuous Systems -Longitudinal vibrations of bar, transverse vibration of beam, torsion of vibrations of circular shaft with various end conditions. Vibration as condition Monitoring tool-Vibration Isolation methods- -Dynamic vibration absorber, Torsional and Pendulum Type absorber- Damped Vibration absorbers-Static and Dynamic balancing-Balancing machines-Field balancing - Active Vibration Control.

UNIT V : EXPERIMENTAL METHODS IN VIBRATION ANALYSIS (10)

Experimental Methods in Vibration Analysis.-Vibration Measuring Instruments - Selection of Sensors-Accelerometer Mountings. -Vibration Exciters-Mechanical, Hydraulic, Electromagnetic and Electrodynamics – Frequency Measuring Instruments-. System Identification from Frequency Response -Testing for resonance and mode shapes.**** Term Project must be submitted at end of the Semester**

TOTAL: L:30 + T:15= 45 PERIODS

REFERENCES:

1. V.P. Singh, "Mechanical Vibrations", Dhanpat Rai and Company Pvt. Ltd., 3rd ed., 2006.
2. Rao S S , "Mechanical Vibrations", Pearson Education, 2004
3. Thomson W T, "Theory of Vibration with Applications", Prentice Hall of India, 1997.
4. Ashok Kumar Mallik, "Principles of Vibration Control", Affiliated East-West Press Pvt. Ltd, 1990.
5. Lewis H Bell, "Industrial Noise Control Fundamentals and Applications", Marcel Dekkev Inc. 1982.
6. Tse Hinkle, Morse, "Mechanical Vibrations", OBS Publishers and Distributors, 1983.
7. Kewel Pujara, Pujara R S, "Noise for Engineers", Dhanpat Rai and Sons, 1984.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x	x			x	x	x	x	x	
2	x	x		x			x	x		x
3	x		x					x		x

15ED104 COMPUTER APPLICATIONS IN DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To develop the modeling skills using computer graphic techniques.
- To impart knowledge on CAD software and data exchange standards.
- To gain knowledge on visual realism and computer animation.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Integrate CAD and gain the advantages of lead time reduction
CO2. Create CAD packages for various products which include parts, assembly etc.,
CO2. Understand the meaning of CAD and transfer of product data in various software

UNIT I : INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS (9)

Output primitives (points, lines, curves etc.) 2D & 3D transformation (Translation, scaling, rotations) windowing-view ports-clipping transformation Open GL Data Exchange standards- IGES, STEP etc. - Communication standards.

UNIT II : CURVES AND SURFACE MODELING (9)

Representation of curves - Bezier curves- cubic spline curve- B-Spline curves – Rational curves - Curve manipulations Representation of Surface Modeling techniques- Analytical surfaces: Plane surface, ruled surface, surface of revolution and tabulated cylinder – synthetic surfaces: Hermite bicubic surface- Bezier surface and B-Spline surface- surface manipulation.

UNIT III : NURBS AND SOLID MODELING (9)

NURBS- Basics- curves, lines, arcs, circle and bi linear surface Regularized Boolean set operations –primitive instancing-sweep representations-boundary representations constructive solid Geometry comparison of representations-user inter face for solid modeling.

UNIT IV : VISUAL REALISM (9)

Hidden-Line-Surface-solid removal algorithms shading - coloring. Introduction to parametric and variational geometry based software sand the in principles creation of prismatic and lofted parts using the sepackages.

UNIT V : ASSEMBLY OF PARTS (9)

Assembly modeling - interferences of positions and orientation - tolerances analysis - mass property calculations- mechanism simulation

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Donald Hearn, M. Pauline Baker, “Computer Graphics”, 4th ed., Prentice Hall, Inc., 2010.
2. Ibrahim Zeid, “Mastering CAD/CAM”, 2nd ed., McGraw Hill, International Edition, 2006.
3. William M Neumann, Robert F. Sproul, “Principles of Computer Graphics”, McGraw Hill Book Co. Singapore, 1989.
4. P.Radhakrishnan, C.P.Kothandaraman, “Computer Graphics and Design”, Dhanpat Rai and Sons,1999.
5. Foley,Wan Dam, Feiner and Hughes, “Computer Graphics Principles & Practices”, Pearson Education, 2003

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x		x		x	x	x		x	x
2		x	x	x		x	x	x	x	x
3	x	x	x		x	x		x	x	

15ED105 ADVANCED MECHANICS OF MATERIALS

(Use of Approved Design Data book is permitted)

L	T	P	C
2	2	0	3

OBJECTIVES:

- To understand the deformation of bodies under the different loads
- To understand dynamics of stresses in various sections

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Apply the failure theory concepts, while designing products
CO2. Gain knowledge about stress distribution
CO3. Calculate the torsion and stresses in sections used in various applications

UNIT I : ELASTICITY (9)

Stress, stress tensor, stress concentration factor, stress strain relation and general equation of elasticity in cartesion, polar and spherical coordinates, differential equations of equilibrium-compatibility-boundary conditions-representation of three-dimensional stress of a tension generalized hook's law - St. Venant's principle - plane stress - Airy's stress function. Energy methods.

UNIT II : SHEAR CENTER AND UNSYMMETRICAL BENDING (9)

Location of shear center for various thin sections – shear flows. Stresses and deflections in beams subjected to unsymmetrical loading-kern of a section.

UNIT III : CURVED FLEXIBLE MEMBERS AND STRESSES IN FLAT PLATES (9)

Curved flexible members, circumference and radial stresses – deflections - curved beam with restrained ends - closed ring subjected to concentrated load and uniform load - chain links and crane hooks. Solution of rectangular plates – pure bending of plates – deflection – uniformly distributed load – various end conditions.

UNIT IV : TORSION OF NON-CIRCULAR SECTIONS (9)

Torsion of rectangular cross section - St.Venants theory- elastic membrane analogy Prandtl's stress function torsional stress in hollow thin wall tubes.

UNIT V : STRESSES IN ROTARY SECTIONS AND CONTACT STRESSES (9)

Radial and tangential stresses in solid disc and ring of uniform thickness and varying thickness allowable speeds. Methods of computing contact stress- deflection of bodies in point and line contact applications.

L: 30 + T:15= 45 PERIODS

REFERENCES:

1. Arthur P Boresi, Richard J. Schmidt, “Advanced Mechanics of Materials”, John Wiley, 2002.
2. Timoshenko and Goodier, “Theory of Elasticity”, McGraw Hill, 1970.
3. Robert D. Cook, Warren C. Young, “Advanced Mechanics of Materials”, Mc- Millan pub. Co., 1985.
4. Srinath. L.S., “Advanced Mechanics of Solids”, Tata McGraw Hill, 1992.
5. G H Ryder, “Strength of Materials”, Macmillan, India Ltd, 2007.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x	x		x				x	
2			x	x		x			x	x
3		x	x			x		x	x	

15ED111 COMPUTER AIDED MODELING LAB

L	T	P	C
0	0	4	2

OBJECTIVES:

- To develop skill on creating of 2D & 3D models, surface models using any one of modeling software.
- To understand the concept of various tolerances and fits used for component design.
- To understand and practice the drawings of machine components and simple assemblies using modeling packages.
- To impart knowledge on simulation of different mechanisms like 4-bar, slider and cam mechanisms using any one of modeling software.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1 . Read the drawing and Interpret the data and dimensions

CO2. Create CAD models for various products which include parts, assembly etc.

CO3. Simulate the physical system using a CAD model

Study of CAD

Study of Sketcher

Solid modeling - Extrude, Revolve, Sweep, etc. and variational sweep, Loft, etc.

Surface modeling - Extrude Sweep, Trim etc. and Mesh of curves, Free form etc.

Feature manipulation - Copy, Edit, Pattern, Suppress, History operations etc.

Assembly - Constraints, Exploded Views, Interference check

Drafting - Layouts, Standard & Sectional Views, Detailing & Plotting

Exercises in Modeling and drafting of Mechanical Components-Assembly using Parametric and feature based Software Packages.

LIST OF EXPERIMENTS:

1. Modeling and Assembling of Machine Vice
2. Create an assembly model of Tailstock
3. Modeling of Connecting rod
4. Modeling of Butterfly Valve Assembly
5. Modeling of Pulley Support Assembly
6. Modeling of Fixture Assembly
7. Modeling of Shaper Tool Head Assembly
8. Surface Modeling of Piston
9. Simulation of Four bar Mechanism
10. Simulation of Slider Crank Mechanisms
11. Simulation of Spur Gear Drive.
12. Simulation of Cam & Follower

TOTAL: P: 45 = 45 PERIODS

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x				x			x	x
2	x		x	x				x	x	
3			x		x	x		x	x	x

15ED121 TECHNICAL SEMINAR-I

L	T	P	C
0	0	2	1

OBJECTIVES:

- To understand the real time problems during production process in industries.
- To provide exposure to the students to refer, read and review the research articles
- To present their learning as seminar

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1 . Review, prepare and present technological developments
CO2. Be familiar in oral and written skills.
CO3. Improve personal and communication skills

ASSESSMENT SCHEME:

During the technical seminar session each student has to prepare and present a topic on Engineering, for duration of about 10 to 15 minutes. In a session of three periods per week, 2 students are expected to present the technical seminar. Each student is expected to present at least twice during the technical semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews. A quiz covering the above will be held at the end of the semester.

TOTAL: P: 45 = 45 PERIODS

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1							x		x	x
2	x						x			
3	x					x				x

15ED201 OPTIMIZATION TECHNIQUES IN DESIGN

L	T	P	C
2	2	0	3

OBJECTIVES:

- To get knowledge on one minimization methods namely elimination methods, interpolation methods and direct root methods
- To understand various unconstrained and constrained minimization methods
- To provide an exposure about the design applications of geometric and stochastic programming.
- To know various modern optimization techniques

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Solve one dimensional optimization problems using elimination or interpolation methods
CO2. Determine optimal solution for constrained or unconstrained optimization problems using appropriate method
CO3. Describe the steps involved in geometric programming, Stochastic programming and modern methods of optimization.

UNIT I : ONE DIMENSIONAL MINIMIZATION METHODS (9)

Unimodal function – Elimination methods – unrestricted search – exhaustive search – dichotomous search – interval halving method – ibonacci method – golden section method – interpolation methods-quadratic and cubic interpolation methods – direct root methods – Newton method – Quasi Newton method – secant method

UNIT II : UNCONSTRAINED OPTIMIZATION TECHNIQUES (9)

Classification of unconstrained minimization methods – Direct search methods – Random walk method – univariate method – Powell's method – simplex method – Indirect search methods – steepest descent method – Fletcher-Reeves method – Newton's method – Marquardt method – Broyden-Fletcher-Goldfarb-Shanno (BFGS) Method

UNIT III : CONSTRAINED OPTIMIZATION TECHNIQUES (9)

Direct Methods – Sequential Linear Programming(SLP) – Zoutendijk's method of feasible directions – Rosen's gradient projection method – Generalized Reduced Gradient (GRG) method –sequential quadratic programming –Indirect Methods – interior penalty function method – exterior penalty function method – Augmented Lagrange Multiplier (ALM) method

UNIT IV : GEOMETRIC AND STOCHASTIC PROGRAMMING (9)

Unconstrained geometric programming problem – differential calculus method – arithmetic-geometric inequality method – constrained geometric programming problem – mixed inequality constraints – applications – formulation of geometric programming problems of design of hydraulic cylinder and helical spring – Stochastic nonlinear programming and geometric programming in design

UNIT V : MODERN METHODS OF OPTIMIZATION (9)

Genetic Algorithms – Simulated Annealing – Particle Swarm Optimization – Ant Colony Optimization – Optimization of Fuzzy Systems – Neural-Network-Based Optimization.

