KUMARAGURU COLLEGE OF TECHNOLOGY

(Autonomous Institution Affiliated to Anna University, Chennai)

COIMBATORE – 641049

CURRICULUM & SYLLABUS

CHOICE BASED CREDIT SYSTEM

(REGULATIONS 2015)

I to IV Semester

ME-CAD CAM

Mechanical Engineering

Department of Mechanical Engineering

Vision

To be a pioneer in the Field of Mechanical Engineering Education, research and services that contributes to the advancement of scientific knowledge leading to social development.

Mission

The Department is committed to provide quality education and training with emphasis on engineering fundamentals and applications to the students to be competent professionals with ethics. The department will execute research and provide services for sustainable development.

Kumaraguru College of Technology
Coimbatore – 641 049
Regulation 2015

CBCS – PG Curriculum

Name of the PG Programme: CAD CAM

Foundation Courses (FC)

S. No.	Course Code	Course Title	Periods/Wk & Credits				Preferred Semester
			L	T	P	C	
1.	P14MAT 103	Applied Mathematics	3	1	0	4	1

Professional Core (PC)

S. No.	Course Code	Course Title	Periods /Wk & Credits				Preferred Semester
			L	T	P	C	
1.	P15CC*T* 101	Computer Integrated Manufacturing Systems	3	0	0	3	1
2.	P15CC*T* 102	Applied Materials Engineering	3	0	0	3	1
3.	P15CC*T* 103	Industrial Robotics and Expert Systems	3	0	0	3	1
4.	P15CC*T* 104	Integrated Mechanical Design	3	1	0	4	1
5.	P15CC*T* 105	Computer Aided Process Planning	3	0	0	3	1
6.	P15CC*P* 101	CAD Laboratory	0	0	3	1	1
7.	P15CC*T* 201	Mechanical Vibrations	3	1	0	4	2
8.	P15CC*T* 202	Advanced Finite Element Analysis	3	1	0	4	2
9.	P15CC*T* 203	Computer Applications in Design	3	0	0	3	2
10.	P15CC*T* 204	Design for Manufacture, Assembly and Environments	3	0	0	3	2
11.	P15CC*P* 201	CAM Laboratory	0	0	3	1	2

Professional Electives (PE)

S. No.	Course Code	Course Title	Periods /Wk & Credits				Preferred Semester
			L	T	P	C	
1	P15CC*T*E21	Design of Hydraulic and Pneumatic System	3	0	0	3	2
2	P15CC*T*E22	Data Communication in CAD/CAM	3	0	0	3	2
3	P15CC*T*E23	Advanced Strength of Materials	3	0	0	3	2
4	P15CC*T*E24	Integrated Product and Processes Development	3	0	0	3	2
5	P15CC*T*E25	Micro Electro Mechanical Systems Design	3	0	0	3	2
6	P15CC*T*E26	Concurrent Engineering	3	0	0	3	2
7	P15CC*T*E27	Artificial Intelligent Systems	3	0	0	3	3
8	P15CCTE31	Flexible Manufacturing Systems	3	0	0	3	3
9	P15CC*T*E32	Optimization Techniques in Design	3	0	0	3	3
10	P15CC*T*E33	Tribology in Design	3	0	0	3	3
11	P15CC*T*E34	Advanced Mechanisms Design and Simulation	3	0	0	3	3
12	P15CC*T*E35	Design of Material Handling Equipments	3	0	0	3	3
13	P15CC*T*E36	Computational Fluid Dynamics	3	0	0	3	3
14	P15CC*T*E37	Geometric Modeling	3	0	0	3	3
15	P14C*T*E38	Ergonomics in Manufacturing	3	0	0	3	3
16	P15CC*T*E39	Integrated Product Design and Development Strategies	3	0	0	3	3
17	P15CC*T*E40	Neural Networks and Fuzzy Logic	3	0	0	3	3
18	P15CC*T*E41	Additive Manufacturing	3	0	0	3	3
19	P15CC*T*E42	Mechanics of Composite Materials	3	0	0	3	3
20	P15CC*TE43*	Advanced Tool Design	3	0	0	3	3
21	P15CC*TE*44	Design and Analysis of Experiments	3	0	0	3	3

22	P15CC*T*E45	Engineering Economics Analysis	3	0	0	3	3
23	P15CC*T*E46	Mechatronics in Manufacturing System	3	0	0	3	3

Employability Enhancement Courses (EEC)

S. No.	Course Code	Course Title	Periods /Wk & Credits				Preferred Semester
			L	T	P	C	
1.	P15CC*P* 301	Project work – Phase I	0	0	12	6	3
2.	P15CC*P* 401	Project work – Phase II	0	0	24	12	4
3.	P15CC*P* 202	Technical Seminar	0	0	2	1	2
4.	P15CCIN01	Advanced Geometrical Dimensioning and Tolerancing	1	0	0	1	3
5.	P15CCIN02	Good shop floor practices for manufacturing excellence	1	0	0	1	3
6.	P15CCIN03	Team Dynamics	1	0	0	1	3
7.	P15CCIN04	Lean Management Tools	1	0	0	1	3