TOTAL: L:30 + T:15= 45 PERIODS

REFERENCES:

1. Rao.S.S, "Engineering Optimization – Theory and Practice", 4th ed., John Wiley & Sons, 2009
2. Ashok D. Belegundu, Tirupathi R. Chandrupatla, "Optimization Concepts and Applications in Engineering", 2nd ed., Cambridge University Press, 2011
3. Kalyanamoy Deb, "Optimization for Engineering Algorithms and Examples", Prentice Hall of India, 2005.
4. Charles L. Byrne, "A First Course in Optimization", CRC Press, 2015
5. Edwin K.P Chong, Stanislaw H. Zak, "An Introduction to Optimization", 2nd ed., John Wiley & Sons, 2001

Mapping of Course Outcome and Programme Outcome

Mapping of Cos and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x	x		x	x			x	x
2			x		x	x			x	x
3		x	x		x	x			x	x

15ED202 MECHANISMS DESIGN AND SIMULATION

L	T	P	C
3	2	0	4

OBJECTIVES:

- To develop a thorough understanding of the various mechanism designs and its simulation with ability to effectively use the various mechanisms in real life problems.
- To understand the layout of linkages in the assembly of a system/machine.
- To study the principles involved in assessing the displacement, velocity and acceleration at any point in a link of a mechanism

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1 . Design the linkages for particular applications and analyze the velocity and acceleration of various mechanisms.

CO2 . Gain ability to research concepts, simulate, and test working conditions and application of modeling methods and their impact on the designed systems.

CO3. Identify the mathematical model for solution of common Engineering problems

UNIT I : INTRODUCTION (9+3)

Review of fundamentals of kinematics-classifications of mechanisms-components of mechanisms – mobility analysis – formation of one D.O.F., Compliant mechanisms-Equivalent mechanisms - Basic kinematic structures of serial and parallel robot manipulators.

UNIT II: KINEMATIC ANALYSIS (9+3)

Analytical methods for velocity and acceleration Analysis– four bar linkage jerk analysis. Velocity analysis of Plane complex mechanisms using graphical method - Spatial RSSR mechanism-Denavit-Hartenberg Parameters.

UNIT III: PATH CURVATURE THEORY AND COUPLER CURVE (9+3)

Fixed and moving centrodes, inflection points and inflection circle. Hartmann's construction-Euler Savary equation, graphical constructions – Bobbilier constructions-Cubic of stationary curvature. Four bar coupler curve-cusp-crunode-coupler driven six-bar mechanisms-straight line generators.

UNIT IV: SYNTHESIS OF FOUR BAR MECHANISMS (9+3)

Type synthesis – Number synthesis –Dimensional synthesis – function generation, path generation, motion generation. Associated Linkage Concept. Graphical methods-Inversion technique-point position reduction-two, three and four position synthesis of four- bar mechanisms. Analytical methods- Bloch method and Freudenstein's Equation, Mechanism defects.

UNIT V: SYNTHESIS OF COUPLER CURVE BASED MECHANISMS & CAM MECHANISMS (9+3)

Cognate Linkgages - parallel motion Linkages. Design of six bar mechanisms-single dwell-double dwell - double stroke. Geared five bar mechanism-multi-dwell. Cam Mechanisms- determination of optimum size of cams. Unbalance, Spring surge and Wind up - Study and use of Mechanism using Simulation Software packages.

**** Term Project must be submitted at end of the Semester**

TOTAL: L: 45 + T:15 = 60 PERIODS

REFERENCES:

1. Uicker, J.J., Pennock, G. R. and Shigley, J.E., "Theory of Machines and Mechanisms", Oxford University Press. 2012
2. Robert L.Norton, "Design of Machinery", Tata McGraw Hill, 2005.
3. Sandor G.N. and Erdman A.G., "Advanced Mechanism Design Analysis and Synthesis", Volume II Prentice Hall, 1984.
4. Amitabh A Ghosh and Asok Kumar Mallik, "Theory of Mechanism and Machines", EWLP, Delhi, 1999.
5. Kenneth J, Waldron, Gary L. Kinzel, "Kinematics, Dynamics and Design of Machinery", John Wiley-sons, 1999.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x	x				x	x		
2		x		x	x			x	x	x
3		x		x			x			

15ED203 MECHANICAL BEHAVIOR OF MATERIALS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know the mechanical behavior of metallic, non-metallic and modern metallic materials under different loading and temperature conditions.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Familiarize in the area of material behaviour under different loading and temperature conditions
CO2. Gain knowledge in selection of materials for the design of engineering structures.
CO3. Know the properties and applications of various materials

UNIT I : BASIC CONCEPTS OF MATERIAL BEHAVIOR (9)

Elasticity in metals and polymers– Strengthening mechanisms, work hardening, solid solutioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviour – Super plasticity –. Theories of failure -Griffith's theory,– Ductile, brittle transition in steel – creep.

UNIT II : BEHAVIOUR UNDER DYNAMIC LOADS AND DESIGN APPROACHES (9)

Stress intensity factor and fracture toughness – Fatigue, fatigue test, fatigue crack propagation under constant load and variable load mechanisms and Paris law.- fail - safe design approaches -Effect of surface and metallurgical parameters on fatigue – Failure analysis, sources of failure, procedure of failure analysis- Impact effects - Notch effects

UNIT III : SELECTION OF MATERIALS (9)

Motivation for selection, cost basis and service requirements – Selection for mechanical properties– Selection for surface durability corrosion and wear resistance – Relationship between materials selection and processing – Case studies in materials selection with relevance to aero, auto, marine, machinery,nuclear and high temperature applications – Computer aided materials selection.

UNIT IV : MODERN METALLIC MATERIALS (9)

Dual phase steels, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) Steel, Maraging steel, Nitrogen steel – Intermetallics, Ni and Ti aluminides, Super plasticity materials – smart materials, shape memory alloys – Metallic glass and nano crystalline materials. Nano structured coatings, thin films, CNT.

UNIT V : NON METALLIC MATERIALS (9)

Polymeric materials – Formation of polymer structure – Production techniques of fibers, foams, adhesives and coating – structure, properties and applications of engineering polymers – Advanced structural ceramics, bio degradable ceramics. WC, TiC, TaC, Al_2O_3, SiC, Si_3N_4 CBN and diamond – properties, processing and applications.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. George E.Dieter, "Mechanical Metallurgy", McGraw Hill, 1988
2. Thomas H. Courtney, "Mechanical Behavior of Materials", (2nd ed.), McGraw Hill, 2000
3. Charles, J.A., Crane, F.A.A. and Fumess, J.A.G., "Selection and use of Engineering Materials", 3rd ed., Butterworth-Heiremann, 1997.
4. Flinn, R.A., and Trojan, P.K., "Engineering Materials and their Applications", 4th ed. Jaico, 1999.
5. Metals Hand book, Vol.10, "Failure Analysis and Prevention", 10th ed., Jaico, 1999.
6. Ashby M.F., "Materials selection in Mechanical Design", 2nd ed., Butter worth, 1999.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x		x	x					
2							x	x	x	
3				x	x				x	

15ED204 ADVANCED FINITE ELEMENT METHODS

L	T	P	C
3	2	0	4

OBJECTIVES:

- To understand the basic principles of the finite element analysis techniques and enhancing the ability to apply the tools of the analysis for solving practical problems arising in engineering design.
- To create expertise in basic elements, one and two dimensional problems, Isoperimetric elements, static and dynamic analysis in both structural and heat transfer problems.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Apply finite elements technique in engineering problem solving for various applications.

CO2. Derive finite element equation and to solve the real time 1D and 2Dstructural and thermal problems.

CO3. Solve and analysis the engineering problems using axi-symmetric and parametric elements.

UNIT I : ONE-DIMENSIONAL PROBLEMS (9+3)

Basic concept of FEM – Weighted residual methods – Variational formulation of B.V.P. – Ritz method – Finite element modeling – Element equations – Linear and quadratic shape functions – Bar and beam elements – Bars and beams of arbitrary orientation - Applications to structural heat transfer problems.

UNIT II : TWO-DIMENSIONAL PROBLEMS (9+3)

Poisson equation – Laplace equation – Weak form – Element matrices for triangular and rectangular elements – Evaluation of integrals – Applications – Conduction and convection heat transfer - Theory of elasticity – Plane strain – Plane stress – Axi-symmetric problems - Principle of virtual displacement.

UNIT III : ISOPARAMETRIC ELEMENTS (9+3)

Natural Co-ordinate Systems – Lagrangian Interpolation Polynomials – Isoparametric elements – Quadrilateral elements formulation – Jacobian matrix –– Triangular elements – Rectangular elements – Serendipity elements - Numerical Integration – Gauss quadrature - Illustrative Examples.

UNIT IV : STRUCTURAL DYNAMIC ANALYSIS (9+3)

Dynamic equations – Consistent and lumped mass matrices - 1-D bar element - Formulation of element stiffness, mass and force matrices - Example problems. Natural frequencies - 1-D beam element - Formulation of element stiffness, mass matrices.

UNIT V : NON-LINEAR PROBLEMS AND ERROR ESTIMATES (9+3)

Introduction – Material non-linearity – Elasto Plasticity – Plasticity – Visco plasticity – Geometric non-linearity – Large displacement – Error norms and convergence rates – H-refinement with adaptivity – adaptive refinement.

TOTAL:L: 45 +T:15= 60 PERIODS

REFERENCES:

1. Reddy J.N., “An Introduction to the Finite Element Method”, Third Edition, McGraw Hill, International Edition, 2005.
2. Cook, Robert Davis et al, “Concepts and Applications of Finite Element Analysis”, Wiley, John & Sons, 2002.
3. Logan D.L, “A First Course in the Finite Element Method”, 5th Edition, Thomson Learning, 2012.
4. Chandrupatla, T. R and Belegundu, A. D., “Introduction to Finite Elements in Engineering”, Pearson Education, New Delhi, 2007.Sugarland L.J., “Applied Finite Element Analysis”, 2th Edition, John Wiley, 2010.
5. S.S.Rao, “Finite Element Analysis”, 2002 Edition.
6. Zienkiewicz, O.C. and Taylor, R.L., “The Finite Element Method”, 6th ed., McGraw Hill International Edition, Physics Services, 2005.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x	x			x			x		x
2	x	x	x	x	x		x	x		x
3		x	x	x	x		x	x	x	x

15ED211 ANALYSIS AND SIMULATION LABORATORY

L	T	P	C
0	0	4	2

OBJECTIVES:

- To impart hands-on training with ANSYS software for solving practical problems arising in engineering design.
- To simulate the real time problems by using these software and also to understand the application of analysis packages.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Analyse the engineering problem using a simulation model and find out the solutions.

CO2. Get familiarized with the computer aided finite element analysis packages which are necessary to solve the engineering problems numerically.

CO3. Design the mechanical systems to meet thermal and fluid flow requirements for various applications

Analysis of Mechanical Components – Use of FEA Packages. Exercises shall include analysis of

1. Analysis of machine elements under Static loads.
2. Analysis of an Axi-symmetric problem.
3. Modal and Harmonic Analysis.
4. Thermal Analysis of mechanical systems.
5. Non-linear Structural Contact Analysis.
6. Eigenvalue Buckling Analysis.
7. Fatigue Analysis of a component.
8. Modeling a component using Pro/E, Importing to ANSYS and Meshing.

Use of kinematics and dynamics simulation software.

Analysis of velocity and acceleration for mechanical linkages of different mechanisms.

TOTAL: P: 45 = 45 PERIODS

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x	x	x			x		x		x
2	x	x		x	x	x			x	x
3		x			x		x		x	

15ED221 TECHNICAL SEMINAR-II

L	T	P	C
0	0	2	1

OBJECTIVES:

- To present their learning as seminar
- To provide exposure to the students to refer, read and review the research articles
- To understand the recent technologies

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Review, prepare and present technological developments
CO2. Get practice of oral and written skills.
CO3. Improve personal and communication skills

During the technical seminar session each student has to prepare and present a topic on Engineering, for duration of about 10 to 15 minutes. In a session of three periods per week, 2 students are expected to present the technical seminar. Each student is expected to present at least twice during the technical semester and the student is evaluated based on that. At the end of the semester, he / she can submit a report on his / her topic of seminar and marks are given based on the report. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also.

Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models. This will enable them to gain confidence in facing the placement interviews. A quiz covering the above will be held at the end of the semester.

TOTAL: P: 45 = 45 PERIODS

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1							x		x	x
2	x						x			
3	x					x				

LIST OF ELECTIVES

M.E. ENGINEERING DESIGN

Professional Electives

Course code	Course Title	L	T	P	C
	Elective for E1				
15EDX01	Design of Fluid Power systems	3	0	0	3
15EDX02	Composite Materials and Mechanics	3	0	0	3
15EDX03	Rapid Prototyping and Tooling	3	0	0	3
15EDX04	Creativity in Design	3	0	0	3
	Elective for E2 and E3				
15EDX05	Maintenance Engineering	3	0	0	3
15EDX06	Design of Material Handling Equipment	3	0	0	3
15EDX07	TRIZ for Product Innovation	3	0	0	3
15EDX08	Advanced Tool Design	3	0	0	3
15EDX09	Experimental Stress Analysis	3	0	0	3
15EDX10	Computer Integrated Manufacturing Systems	3	0	0	3
15EDX11	Bearing Design and Rotor Dynamics	3	0	0	3
15EDX12	Mechatronics in Manufacturing Systems	3	0	0	3
	Electives for E4 and E5				
15EDX13	Design for Manufacture, Assembly and Environments	3	0	0	3
15EDX14	Computational Fluid Dynamics	3	0	0	3
15EDX15	Design of Pressure Vessel and Piping	3	0	0	3
15EDX16	Design of Heat Exchangers	3	0	0	3
15EDX17	Productivity Management and Re-Engineering	3	0	0	3
15EDX18	Reverse Engineering	3	0	0	3
15EDX19	Design for Six Sigma	3	0	0	3
15EDX20	Engineering Fracture Mechanics	3	0	0	3
15EDX21	Tribology in Design	3	0	0	3
15EDX22	Design Paradigm	3	0	0	3
15EDX23	Micro Electro Mechanical Systems	3	0	0	3
15EDX24	Nanomaterials and Nano Technology	3	0	0	3

Open Electives

Course code	Course Title	L	T	P	C
15EDY01	Industrial Robotics and Expert systems	3	0	0	3
15EDY02	Supply Chain Management	3	0	0	3
15EDY03	Enterprise Resource Planning	3	0	0	3

***PE- Professional Electives *OE-Open Electives**

15EDX01 DESIGN OF FLUID POWER SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on fluid power engineering and power transmission systems
- To create expertise in applications of fluid power systems in automation of machine tools and others equipment
- To design hydraulic and electro-hydraulic systems for automation, pneumatic system circuits and to design low cost automation systems.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Acquire knowledge about pumps and valves used in fluid power systems
CO2. Develop fluid power circuits
CO3. Know the installation and maintenance of the hydraulic and pneumatic circuits

UNIT I : OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS (9)

Fluids – Properties - Types of Fluid power system - Hydraulic Power Generators – Selection and specification of pumps - Pump characteristics. Linear and Rotary Actuators – Selection, Specification and characteristics.

UNIT II : CONTROL AND REGULATION ELEMENTS (6)

Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems. Electro hydraulic servo valves..

UNIT III : HYDRAULIC CIRCUITS (9)

Reciprocation - Quick return – Sequencing - Synchronizing Circuits - Accumulator circuits – Industrial circuits - Press circuits - Hydraulic milling machine – Grinding - Planning - Copying – Forklift – Earth mover circuits - Design and selection of components - Safety and emergency mandrels.

UNIT IV: PNEUMATIC SYSTEMS AND CIRCUITS (12)

Fundamentals of Pneumatic- Control elements, position and pressure sensing - Logic circuits -Switching circuits - Fringe conditions modules and these integration - Sequential circuits – Cascade methods - Mapping methods - Step counter method - Compound circuit design - Combination circuit design.

UNIT V: INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS (9)

Pneumatic equipment- Selection of components - Design calculations – Application - Fault finding -Hydro pneumatic circuits - Use of microprocessors for sequencing - PLC, Low cost automation -Robotic circuits.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Antony Espossito, “Fluid Power with Applications”, Pearson education 2008
2. A.Dudley, Pease and J. J. Pippenger, “Basic fluid power”, Prentice Hall. 2010
3. Andrew Parr, “Hydraulic and Pneumatic”, Jaico Publishing House 2004.
4. Bolton. W., “Pneumatic and Hydraulic Systems”, Butterworth –Heinemann, 1997

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x			x			x		x	
2	x		x				x		x	
3	x		x		x	x	x	x	x	

15EDX02 COMPOSITE MATERIALS AND MECHANICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge of simple stresses, strains and deformation due to external loads and their relations in orthotropic materials and their manufacturing.
- To impart knowledge on various smart materials and smart systems.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Describe the properties of various available composite materials.
CO2. Design the composite product suitable for specific applications.
CO3. Select suitable composite or smart materials for industrial oriented applications.

UNIT I : INTRODUCTION TO COMPOSITE MATERIALS (9)

Definition – Classification, Advantages and Applications – Matrix: Types – Polymer, Metal, Ceramics - Properties and Applications – Fibers: Glass – Carbon -Ceramic and Aramid fibers - Characteristics, Manufacturing of Fibers –Fiber Surface Treatments- Fillers and additives.

UNIT II : MANUFACTURING OF COMPOSITES (9)

Manufacturing of Polymer Matrix Composites (PMCs):, Handlay -up, Bag Moulding, Compression Moulding, Pultrusion, Filament Winding, Resin Transfer Moulding (RTM). Manufacturing of Metal Matrix Composites (MMCs): Solid State Processing, Liquid State Processing, Vapour State Processing. Manufacturing of Ceramic Matrix Composites (CMCs): Hot Pressing, Reaction Bonding Process, Infiltration Technique, Direct Oxidation - Quality Inspection methods.

UNIT III : MECHANICS AND PERFORMANCE (9)

Characteristics of fiber – reinforced lamina – Laminates – Interlaminar stresses – Static Mechanical Properties – Fatigue and Impact Properties – Environmental effects – Fracture Behavior and damage Tolerance.

UNIT IV: FAILURE ANALYSIS AND DESIGN (9)

Failure Predictions – Failure Theories - Laminate Design Consideration - Classical lamination Theory - Analysis of Laminated Composite Beams – Plates - Shells Vibration and Stability Analysis – Finite Element Method of Analysis - Analysis of Sandwich structures.

UNIT V: SMART MATERIALS (9)

Shape memory alloys- Shape memory effect- Piezoelectric – ferroelectric and magnetostrictive materials – Magnetorheological fluids – Polymers in smart applications – Applications of smart materials in designing sensors, actuators and smart structures.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. P. K.Mallick, “Fiber –Reinforced Composites: Materials, Manufacturing and Design”, Maneel Dekker Inc, 2007.
2. J. C.Halpin, “Primer on Composite Materials Analysis”, Techomic Publishing Co., 2006.
3. K. Kaw, “Mechanics of Composite Materials”, CRC Press, NY, 2006.
4. F.L.Matthews and R.D.Rawlings, “Composite Materials: Engineering and Science”, Woodhead Publishing, 2005.
5. A.V.Srinivasan and Michael McFarland, “Smart Structures: Analysis and Design”, Cambridge University Press, UK, 2001.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1				x		x	x			
2		x	x	x	x	x	x			x
3				x		x	x			x

15EDX03 RAPID PROTOTYPING AND TOOLING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand a class of rapid prototyping (RP) technologies for rapid product development, includ reverse engineering, rapid prototyping and rapid tooling.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Apply the tools and techniques for rapid production of products with complicated shapes at low cost.
CO2. Determine the suitable rapid prototyping technology and their potential to support design and manufacturing.
CO3. Be familiar with challenges associated with reverse engineering and data processing tools; and the case studies relevant to rapid manufacturing and tooling .

UNIT I : INTRODUCTION (7)

Need - Development of RP systems – RP process chain - Impact of Rapid Prototyping and Tooling on Product Development – Benefits- Direct, Indirect - Applications – Digital prototyping - Virtual prototyping – Three dimensional Printing

UNIT II : LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS (10)

Stereo lithographyApparatus,FuseddepositionModeling,Laminatedobject manufacturing, three dimensional printing Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

UNIT III: POWDER BASED RAPID PROTOTYPING SYSTEMS (10)

Selective Laser Sintering, Direct Metal Laser Sintering, Direct shell production casting, Laser Engineered Net Shaping, Selective Laser Melting, Electron Beam Melting: Processes, materials, products, advantages, applications and limitations – Case Studies.

UNIT IV : REVERSE ENGINEERING AND CAD MODELING (10)

Basic concept- Digitization techniques – Model Reconstruction – Data Processing for Rapid Prototyping : CAD model preparation, Data Requirements – geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation.

UNIT V: RAPID TOOLING (8)

Classification: Soft tooling - Direct, Indirect – Hard tooling - Direct, Indirect - Case studies - automotive, aerospace and Biomedical industries.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Chua C.K., Leong K.F., and Lim C.S., “Rapid prototyping: Principles and applications”, Third Edition, Worl Scientific Publishers, 2010.
2. Peter D.Hilton, Hilton/Jacobs, Paul F.Jacobs, “Rapid Tooling: Technologies and Industrial Applications”, CRC press, 2000.
3. Andreas Gebhardt, “Rapid prototyping”, Hanser Gardener Publications, 2003.
4. Liou W.Liou, Frank W.Liou, “Rapid Prototyping and Engineering applications: A tool box for prototype Development”, CRC Press, 2007.
5. Ali K. Kamrani, Emad Abouel Nasr, “Rapid Prototyping: Theory and practice”, Springer, 2006.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x			x		x			
2			x	x				x		
3		x			x		x		x	x

15EDX04 CREATIVITY IN DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To acquire knowledge in basic concepts of design process, creativity in design, visualization of mechanism and innovative thinking.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Gain knowledge of creative process in design.
CO2. create the mechanism of thinking and visualization
CO3. Identify the engineering problems and design the system

UNIT I : BASICS OF DESIGN (7)

Process Design, Emotional Design – Three levels of Design – Viceral, Behavioral and Reflective. Recycling and availability- Creativity and customer needs analysis. Innovative product and service designs, future directions in this application of creativity thinking in quality management. Need for design creativity – creative thinking for quality – essential theory about directed creativity.

UNIT II : THINKING (10)

Definitions and theory of mechanisms of mind heuristics and models: attitudes, Approaches and Actions that support creative thinking - Advanced study of visual elements and principles like line, plane, shape, form, pattern, texture gradation, color symmetry.

UNIT III: VISUALIZATION OF MECHANISM (10)

Spatial relationships and compositions in 2 and 3 dimensional space - procedure for genuine graphical computer animation – Animation aerodynamics – virtual environments in scientific Visualization Unifying principle of data management for scientific visualization – Unifying principle of data management for scientific visualization - Visualization benchmarking.

UNIT IV : CREATIVITY (10)

Methods and tools for Directed Creativity – Basic Principles – Tools of Directed Creativity – Tools that prepare the mind for creative thought – stimulation of new ideas – Development and Actions: - Processes in creativity ICEDIP – Inspiration, Clarification, Distillation, Perspiration, Evaluation and Incubation – Creativity and Motivation The Bridge between man creativity and the rewards of innovativeness – Applying Directed Creativity to the challenge of quality management.

UNIT V: INNOVATION (8)

Achieving Creativity – Introduction to TRIZ methodology of Inventive Problem Solving - the essential factors – Innovator's solution – creating and sustaining successful growth – Disruptive Innovation model – Segmentive Models – New market disruption - Commoditation and DE-commoditation – Managing the Strategy Development Process – The Role of Senior Executive in Leading New Growth – Passing the Baton.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Donald A. Norman, "Emotional Design", Perseus Books Group New York , 2004
2. Clayton M. Christensen Michael E. Raynor, "The Innovator's Solution", Harvard Business School Press Boston, USA, 2003
3. Semyon D. Savransky, "Engineering of Creativity – TRIZ", CRC Press New York USA, 2000
4. Rousing Creativity: Think New, NowFloydHurr, ISBN 1560525479, Crisp Publications Inc. 1999
5. Geoffrey Petty, "How to be better at Creativity", The Industrial Society 1999.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x		x	x			x	x		
2	x					x	x			x
3	x		x						x	

15EDX05 MAINTENANCE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To enable the student to understand the principles, functions and practices adapted in industry for the successful management of maintenance activities.
- To explain the different maintenance strategies like Preventive maintenance, condition monitoring and repair of machine elements.
- To illustrate some of the simple instruments used for condition monitoring

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Be familiar with the basics of maintenance systems.

CO2. Gain ability to plan and schedule maintenance activities.

CO3. Be familiar with the safety and other aspects of maintenance functions.

UNIT I : INTRODUCTION TO MAINTENANCE SYSTEMS (9)

Introduction to repair and Maintenance -Maintenance as business – Maintenance systems such as reactive, preventive, predictive or proactive systems – Human resources management in Maintenance management - maintainability- Inherent and overall availability. - Mean time between failures, mean time to repairs and mean down time - Testability and supportability - "Design for Maintenance" – Poor maintainability aspects - Design for reliability.

UNITII : CONDITION BASED MAINTENANCE (9)

Condition based monitoring of equipment and systems -condition monitoring techniques such as a) Vibration analysis, b) Ultrasonic detection techniques, c) Thermography, d) Oil and lubricant analysis, e) Motor condition monitoring (MCM) - Shaft alignments through laser - Vibration instruments -Outline on Thermography.

UNIT III : MAINTENANCE TECHNIQUES SUCH AS RCM, TPM & CMMS (9)

Reliability centred Maintenance-Failure Mode and Effect Analysis-Root cause Analysis- logic tree analysis-Criticality matrix - Total Productive Maintenance, Overall Equipment Effectiveness-Lean manufacturing- TPM and TPO- Relationship between OEE and world-class Maintenance- Ladder of Maintenance improvement-Computerized Maintenance management system in a business scenario- data acquisition for effective management of CMMS.

UNIT IV : ASSET PLANNING AND SCHEDULING OF ACTIVITIES IN MAINTENANCE (9)

Asset and spare part management, - Conventional spare Parts management techniques such as Economic Order Quantity, two bin systems - Latest trends in monitoring through bar codes, mobile computer and wireless data transmissions - Different aspects of planning and scheduling of Maintenance, such as shutdowns- Critical aspects of both routine and shut down Maintenance -. bar charts – PERT network during shut down -Man power Training and utilization of skilled manpower - Sequencing of activities.

UNIT V: SAFETY AND OTHER ASPECTS OF MAINTENANCE FUNCTIONS (9)

Safety Engineering. - Hazard analysis -General rules and guidelines in safety and hazard prevention - Analytical tools - Hazard analysis- Fault Tree Analysis – Sneak Circuit analysis - Integrated approach to Maintenance-Statistical distributions such as normal, gamma and "Weibull" in Maintenance- Maintenance effectiveness.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Venkataraman.K, “Maintenance Engineering and Management”, PHI Learning-2007.
2. Kelly. A and Harris, M. J, “Management of Industrial Maintenance”, Butter worth & Co., 1978.
3. David J. Smith, “Reliability and Maintainability in Perspective”, McMillan, 2nd Ed., 1985.
4. Gwidon W Stachowiak and Andrew W. Batchelor, “Engineering Tribology”, Butterwork-Heinmann, 2001.
5. John V.Grimaldi & Rollin H.Simonds, “Safety Management”, AITBS Publishers & Distributors, 2001

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x								x	
2			x			x				
3			x			x			x	x

15EDX06 DESIGN OF MATERIAL HANDLING EQUIPMENTS

(Use of approved Data Book is permitted)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart basic concept of material handling, types, selection and its application.
- To give comprehensive insight in to design of hoists, conveyors and elevators.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Design the various equipments for material handling in industries.

CO2. Determine the requirement of different material handling equipments for various applications.

CO3. Identify engineering problems and to carry out the engineering design of a design or component to meet desired needs

CO4. Research concept, simulate, test working conditions and applications of modeling methods and their impact on the desired system

UNIT I : MATERIALS HANDLING EQUIPMENT (9)

Intraplant transporting facilities - types - Principle groups of material handling equipment - Choice of material handling equipment – Types of material handling equipment – General characteristics - applications.

UNIT II : DESIGN OF HOISTS (9)

Welded and roller chains - Hemp and wire ropes Design of ropes, pulleys, pulley systems, 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 (9)

Hand and power drives - Traveling gear - Rail traveling mechanism - cantilever and monorail cranes – Trackless travelling mechanism - Slewing, jib and luffing gear - cogwheel drive - selecting the motor ratings.

UNIT IV : CONVEYORS (9)

Types - description - design and applications of belt conveyors, apron conveyors and escalators Pneumatic conveyors, Screw conveyors and vibratory conveyors.

UNIT V : ELEVATORS (9)

Bucket elevators: design - loading and bucket arrangements - Cage elevators – shaft way, guides, counter weights, hoisting machine, safety devices, stackers - Design of fork lift trucks.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Rudenko, N., “Materials Handling Equipment”, ELnvee Publishers, 1970.
2. R. B.Chowdary and G. R. N.Tagore, “Material Handling Equipments”, Khannna Publishers, 2003.
3. Spivakovsy, A.O. and Dyachkov, V.K., “Conveying Machines, Volumes I and II”, MIR Publishers, 1985.
4. Alexandrov, M., “Materials Handling Equipments”, MIR Publishers, 2002.
5. Boltzharol, A., “Materials Handling Handbook”, The Ronald Press Company, 2009.
6. P.S.G. Tech., “Design Data Book”, Kalaikathir Achchagam, Coimbatore, 2012.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x				x		x		
2										x
3			x			x				
4					x					

15EDX07 TRIZ FOR PRODUCT INNOVATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge on product development technique through TRIZ.
- To expertise on the concept of TRIZ and ARIZ algorithms for design.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Acquire knowledge about TRIZ
CO2. Solve inventive technical problems within the framework of TRIZ
CO3. Familiar with QFD and other problem solving techniques

UNIT I : INTRODUCTION TO TRIZ (9)

Introduction to Product Innovation – Relationship between Invention and Innovation – Theories of Innovation: Breakthrough, incremental and open source. TRIZ – Theory to resolve Inventive Problems – TIPS – Theory ofInventive Problems Solving – Origin – Historical Development – About the Author – GenrichAltshuller – TRIZResearch for the improvement of Products, Processes, Systems and Services – Essence of TRIZ.

UNIT II : CONCEPT OF TRIZ (9)

Ideal final Result – Problem formulation and Functional analysis – Ideality – Contradiction; Physical and Technical – Resolving Contradiction – 39 Contradicting Parameters – Contradiction Matrix – Use of S Curveand Technology Evolution Trends; Statics, Kinematics and Dynamics – Case Studies.

UNIT III : INVENTIVE PRINCIPLES AND STANDARD SOLUTIONS (9)

Definition of 40 Inventive Principles – Definition of 76 Standard Solutions – Improving the System with no orlittle change (13) – Improving the system by changing the system (23) – System Transitions (6) – Detection and Measurement (17) – strategies for simplification and improvement – Case Studies

UNIT IV: ARIZ ALGORITHM (9)

ARIZ – The Algorithm for Inventive Problem Solving – ARIZ frame work; Restructuring of the original problem – Removing the Physical Contradiction – Analysing the Solution – Macro flow Chart of ARIZ

UNIT V: CASE STUDIES (9)

Case Studies of Machine Tool – Automobile – Aircraft – Robotics. TRIZ and Quality – Synergy between QFD– Quality Function Deployment, Taguchi and TRIZ.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Michael A orloff, “Inventive thinking through TRIZ”, Springer, 2012
2. Semyon D and Savransky, “Engineering of Creativity - Introduction to TRIZ Methodology of Inventive Problem Solving”, CRC Press LLC, 2000
3. Fey V R and Rivin E I , “Innovation on Demand: New Product Development Using TRIZ”, Cambridge University Press 2005.
4. Genrich Altshuller , “TRIZ Keys to Technical Innovation”, Technical Innovation Center, 2002

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x	x					x	x		
2	x			x				x		
3						x	x	x	x	

15EDX08 ADVANCED TOOL DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the design process and products.
- To understand the selection of proper materials and design for manufacture.
- To understand various types of tools and their application.
- To gain proficiency in the development of required views of the final design

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Apply the design concepts in various industrial applications
CO2. Gain knowledge about standards in tool design
CO3. Design the tools for NC machines

UNIT I : INTRODUCTION TO TOOL DESIGN (9)

Introduction –Tool Engineering – Tool Classifications– Standards in tool design-Tool Design Objectives – Tool Design in manufacturing-Challenges and requirements –Planning the tool design- Limits and fits - Tooling Materials- Ferrous and Non ferrous Tooling Materials- Carbides, Ceramics and Diamond -Nonmetallic tool materials.

UNIT II : DESIGN OF DRILL JIGS (10)

Introduction – Fixed Gages – Gage Tolerances – Selection of material for Gages – Indicating Gages – Automatic gages – Principles of location – Locating methods and devices – Principles of clamping – Drill jigs – Chip formation in drilling – General considerations in the design of drill jigs – Drill bushings – Methods of construction – Drill jigs and modern manufacturing.

UNIT III : DESIGN OF FIXTURES (8)

Introduction – Fixtures and economics – Types of Fixtures – Vise Fixtures – Milling Fixtures – Boring Fixtures – Broaching Fixtures – Lathe Fixtures – Grinding Fixtures.

UNIT IV : DESIGN OF PRESS TOOL DIES (9)

Types of Die construction – Die-design fundamentals – Blanking and Piercing die construction – Pilots – Strippers and pressure pads- Presswork materials – Strip layout – Short-run tooling for Piercing – Bending dies – Forming dies – Drawing operations.

UNIT V : TOOL DESIGN FOR NUMERICALLY CONTROLLED MACHINE TOOLS (9)

Introduction – The need for numerical control – A basic explanation of numeric control – Numerical control systems in use today (Tool for Numerical control machine) – Fixture design for numerically controlled machine tools – Cutting tools for numerical control – Tool holding methods for numerical control – Automatic tool changers and tool positioners – Tool presetting – Introduction – General explanation of the Brown and sharp machine – tooling for Automatic screw machines.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. C. Donaldson, G. H.Lecain and V. C.Goold , “Tool Design” , Tata McGraw- Hill, 2007
2 Edward G.Hoffman , “Jig and Fixture Design”, Thomsonasia Pvt Ltd, Singapore, 2004.
3. B. L.Juneja and G S.Sekhon, “Fundamentals of Metal cutting and Machine tools”, New Age International (P) Ltd., New Delhi, 2005.
4. R.A.Lindberg, “Process and Materials of Manufacture”, Prentice-Hall of India Pvt. Ltd, New Delhi, 2004.
5. S. F.Krar and F. A. Check, “Technology of Machine Tools”, Tata McGraw-Hill International, 2003.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x				x	x	x		
2		x	x					x	x	
3		x	x		x	x	x			

15EDX09 EXPERIMENTAL STRESS ANALYSIS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic aspects of experimental stress analysis
- To understand the emerging techniques like digital image correlation
- To understand the fundamental aspects of six different experimental techniques such as Moiré, Brittle Coatings, Holography, Speckle Methods, Thermo elastic Stress Analysis and Caustics.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Recognize the area of application for the this methods for the health monitoring systems the structures

CO2. Evaluate the stress at the critical points and to measure the severity of damage that occur due to the expose of the structures to the adverse loading condition

CO3. Measure the severity of damage under complex loadings for the load bearing structures

UNIT I : EXPERIMENTAL STRESS ANALYSIS USING STRAIN GUAGUES (9)

Overview of Experimental Stress Analysis - Optical Methods Work as Optical Computers – Stress - Strain and Displacement Fields. Introduction to Strain Gauges - Strain Sensitivity of a Strain Gauge - Bridge Sensitivity - Rosettes, Strain Gauge Alloys, Carriers and Adhesives. Performance of Strain Gauge System - Temperature Compensation - Two-wire and Three-wire Circuits. Correction Factors for Special Applications - Special Gauges

UNIT II : TRANSMISSION PHOTOELASTICITY (9)

Physical Principle of Strain Gauges - Photoelasticity and Moiré - Hologram Interferometry -Speckle Methods - Introduction to Shearography - TSA, DIC and Caustics. Fringe Patterns – Richness of Qualitative Information - Multi-Scale Analysis in Experimental Mechanics, Selection of an Experimental Technique.

UNIT III : THREE DIMENSIONAL PHOTOELASTICITY AND DIGITAL PHOTOELASTICITY (9)

Introduction to Transmission Photoelasticity - Ordinary and Extraordinary Rays - Light Ellipse, Passage of Light Through a Crystal Plate, Retardation Plates, Stress-optic Law, Determination of Photoelastic Parameters at an Arbitrary Point, Tardy's Method of Compensation, Calibration of Photo elastic Materials, Fringe Thinning Methodologies, Fringe Ordering in Photoelasticity, Miscellaneous Topics in Transmission Photoelasticity, Three Dimensional Photoelasticity, Overview of Digital Photoelasticity.

UNIT IV: PHOTOELASTIC COATINGS AND BRITTLE COATINGS (9)

Introduction to Photoelastic Coatings - Correction Factors for Photoelastic Coatings, Coating Materials - Selection of Coating Thickness, Industrial Application of Photoelastic Coatings, Calibration of Photoelastic Coatings. Introduction to Brittle Coatings - Analysis of Brittle Coatings.

UNIT V: NON DESTRUCTIVE TESTING METHODS (9)

Load testing on structures, buildings, bridges and towers – Rebound Hammer – acoustic emission – Sound level meter - ultrasonic testing principles and application – Holography – use of laser for structural testing – Vibration transducers for velocity and acceleration measurements- Vibrometer – Vibration Analyser

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Sadhu Singh – "Experimental Stress Analysis", Khanna Publishers, New Delhi, 2009.
2. JW Dalley and WF Riley, "Experimental Stress Analysis", McGraw Hill Book Company, N.Y. 1991
3. L.S.Srinath et al., "Experimental Stress Analysis", Tata McGraw Hill Company, New Delhi, 1984
4. R.S.Sirohi, HC Radhakrishna, "Mechanical Measurements", New Age International (P) Ltd. 2013
5. F.K Garas, J.L. Clarke and GST Armer, "Structural assessment", Butterworths, London, 1987

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x							x		
2			x		x					x
3		x	x				x			

13EDX10 COMPUTER INTEGRATED MANUFACTURING SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To gain knowledge on total manufacturing system at various levels of planning and manufacturing.
- To understand the different types of flexible manufacturing systems and to handle the product data and software used for manufacturing

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Describe the stages in product development
CO2. Identify design attributes and manufacturing attributes of product.
CO3. Explain the applications of computers in material handling, quality control and data collection system.

UNIT I : CIM MODELS (9)

Introduction - types of manufacturing - evolution of CIM - hardware and software - nature and role of elements - development of CIM - Models - Esprit - CIM OSA model, NIST AMRF model, SIEMENS model, digital equipment corporation, IBM concept of CIM, present scenario

UNIT II : PRODUCT DEVELOPMENT THROUGH CIM (9)

Product development cycle - sequential engineering (SE) and concurrent engineering (CE) - comparison of SE & CE & implementation - CE and IT - soft and hard prototyping - characteristics of CE - key factors - example of CE- manufacturability, lead time, design improvement - Taguchi method - VE - PLCM

UNIT III : COMPUTER AIDED PROCESS PLANNING (9)

Process planning - structure of process planning software and operation - information required of process planning - CAD based process planning - Group Technology (GT) - coding structure - OPITZ, MICLASS - benefits of GT - process selection - experience based learning - handbooks/data books/manuals - decision tables, trees – process capability - Variant and Generative process planning - implementation.

UNIT IV : ROBOTICS AND COMPUTER AIDED QUALITY CONTROL (9)

Robot - definition, types, performance capabilities - programming - geometric requirements - simulation - adaptive control - robot operation - ends of arm tooling - control system - Robot in CIM system - presentation of work to robots - product design - Computer aided quality control - TQM, QC & CIM, inspection and testing - SPC - CAQC- CMM, non-contact inspection, post process metrology, computer aided inspection, FIS

UNIT V : FMS AND SHOP FLOOR DATA COLLECTION SYSTEM (9)

FMS - subsystems, scope, other manufacturing approaches - types and benefits of FMS - major elements - optimization, operational elements - typical FMS layout - Shop floor control - data collection systems, types, data input techniques - automatic data collection systems - bar code - OCR - MICR - voice recognition - smart cards – data acquisition systems.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Radhakrishnan P., Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd ed., New Age International (P) Ltd., New Delhi, 2000
2. Mikell.P.Groover "Automation, Production Systems and computer integrated manufacturing", Pearson Education 2008
3. Kant Vajpayee S., "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.
4. Mikell.P.Groover and Emory Zimmers Jr., "CAD/CAM", Prentice Hall of India Pvt. Ltd., New Delhi-1, 2003.
5. David D.Bedworth, Mark R.Hendersan, Phillip M.Wolfe "Computer Integrated Design and Manufacturing", McGraw-Hill Inc 2008.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x					x	x	x	x	x
2		x	x	x		x		x	x	x
			x	x	x	x	x	x	x	x

15EDX11 BEARING DESIGN AND ROTOR DYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know about different types of bearings available for machine design and their operating principles
- To design hydrodynamic/ hydrostatic / rolling bearing for given specifications and analyze the bearings for their performance
- To understand the bearing behavior under dynamic conditions

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Get the knowledge in the analysis of all types of bearings.
CO2. Be familiar with specifications of all types of bearings
CO3. Gain skill for conducting dynamic / vibration analysis and trouble shooting of bearings

UNIT I : CLASSIFICATION AND SELECTION OF BEARINGS (6)

Selection criteria-Dry and Boundary Lubrication Bearings-Hydrodynamic and Hydrostatic bearings- Electro Magnetic bearings-Dry bearings-Rolling Element bearings- Bearings for Precision Applications-Foil Bearings-Special bearings- Selection of plain Bearing materials –Metallic and Non metallic bearings.

UNIT II : DESIGN OF FLUID FILM BEARINGS (10)

Design and performance analysis of Thrust and Journal bearings – Full, partial, fixed and pivoted journal bearings design procedure-Minimum film thickness – lubricant flow and delivery – power loss, Heat and temperature distribution calculations- Design based on Charts & Tables and Experimental curves-Design of Foil bearings-Air Bearings- Design of Hydrostatic bearings-Thrust and Journal bearings- Stiffness consideration - flow regulators and pump design

UNIT III : SELECTION AND DESIGN OF ROLLING BEARINGS (10)

Contact Stresses in Rolling bearings- Centrifugal stresses- Elasto hydrodynamic lubrication- Fatigue life calculations- Bearing operating temperature- Lubrication- Selection of lubricants- Internal clearance – Shaft and housing fit- -Mounting arrangements-Materials for rolling bearings- Manufacturing methods- Ceramic bearings-Rolling bearing cages-bearing seals selection.

UNIT IV : DYNAMICS OF HYDRODYNAMIC BEARINGS (10)

Hydrodynamic Lubrication equation for dynamic loadings-Squeeze film effects in journal bearings and thrust bearings -Rotating loads , alternating and impulse loads in journal bearings – Journal centre Trajectory- Analysis of short bearings under dynamic conditions- Finite difference solution for dynamic conditions.

UNIT V : ROTOR DYNAMICS (9)

Rotor vibration and Rotor critical speeds- support stiffness on critical speeds- Stiffness and damping coefficients of journal bearings-computation and measurements of journal bearing coefficients -Mechanics of Hydro dynamic Instability- Half frequency whirl and Resonance whip- Design configurations of stable journal bearings

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Weng Jeng Chen and J Edger Gunter, “Introduction to Dynamics of Rotor–Bearing Systems”, Trafford Publishing Ltd., London 2007.
2. J. S.Rao, “Rotor Dynamics”, New Age International Publishers, New Delhi, 2004.
3. Neale, M.J. “Tribology Hand Book”, Butterworth Heinemann, United Kingdom 2001.
4. T.Yamamoto and Y.Ishida, “Linear and Nonlinear Rotor dynamics: A Modern Treatment with Applications”, John Wiley and Sons Inc, New York, 2001.
5. S.K.Basu, S.N.Sengupta & B.B.Ahuja ,”Fundamentals of Tribology”, Prentice –Hall of India Pvt. Ltd , New Delhi, 2005.
6. G.W.Stachowiak & A.W .Batchelor , “Engineering Tribology”, Butterworth-Heinemann, UK, 2005.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x				x	x			x	
2	x		x		x				x	
3	x		x		x			x	x	x

15EDX12 MECHATRONICS IN MANUFACTURING SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To develop interdisciplinary knowledge on Electronics, Electrical, Mechanical and Computer Systems for the design of Mechanical and Electronic Systems.
- To impart the knowledge on microprocessors and their interfacing with mechanical systems.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Describe the various types of sensors and transducers.
CO2. Program the microprocessor.
CO3. Select suitable components for industrial automation.

UNIT I : INTRODUCTION (9)

Introduction to Mechatronics - Systems - Mechatronics in Products - Mechatronics approach for design process, modeling of engineering systems, modeling system with spring, damper and mass, modeling chamber filled with fluid, modeling pneumatic actuator. Transfer functions, frequency response of systems.

UNIT II : SENSORS AND TRANSDUCERS (9)

Sensors for motion and position measurement, force, torque, tactile, temperature sensors, ultrasonic sensors, magnetostrictive sensors.

UNIT III : MICROPROCESSORS IN MECHATRONICS (9)

Introduction - Architecture - Pin configuration - Instruction set - Programming of Microprocessors using 8085 instructions - Interfacing input and output devices - Interfacing D/A converters and A/D converters – Applications - Temperature control - Stepper motor control - Traffic light controller.

UNIT IV : AUTOMATION SYSTEM DESIGN (9)

Design of fluid power circuits – cascade, KV-map and step counter method. PLC – Basic structure -Input / Output processing – Programming of PLC. Sizing of components in pneumatic and hydraulic systems. Analysis of hydraulic circuits.

UNIT V : REAL TIME INTERFACING (9)

Introduction to data acquisition and control systems, overview of I/O process, virtual Instrumentation, interfacing of various sensors and actuators with PC, Condition monitoring, SCADA systems. Traditional Mechatronics design - Designing - Possible design solutions – Case studies of Mechatronics systems.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Bradley. D.A, Dawson.D., Buru.N.C. and Loader.A.J., “Mechatronics”, Chapman and Hall,2008.
2. Devdas shetty and Richard A.Kolk., “Mechatronics System Design”, PWS Publishing company, USA,2010.
3. Sanjay Gupta and Joseoh John, “Virtual Instrumentation using Lab VIEW”, Tata McGraw Hill Publications, 2005.
4. Sabrie soloman, “Sensors and Control System in Manufacturing”, McGraw Hill, Inc, 2010.
5. HMT, “Mechatronics”, Tata McGraw Hill Publications, 2005.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x		x						
2			x			x				
3					x		x			x

15EDX13 DESIGN FOR MANUFACTURE, ASSEMBLY AND ENVIRONMENTS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the principles of component design for easy manufacturing.
- To study the process capability, and factors influencing form design.
- To know the machining and casting considerations for manufacturing oriented design.
- To expose the impact of design on environment to achieve eco-friendly component design

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Estimate tolerances for different dimension of a product based on the selected manufacturing process

CO2. Select material for particular product based on the functional requirement.

CO3. Design the components based on environmental issues.

UNIT I : INTRODUCTION (9)

General design principles for manufacturability –Factors influencing design-Types of problems to be solved-evaluation of customer's requirements-Systematic working plan for the designer-Possible solutions- Evaluation method- Process capability - Feature tolerances -Geometric tolerances - Assembly limits -Datum features - Tolerance stacks-Interchangeable part manufacture and selective assembly.

UNIT II : FACTORS INFLUENCING FORM DESIGN (9)

Working principle, Material, Manufacture, Design- Materials choice - Influence of basic design, mechanical loading, material, production method, size and weight on form design- form design of welded members and forgings

UNIT III : COMPONENT DESIGN – CASTING CONSIDERATION (9)

Form design of grey iron, steel, malleable iron and aluminium castings. Redesign of castings based on parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores.

UNIT IV : COMPONENT DESIGN - MACHINING CONSIDERATION (9)

Design features to facilitate machining - drills - milling cutters - keyways – Dowelling procedures, counter sunk screws - Reduction of machined area- simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly. Redesign For Manufacture - Identification of uneconomical design - Modifying the design - Group technology - Computer Applications for DFMA

UNIT V : DESIGN FOR THE ENVIRONMENT (9)

Introduction – Importance of DFE -Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment - Weighted sum assessment method –Techniques to reduce environmental impact – Design to minimize material usage –Design for disassembly – Design for recyclability – Design for remanufacture –Design for energy efficiency – Design to regulations and standards.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Boothroyd. G, "Design for Assembly Automation and Product Design", 2nd ed., NewYork, Marcel Dekker, 2005
2. Bralla, "Design for Manufacture handbook", 2nd ed., McGraw hill, 2002
3. Boothroyd, G, Heartz and Nike, "Product Design for Manufacture", 3rd ed., 2012, CRS Press, 2012.
4. Dickson, John. R, and Corroda Poly, "Engineering Design and Design for Manufacture and Structural
5. Approach", Field Stone Publisher, USA, 1995.
6. Fixel, J. "Design for the Environment", McGraw Hill, 1996.
7. Kevien Otto and Kristin Wood, "Product Design", Pearson Publication, 2004.
8. Harry Peck, "Designing for Manufacture", Pitman publishing, 1983.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x		x				x		
2				x					x	
3		x	x						x	x

15EDX14 COMPUTATIONAL FLUID DYNAMICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce Governing Equations of viscous fluid flows.
- To introduce numerical modeling and its role in the field of fluid flow and heat transfer.
- To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Solve complex problems in the field of fluid flow
CO2. Solve complex problems in the field of heat transfer.
CO3. Solve complex problems in the field of CFD

UNIT I : GOVERNING EQUATIONS AND BOUNDARY CONDITIONS (3)

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behavior of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II: FINITE DIFFERENCE METHOD (15)

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – solution methods for finite difference equations – Elliptic equations – Iterative solution Methods – Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations

UNIT III: FINITE VOLUME METHOD (FVM) FOR DIFFUSION (15)

Finite volume formulation for steady state One, Two and Three - dimensional diffusion problems. One dimensional unsteady heat conduction through Explicit, Crank – Nicolson and fully implicit schemes.

UNIT IV: FINITE VOLUME METHOD FOR CONVECTION DIFFUSION (8)

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes-properties of discretization schemes – Conservativeness, Boundedness, Trasnportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT V: CALCULATION FLOW FIELD BY FVM (8)

Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants. Turbulence models, mixing length model, two equation (k-Є) models – High and low Reynolds number models.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The Finite Volume Method", Longman, 1998.
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 1998.
3. Patankar, S.V. "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation, 2004.
4. Muralidhar, K., and Sundararajan, T., "Computations Fluid Flow and Heat Transfer", Narosa Publishing House, NewDelhi, 1995.
5. T.J. Chung, "Computational Fluid Dynamics", Cambridge University Press, 2002.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x					x		x		
2	x	x				x				
3	x	x							x	

15EDX15 DESIGN OF PRESSURE VESSELS AND PIPING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To educate the means of flow distribution and stress analysis in pressure vessels.
- To understand the stress analysis of piping layout

COURSE OUTCOMES:

On completion of this course, the students will be able to

- CO1. Design the pressure vessels and piping layout for industrial applications.
- CO2. Analyze the failure of pressure vessels and safety measures taken for avoiding failure
- CO3. Determine the stresses in pressure vessels to design the system.

UNIT I : INTRODUCTION (3)

Methods for determining stresses – Terminology and Ligament Efficiency – Applications.

UNIT II : STRESSES IN PRESSURE VESSELS (12)

Introduction – Stresses in a circular ring, cylinder – Membrane stress Analysis of Vessel Shell components – Cylindrical shells, spherical Heads, conical heads – Thermal Stresses – Discontinuity stresses in pressure vessels.

UNIT III : DESIGN OF VESSELS (12)

Design of Tall cylindrical self supporting process columns – supports for short vertical vessels – stress concentration – at a variable Thickness transition section in a cylindrical vessel, about a circular hole, elliptical openings. Theory of Reinforcement – pressure vessel Design.

UNIT IV : BUCKLING AND FRACTURE ANALYSIS IN VESSELS (9)

Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

UNIT V : PIPING (9)

Introduction – Flow diagram – piping layout and piping stress analysis.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. John F. Harvey, “Theory and Design of Pressure Vessels”, CBS Publishers and Distributors, 1987.
2. Henry H. Bedner, “Pressure Vessels, Design Hand Book”, CBS publishers and Distributors, 1987.
3. Stanley, M. Wales, “Chemical process equipment, selection and Design”, Buterworths series in Chemical Engineering, 1988.
4. William. J., Bees, “Approximate Methods in the Design and Analysis of Pressure Vessels and Piping”, Pre ASME Pressure Vessels and Piping Conference, 1997.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs											
COs	POs										
	1	2	3	4	5	6	7	8	9	10	11
1	x						x		x		
2	x			x			x		x		x
3		x	x	x	x			x	x		

15EDX16 DESIGN OF HEAT EXCHANGERS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To build the necessary background for the design of the various types of heat exchangers.
- To learn the thermal and stress analysis on various parts of the heat exchangers.
- To learn the sizing of heat exchangers, thermal and mechanical stress analysis for various heat exchange applications.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Apply the concepts and knowledge get to design and analyze the sizing and rating of the heat exchange for various applications
CO2. Calculate the efficiency of heat exchanger.
CO3. Analyze heat transfer depending on nature of problem and available data

UNIT I : FUNDAMENTALS AND CLASSIFICATION OF HEAT EXCHANGER (9)

Parallel flow, Counter flow and cross flow; shell and tube and plate type; single pass and multipass; once through stream generators etc.

UNIT II : PROCESS DESIGN OF HEAT EXCHANGERS (9)

Heat transfer correlations, Overall heat transfer coefficient, LMTD, sizing of finned tube heat exchangers, U tube heat exchangers, fouling factors, pressure drop calculations.

UNIT III : MECHANICAL DESIGN OF SHELL AND TUBE TYPE (9)

Thickness calculations, Tube sheet design using TEMA formula, Concept of equivalent plate for analyzing perforated analysis, flow induced vibration risks including acoustic issue and remedies, tube to tube sheet joint design, buckling of tubes, thermal stresses

UNIT IV : COMPACT AND PLATE HEAT EXCHANGERS (9)

Types – merits and demerits – design of compact heat exchangers, plate heat exchangers – performance influencing parameters, limitations.

UNIT V: CONDENSERS & COOLING TOWERS (9)

Design of surface and evaporative condensers – cooling tower – performance characteristics.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. SadikKakac, Hongtan Liu, Heat Exchangers Selection, Rating and Thermal Design, CRC Press, 2002.
2. J. P .Gupta, Fundamentals of Heat exchanger and pressure vessels technology, Hemisphere publishing corporation, springer –Verlag (outside NA), 1986
3. P Arthur Frass, Heat Exchanger Design, John Wiley & Sons,1988.
4. Taborek.T, Hewitt.G.F and Afgan.N, Heat Exchangers Theory and Practice, McGraw-Hill Book Co.1980.
5. Hewitt.G.F,Shires.G.L,Bott.T.R, Process Heat Transfer, CRC Press,1994.
6. E.A.D. Sanders, Heat Exchangers, Selection Design and Construction Layman Scientific and Technical; co Published with John Wiley & Sons, 1988

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x	x		x	x		x		x	x
2	x		x				x			x
3	x		x	x		x	x	x		x

15EDX17 PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To integrate the concepts of productivity models, organization transformation and Re-engineering process.
- To know the system approach to productivity measurement.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Apply the productivity improvement concepts in industries.
CO2. Be familiar with all aspect of reengineering tools
CO3. Apply the re-engineering tools and techniques for performance improvement.

UNIT I : PRODUCTIVITY (9)

Productivity–Factor affecting productivity- Productivity benefit model- Productivity Cycle - Productivity Measurement at International, National and Industrial level.

UNIT II : PRODUCTIVITY PLANNING IN ORGANIZATIONS (9)

Productivity planning: Importance - Short term versus long term – Responsibilities - Weighted partial productivity- Production evaluation tree - Long term –Total Productivity maximization model - Total Productivity Profit model.

UNIT III : ORGANIZATIONAL TRANSFORMATION (9)

Principles of organizational transformation and re-engineering-Six R'S of organizational transformation and reengineering-fundamentals of process re engineering- Preparing the workforce for transformation and reengineering- Principle & methodology- Guidelines- LMI CIP Model.

UNIT IV : RE-ENGINEERING PROCESS IMPROVEMENT MODELS (9)

PMI models, Moen and Nolan Strategy for process improvement, LMICIP personal improvement model-, NPRDC process improvement model.

UNIT V : RE-ENGINEERING TOOLS AND IMPLEMENTATION (9)

Analytical and process tools and techniques – Information and Communication Technology – Implementation of Reengineering Projects – Success Factors and common implementation Problem – Case studies.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Sumanth, D.J., "Productivity Engineering and Management", TMH, New Delhi, 2007.
2. Edosomwan, J.A., "Organisational Transformation and Process Re-engineering", Library Catalog 1995.
3. Rastogi, P.N., "Re-engineering and Re-inventing the Enterprise", Wheeler Pub.New Delhi, 1995.
4. Premvrat, Sardana, G.D. and Sahay, B.S., "Productivity Management – A Systems Approach", Narosa Publishing House. New Delhi, 1998.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x									
2	x							x	x	x
3	x		x			x				x

15EDX18 REVERSE ENGINEERING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the concepts of reverse engineering
- To know the different types of reverse engineering tools

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Apply the Reverse Engineering tools and techniques for development of products.
CO2. Know Data management and integration in reverse engineering.
CO3. Manage the data used in various applications for analysis.

UNIT I : INTRODUCTION **(9)**

Scope and tasks of RE - Domain analysis- process of duplicating

UNIT II : TOOLS FOR RE **(9)**

Functionality - dimensional – developing technical data – digitizing techniques – construction of surface Model-solid-part material- characteristics evaluation - software and application- prototyping – verification

UNIT III : CONCEPTS **(9)**

History of Reverse Engineering – Preserving and preparation for the four stage process – Evaluation and Verification- Technical Data Generation, Data Verification, Project Implementation

UNIT IV : DATA MANAGEMENT **(9)**

Data reverse engineering – Three data Reverse engineering strategies – Definition – organization data issues - Software application – Finding reusable software components – Recycling real-time embedded software– Design experiments to evaluate a Reverse Engineering tool – Rule based detection for reverse Engineering user interfaces – Reverse Engineering of assembly programs: A model based approach and its logical basics.

UNIT V : INTEGRATION **(9)**

Cognitive approach to program understated – Integrating formal and structured methods in reverse engineering – Integrating reverse engineering, reuse and specification tool environments to reverse engineering – coordinate measurement – feature capturing – surface and solid members.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. J Biggerstaff, “Design Recovery for Maintenance and Reuse”, IEEE Corpn. July 1991
2. White paper on RE, S. Rugaban, Technical Report, Georgia Inst. of Technology, 1994
3. Katheryn, A. Ingle, “Reverse Engineering”, McGraw-Hill, 1994
4. Aiken.Peter, “Data Reverse Engineering”, McGraw-Hill, 1996
5. Linda Wills, Kluiver, “Reverse Engineering”, Academic Publishers, 1996
6. Donald R. Honsa, “Co-ordinate Measurement and Reverse Engineering”, ISBN 1555897, American Gear Manufacturers Association.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x		x							x
2			x		x			x		x
3		x	x		x			x		x

15EDX19 DESIGN FOR SIX SIGMA

L	T	P	C
3	0	0	3

OBJECTIVES:

- To gain insights about the importance of lean manufacturing and six sigma practices
- To gain knowledge of improving productivity level in production process

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Relate the tools and techniques of lean sigma to increase productivity

CO2. Be familiar with methodology to produce products with minimum wastages and maximum Productivity

CO3. Get familiarized in six sigma

UNIT I : INTRODUCTION TO SIX SIGMA (9)

Introduction to Six sigma, Project charter, PPM calculator, Gauge R&R , Linear Regression, One / Two way ANOVA, Assembly tolerancing, Basic Control charts, Case studies.

UNIT II : DEFINE PHASE (9)

Customer CTQ, QFD, Standardization, Reactive design to Predictive design quality.

UNIT III : MEASURE & ANALYSE PHASE (9)

Decomposition, Principal compound methods, Statistical distributions (non parametric), FMECA (Quantitative model), Reliability (Non normal), Availability, Maintainability (log normal), Risk assessment, Warranty prediction, QCF.

UNIT IV : DESIGN PHASE (9)

Generate and validate system / sub system models (Field trials), Identifying transfer function, Score cards, Design robustness – Taguchi SN ratio's, Error proofing.

UNIT V : VALIDATE PHASE (9)

Predicting process performance with Simulation, Testing a design, Statistically confirm build compare Predictions, Supplier - Manufacturing control plans for mean and variance, control charts, Piloting a design.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Six Sigma for Organizational Excellence, K. Muralidharan, 2015.
2. Six Sigma Demystified, Paul Keller, 2005
3. Statistical and Managerial Techniques for Six Sigma Methodology, Stefano Barone University of Palermo, Italy and Chalmers University of Technology, Sweden Eva Lo Franco University of Palermo, Italy, First Edition 2012.
4. Six sigma for Dummies, Craig Gygi and Bruce Williams with Neil DeCarlo, John Wiley & Sons, Inc. Second Edition 2012.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x	x			x				x	
2	x	x		x						x
3	x			x		x		x		

15EDX20 ENGINEERING FRACTURE MECHANICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To provide knowledge on elements of solid mechanics.
- To understand the crack growth and energy balance.
- To study the applications of fracture mechanics.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Gain knowledge on stationary crack, crack growth and fatigue crack growth.
CO2. Analyze crack growth for cyclic loading and crack initiation under large scale.
CO3. Analyze the different effects of cracks, thermal and residual stresses.

UNIT I : ELEMENTS OF SOLID MECHANICS (9)

The geometry of stress and strain, elastic deformation, plastic and elastic-plastic deformation – limit analysis.

UNIT II : STATIONARY CRACK UNDER STATIC LOADING (6)

Two dimensional elastic zone fields – Analytical solutions yielding near a crack front – Irwin's approximation – Plastic zone size – Dugdaale model – J integral and its relation to crack opening development.

UNIT III : ENERGY BALANCE AND CRACK GROWTH (9)

Griffith analysis – Linear fracture mechanics – Crack opening displacement – Dynamic energy balance – Crack arrest.

UNIT IV : FATIGUE CRACK GROWTH CURVE (12)

Empirical Relation describing crack growth by fatigue – life calculations for a given load amplitude – effects of changing the load spectrum – Effects of Environment.

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: L: 45 = 45 PERIODS

REFERENCES:

1. Tribikram Kundu, "Fundamentals of Fracture Mechanics", ANE Books Pvt. Ltd. New Delhi / CRC Press, 1st Indian Reprint, 2012
2. David Broek, "Elementary Engineering Fracture Mechanics", Fifthoff and Noerdhoff International Publisher, 1978.
3. Kare Hellan, "Introduction of Fracture Mechanics", McGraw-Hill Book Company, 1985.
4. Preshant Kumar, "Elements of Fracture Mechanics", Wheeler Publishing, 1999.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1			x		x		x			
2		x	x							
3					x	x		x		

15EDX21 TRIBOLOGY IN DESIGN

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge in the friction, wear and lubrication aspects of machine components
- To understand the material properties which influence the tribological characteristics of surfaces.
- To understand the analytical behavior of different types of bearings and design of bearings based on analytical /theoretical approach

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Select material / surface properties based on the tribological requirements

CO2. Get Methodology for deciding lubricants and lubrication regimes for different operating conditions

CO3. Get Analysis ability of different types of bearings for given load/ speed conditions.

UNIT I : SURFACE INTERACTION AND SURFACE TREATMENT (7)

Topography of Surfaces – Surface features-Properties and Measurement – Surface interaction – Surface treatments – Surface modifications – surface coatings methods- Surface Topography measurements –Laser methods – instrumentation - International standards in friction and wear measurements

UNIT II : WEAR AND FRICTION (8)

Types of wear – Mechanism of various types of wear – Laws of wear –Theoretical wear models-Wear of Metals and Non metals – Adhesive theory of sliding friction –Rolling friction-Friction properties of metallic and Non-Metallic Materials – Friction in extreme conditions –Thermal considerations in sliding contact

UNIT III : LUBRICANTS AND LUBRICATION REGIMES (8)

Lubricants and their physical properties- Viscosity and other properties of oils –Additives-and selection of Lubricants- Lubricants standards ISO,SAE,AGMA, BIS standards – Lubrication Regimes –Solid Lubrication-Dry and marginally lubricated contacts- Boundary Lubrication- Hydrodynamic lubrication –– Elasto and plasto hydrodynamic - Magneto hydrodynamic lubrication – Hydro static lubrication – Gas lubrication.

UNIT IV : THEORY OF HYDRODYNAMIC AND HYDROSTATIC LUBRICATION (12)

Reynolds Equation,-Assumptions and limitations-One and two dimensional Reynolds Equation-Reynolds and Somerfield boundary conditions- Pressure wave, flow, load capacity and friction calculations in Hydrodynamic bearings-Long and short bearings-Pad bearings and Journal bearings-Squeeze film effects-Thermal considerations-Hydrostatic lubrication of Pad bearing- Pressure , flow , load and friction calculations-Stiffness considerations- Various types of flow restrictors in hydrostatic bearings.

UNIT V : CONTACT MECHANICS AND TRIBO MEASUREMENTS (10)

Contact mechanics, Analysis of contacts, Elastic plastic contact of frictionless solids, problems. Bearing torque calculation, temperature analysis, endurance testing and failure analysis, bearing performance measurements, bearing vibration measurements.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. B.C Majumdar, “Introduction to Tribology of bearings”, S. Chand and company Ltd., New Delhi 2008.
2. Prasanta Sahoo, “Engineering Tribology”, Prentice Hall of India, New Delhi 2005.
3. Rabinowicz.E, “Friction and Wear of materials”, John Willey & Sons,UK,1995
4. Cameron, A. “Basic Lubrication Theory”, Ellis Herward Ltd., UK, 1981
5. Halling, J. (Editor) – “Principles of Tribology”, Macmillian, 1984.
6. Williams J.A. “Engineering Tribology”, Oxford Univ. Press, 1994.
7. S.K.Basu, S.N.Sengupta, B.B.Ahuja, “Fundamentals of Tribology”, Prentice–Hall of India Pvt. Ltd., New Delhi, 2005
8. G.W.Stachowiak, A.W .Batchelor, “Engineering Tribology”, Butterworth-Heinemann, UK, 2005

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x					x			x	
2		x		x				x		
3			x			x			x	

15EDX22 DESIGN PARADIGM

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on various design methodologies for manufacture and assembly, value engineering and the economics of product development

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Gain an exposure to the interrelation between design and manufacture.

CO2. Be familiar with the various design aspects to be considered for manufacturing the products using different processes.

CO3. Understand the important challenges associated with value engineering and product development economics.

UNIT I : DESIGN FOR MANUFACTURE (9)

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances - Geometric tolerances - Assembly limits – Datum features - Tolerance stacks.

UNIT II : FORM DESIGN OF CASTINGS AND WELDMENTS (9)

Redesign of castings based on parting line considerations - Minimizing core requirements - Redesigning a cast members using weldments-factors influencing form design-Working principle, Material, Manufacture, Design - Possible solutions - Materials choice - Influence of materials-on from design - form design of welded members, forgings and castings.

UNIT III : DESIGN FOR ASSEMBLY (9)

Processes-Handling and insertion process - Manual, automatic and robotic assembly-Cost of Assembly-Number of Parts-DFA guidelines

UNIT IV: VALUE ENGINEERING (9)

Value –types –functional –operational –aesthetic –cost – material – Design process – value and worthiness – procedure -brainstorming sessions –evaluation –case studies –value estimation- Value analysis - Design for value - Selection of alternatives - optimization – Implementation.

UNIT V : PRODUCT DEVELOPMENT ECONOMICS (9)

Economics analysis-Quantitative and qualitative analysis-Economic Analysis process-Estimating magnitude and time of future cash inflows and out flows-Sensitivity analysis-Project trade-offs-Tradeoff rules-Limitation of quantitative analysis-Influence of qualitative factors on project success.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. George E Dieter, “Engineering Design”, McGraw-Hill Int. Editions, 2013
2. S.S.Iyer, “Value Engineering”, New Age International, 2000
3. Charles E. Ebeling, “Reliability and Maintainability Engineering”, TMH, 2000
4. Harry Peck, “Designing for Manufacture” Pitman Publications, 1983.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x			x	x				x	
2	x		x	x			x			
3	x	x				x	x	x	x	x

15EDX23 MICRO ELECTRO MECHANICAL SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on MEMS and manufacturing techniques
- To get an exposure on the application of MEMS
- To create exposure to packaging techniques of MEMS

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Gain knowledge about MEMS and Microsystems
CO2. Familiarize with the materials used in MEMS and microsystems
CO3. Choosing the suitable fabrication technique.

UNIT I : INTRODUCTION (9)

Introduction to MEMS and Microsystems - Typical MEMS and Microsystem products - Microsystems and micro electronics - Applications of Microsystems in automotive and other industries - Microsensors - Acoustic wave sensors, Bio medical sensors - Optical sensors, Pressure sensors - Microactuators - Microgrippers, Micromotors, Microvalves, Micropumps.

UNIT II : MATERIALS FOR MEMS AND MICROSYSTEMS (9)

Substrates and Wafers - Active substrate materials - Silicon as a substrate material - Silicon compounds - Silicon Dioxide, Silicon Carbide, Silicon Nitride, Polycrystalline Silicon - Silicon Piezoresistors - Gallium Arsenide - Quartz - Polymers - Polymers as Industrial Materials, Polymers for MEMS and Microsystems, Conductive Polymers - Packaging Materials

UNIT III : MICROSYSTEM FABRICATION PROCESSES (9)

Photolithography - Photoresists and Application, Light Sources, Phoresist Development, Removal and Postbacking - Ion implantation - Diffusion - Oxidation - Chemical Vapor Deposition - Working Principle, Chemical Reactions, Rate of deposition - Physical Vapor Deposition - sputtering

UNIT IV : MICROMANUFACTURING (9)

Bulk Micromanufacturing - Etching - Isotropic and Anisotrotpic Etching, Wet Etching, Dry Etching - Surface Micromachining - General Process, Mechanical problems associated with Surface Micromachining - LIGA Process- general Process, Materials for Substrates and Photoresists - Electroplating - SLIGA Process.

UNIT V : MICROSYSTEM PACKAGING (9)

Mechanical Packaging of Microelectronics - Microsystem Packaging - General considerations, Three Levels of Microsystem Packaging - Interfaces in Microsystem Packaging - Essential Packaging Technologies – Die Preparation, Surface bonding, Wire bonding - Three Dimensional Packaging - Assembly of Microsystems - Selection of Packaging Materials.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Tai-Ran Hsu, “MEMS & Microsystems Design and Manufacture”, McGraw Hill Education, 2010.
2. N.P.Mahalik, “MEMS”, McGraw-Hill Companies, 2010.
3. Gardner, W. Julian, K. Varadan Vijay and O. Awadelkarim, Osama, “Micro sensors MEMS and Smart Devices”, Jhon Wiley & Sons Ltd, 2001.
4. Gad-el-Hak, Mhamed, The MEMS Handbook, CRC Press, 2002.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x		x							x
2	x			x	x				x	
3	x	x	x				x			

15EDX24 NANOMATERIALS AND NANOTECHNOLOGY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on the general issues relating to nanotechnology and nano fabrication.
- To impart knowledge on the methods for production of Nanoparticles and Characteristic techniques of nanomaterials.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Acquire the knowledge of the representatives of Nano particles and feature techniques of Nano materials.

CO2. Be familiar with new trends in engineering, namely Nanotechnology and Nanofabrication and with their applications in modern industries.

CO3. Get knowledge in the field of Nano technology and nano materials

UNIT I : ZERO – DIMENSIONAL NANOSTRUCTURES AND ONE DIMENSIONAL NANOSTRUCTURE- NANOWIRES AND NANORODS (10)

Nanoparticles through homogenous nucleation, nanoparticles through the heterogeneous nucleation, kinetically confined synthesis of nanoparticles, epitaxial core – shell nanoparticles. Spontaneous growth, template based synthesis, electro spinning, and lithography.

UNIT II : TWO-DIMENSIONAL NANOSTRUCTURES - THIN FILMS AND NANOSTRUCTURES FABRICAITON (10)

Fundamentals of film growth, vacuum science, Physical Vapor Deposition (PVD), Chemical Vapor Deposition(CVD), Atomic Layer Deposition (ALD), Electrochemical Deposition, Sol-Gel films. Lithography, nano manipulation and nanolithography, soft lithography, assembly of nanoparticels and nanowires, other methods of micro fabrication.

UNIT III : NANOMECHANICS AND NANO ELECTRONICS (10)

A high speed review of motion: Displacement, velocity, acceleration and force, nano mechanical oscillation, feeling faint forces. Electron energy bands, electrons in solids: conductors, insulation and semi conductors, fermi energy, the density of states for solids, quantum confinement, tunneling, single electron phenomenon, molecular electronics.

UNIT IV : NANOSCALE HEAT TRANSFER AND NANOPHOTONICS (10)

Nanoscale heat, conduction, convection, radiation. Photonics properties of nanomaterials, near-field light, optical tweezers, photonic crystals.

UNIT V : NANOSCALE FLUID MECHANICS (5)

Fluids at the nanoscale: major concepts, flow fluids flow at the nanoscale, applications of nanofludics.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Ben Rogers, Pennathur and Adams, Nanotechnology: Understanding Small System, CRC Press, 2008.
2. Bhushan, Bharat (Ed.) Handbook of Nanotechnology, Springer 2006.
3. Guozhong Cao, Nanostructures and Nanomaterials, Imperial College Press, 2006.
4. Yury Gogotsi, Nanomaterials Handbook, Drexel University, Philadelphia, Pennsylvania, USA, 2006.
5. Lundstrom, Mark, Guo, Jing, Nanoscale transistors, Device physics, modeling and simulation, Springer, 2006.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1				x			x			
2		x	x	x			x	x	x	
3			x	x		x	x			

15EDY01 INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart the design concepts, parts and types of robots.
- To create expertise in various drive systems of robot, sensors and their applications, programming, justification, implementation and safety of robot.

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Understand the robot kinematics and dynamics.
CO2. Acquire the ability to write basic program to control robot.
CO3. Gain knowledge about sensors used in robotics field.

UNIT I : INTRODUCTION AND ROBOT KINEMATICS (9)

Definition need and scope of Industrial robots – Robot anatomy – Work volume – Precision movement – End effectors – Sensors. Robot Kinematics – Direct and inverse kinematics – Robot trajectories – Control of robot manipulators – Robot dynamics – Methods for orientation and location of objects.

UNIT II : ROBOT DRIVES AND CONTROL (9)

Controlling the Robot motion – Position and velocity sensing devices – Design of drive systems – Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves, electric drives – Motors – Designing of end effectors – Vacuum, magnetic and air operated grippers.

UNIT III : ROBOT SENSORS (9)

Transducers and Sensors – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Representation - Image Grabbing – Image processing and analysis – Edge Enhancement – Contrast Stretching – Band Rationing - Image segmentation – Pattern recognition – Training of vision system.

UNIT IV : ROBOT CELL DESIGN AND APPLICATION (9)

Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis. Industrial application of robots.

UNIT V: ROBOT PROGRAMMING, AI AND EXPERT SYSTEMS (9)

Methods of Robot Programming – Characteristics of task level languages - lead through programming methods – Motion interpolation. Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – problem representation in AI – Problem reduction and solution techniques - Application of AI and KBES in Robots.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill, 1987.
2. YoramKoren, “Robotics for Engineers”, McGraw-Hill, 1987.
3. Kozyrey, Yu. “Industrial Robots”, MIR Publishers Moscow, 1985.
4. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, “Robotics Engineering – An Integrated Approach”, Prentice-Hall of India Pvt. Ltd., 1984.
5. Deb, S.R. “Robotics Technology and Flexible Automation”, Tata McGraw-Hill, 1994.
6. Mikell, P. Groover, Mitchell Weis, Roger, N. Nagel, Nicholas G. Odrey, “Industrial Robotics Technology, Programming and Applications”, McGraw-Hill Int. 1986.
7. Timothy Jordanides et al., “Expert Systems and Robotics”, Springer –Verlag, New York, 1991.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1				x			x			
2		x	x		x	x	x			
3		x	x		x	x	x	x	x	

15EDY02 SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basics of logistics
- To understand the supply chain management models and supply chain activity systems
- To use of various tools and techniques for effective management of supply chain

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Define business concepts and theories underlying supply chain management
CO2. Summarise the nature of different kinds of flows within the supply chain
CO3. Describe how supply chains can be managed more effectively.

UNIT I : INTRODUCTION TO SUPPLY CHAIN MANAGEMENT (9)

Supply chain management, development chain , global optimization, managing uncertainty and risk, evolution, complexity ,key issues . Supply contracts-introduction, strategic components, supply contracts, limitation, contracts for make to stock/make – to – order supply chains, contracts with asymmetric information, contracts for nonstrategic components.

UNIT II : INVENTORY MANAGEMENT AND RISK POOLING (9)

single stage inventory control-economic lot size model, effect of demand uncertainty, single period model, initial inventory ,multiple order opportunities, continuous review policy, variable lead times, periodic review policy, service level optimization, risk pooling, centralized versus decentralized systems, managing inventory in the supply chain, practical issues, forecasting.

UNIT III : THE VALUE OF INFORMATION (9)

Bullwhip Effect, information sharing and incentives, effective forecasts, information for the coordination of systems, locating desired products, lead - time reduction ,information and supply chain trade – offs, decreasing marginal value of information. supply chain integration- push, pull, and push-pull systems, impact of lead time, demand – driven strategies, impact of the internet on supply chain strategies,

UNIT IV: DISTRIBUTION STRATEGIES AND STRATEGIC ALLIANCES (9)

Distribution strategies-introduction, Direct shipment Distribution strategies, Transshipment, selecting an appropriate strategy. Strategic Alliances – introduction, frame work for strategic alliances, third party logistics, retailer – supplier partnerships, Distributor integration.

UNIT V : GLOBAL LOGISTICS AND RISK MANAGEMENT (9)

Introduction, risk management, issues in international supply chain management, regional differences in logistics. Coordinated product and supply chain design– general framework, Design for logistics, supplier integration into new product development, mass customization

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. David Simchi – Levi, “Designing and Managing the Supply Chain”, 3rd ed., Tata McGraw–Hill Edition, New Delhi, sixth reprint 2010.
2. Sunil Chopra and Peter Meindl “Supply Chain Management”, Pearson education ,2010.
3. Nicolas, J.N., “Competitive Manufacturing Management - Continuous Improvement, Lean production, Customer Focused Quality”, McGraw-Hill, NY, 1998.

Mapping of Course Outcome and Programme Outcome

Mapping of COs and POs										
COs	POs									
	1	2	3	4	5	6	7	8	9	10
1	x									
2			x	x					x	
3		x				x	x			

15EDY03 ENTERPRISE RESOURCE PLANNING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To know the basics and principles of ERP
- To understand the ERP implementation
- To create awareness and benefits of ERP

COURSE OUTCOMES:

On completion of this course, the students will be able to

CO1. Develop ERP system

CO2. Gain knowledge about handling of ERP tools in various areas like production and material management.

CO3. Apply ERP concepts to improve reliability and productivity

UNIT I : ENTERPRISE RESOURCE PLANNING (9)

Introduction, Dimensions of EMS, Concept and terminology, Overview of ERP system - Legacy system Vs ERP system ,Objective of ERP, ERP Development process ,Origin of Enterprise Resource planning, Structure of Enterprise Resource planning ,Benefits of ERP, MIS, Structure of MIS.

UNIT II : ERP FUNCTIONAL MODULES (9)

ERP Modules,-Human Resources Management, Material Planning and control, Inventory, Forecasting, Production Planning, Seles and Distribution, Purchase, Finance and Accounting and Quality Management Module.

UNIT III : INFORMATION SYSTEM PROSPECTIVE OF ERP (9)

Online Analysis and Processing, Transaction Processing, Knowledge Base System, Material Requirement Planning, Business Process Re-Engineering, Supply Chain Management, Customer Relationship Management, Information and Communication Technology.

UNIT IV : IMPLEMENTATION OF ERP (9)

Pre-Packed Evaluation and Screening, Evaluation and Selection of the Package, Designing of the project planning Phases, Tips for ERP Implementation, Evaluation Criterion of ERP Products, ERP Projects Implementation in Industry, IT Infrastructure for ERP.

UNIT V : MANAGERIAL ISSUES IN ERP (9)

Critical Success Factors to Make ERP Project Successful, Failure of ERP, Key Managerial Issues in ERP, Cultural Implementation Issues of ERP, ERP Selection Issues, Return On Investment and ERP, Pre Implementation Issues of ERP System, Post Implementation Issues of ERP System.

TOTAL: L: 45 = 45 PERIODS

REFERENCES:

1. Adesh K. Pandey, “Introduction to E-Commerce and ERP”, S.K.Kataria & Sons, 2012.
2. Sadagopan. S, “ERP-A Managerial Perspective”, Tata McGraw Hill, 1999.
3. Ashim Raj Singla, “Enterprise Resource Planning”, Cengage Learning. 2010.
4. Vinod Kumar Garg and N.K.Venkitakrishnan, “Enterprise Resource Planning – Concepts and Practice”, Prentice Hall of India, 1998.
5. ERPWARE, “ERP Implementation Framework”, Garg & Venkitakrishnan, Prentice Hall, 2004.

Mapping of Course Outcome and Programme Outcome

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COs	POs									
	1	2	3	4	5	6	7	8	9	10
1		x	x					x		
2	x		x				x		x	x
3	x				x			x		