CBCS – PG Curriculum

Name of the PG Programme: CAD /CAM

Semester – 1

	Course Code	Course Title	Category	Contact Hours	Hours/Week & Credits				Pre- requisites
					L	T	P	C	
Theory									
1.	P15MAT03	Applied Mathematics	FC	4	3	1	0	4	
2.	P15CC*T* 101	Computer Integrated Manufacturing Systems	PC	3	3	0	0	3	
3.	P15CC*T* 102	Applied Materials Engineering	PC	3	3	0	0	3	
4.	P15CC*T* 103	Industrial Robotics and Expert Systems	PC	3	3	0	0	3	
5.	P15CC*T* 104	Integrated Mechanical Design	PC	4	3	1	0	4	
6.	P15CC*T* 105	Computer Aided Process Planning	PC	3	3	0	0	3	
Practicals									
	P15CC*P* 101	CAD Laboratory	PC	3	0	0	3	1	
Total credits									
				23	18	2	3	21	

Semester – 2

	Course Code	Course Title	Category	Contact Hours	Hours /Week & Credits				Pre-requisites
					L	T	P	C	
Theory									
1.	P15CC*T* 201	Mechanical Vibrations	PC	4	3	1	0	4	
2.	P15CC*T* 202	Advanced Finite Element Analysis	PC	4	3	1	0	4	
3.	P15CC*T* 203	Computer Applications in Design	PC	3	3	0	0	3	
4.	P15CC*T* 204	Design for Manufacture, Assembly and Environments	PC	3	3	0	0	3	

5.		Elective – 1	PE	3	3	0	0	3		
6.		Elective – 2	PE	3	3	0	0	3		
Practicals										
	P15CC*P* 201	CAM Laboratory	PC	3	0	0	3	1		
	P15CC*P* 202	Technical Seminar	EEC	3	0	0	3	1		
Total credits										
				26	18	2	6	22		

Semester – 3

	Course Code	Course Title	Category	Contact Hours	Hours /Week & Credits				Pre- requisites
					L	T	P	C	
Theory									
	E3	Elective – 3	PE	3	3	0	0	3	
	E4	Elective – 4	PE	3	3	0	0	3	
	E5	Elective – 5	PE	3	3	0	0	3	
	E6	Elective – 6 (Self Study Course)	PE	3	3	0	0	3	
Practicals									
	P15CC*P* 301	Project work – Phase I	EEC	12	0	0	12	6	
Total credits									
					12	0	12	18	

Semester – 4

	Course Code	Course Title	Category	Contact Hours	Hours /Week & Credits				Pre- requisites
					L	T	P	C	
Theory									
1.	P15CC*P* 401	Project work – Phase II	EEC	24	0	0	24	12	
Total credits									
				24	0	0	24	12	

Electives

	Course Code	Course Title	Category	Contact Hours	Hours /Week & Credits				Pre- requisites	
					L	T	P	C		
1.	P15CC*T*E21	Design of Hydraulic and Pneumatic System	PE	3	3	0	0	3		
2.	P15CC*T*E22	Data Communication in CAD/CAM	PE	3	3	0	0	3		
3.	P15CC*T*E23	Advanced Strength of Materials	PE	3	3	0	0	3		
4.	P15CC*T*E24	Integrated Product and Processes Development	PE	3	3	0	0	3		
5.	P15CC*T*E25	Micro Electro Mechanical Systems Design	PE	3	3	0	0	3		
6.	P15CC*T*E26	Concurrent Engineering	PE	3	3	0	0	3		
7.	P15CC*T*E27	Artificial Intelligent Systems	PE	3	3	0	0	3		
8.	P15CCTE31	Flexible Manufacturing Systems	PE	3	3	0	0	3		
9.	P15CC*T*E32	Optimization Techniques in Design	PE	3	3	0	0	3		
10.	P15CC*T*E33	Tribology in Design	PE	3	3	0	0	3		
11.	P15CC*T*E34	Advanced Mechanisms Design and Simulation	PE	3	3	0	0	3		
12.	P15CC*T*E35	Design of Material Handling Equipments	PE	3	3	0	0	3		
13.	P15CC*T*E36	Computational Fluid Dynamics	PE	3	3	0	0	3		
14.	P15CC*T*E37	Geometric Modeling	PE	3	3	0	0	3		
15.	P15C*T*E38	Ergonomics in Manufacturing	PE	3	3	0	0	3		
16.	P1CC*T*E39	Integrated Product Design and Development Strategies	PE	3	3	0	0	3		
17.	P15CC*T*E40	Neural Networks and Fuzzy Logic	PE	3	3	0	0	3		
18.	P15CC*T*E41	Additive Manufacturing	PE	3	3	0	0	3		
19.	P15CC*T*E42	Mechanics of Composite Materials	PE	3	3	0	0	3		
20.	P15CC*TE43*	Advanced Tool Design	PE	3	3	0	0	3		
21.	P15CC*TE*44	Design and Analysis of Experiments	PE	3	3	0	0	3		
22.	P15CC*T*E45	Engineering Economics	PE	3	3	0	0	3		

		Analysis								
23.	P15CC*T*E46	Mechatronics in Manufacturing System	PE	3	3	0	0	3		
Total credits										
					69	0	0	69		

*** All electives should be only in category PE**

**** Grouping of electives according to specialization is optional**

DEPARTMENT OF MECHANICAL ENGINEERING
ME CAD /CAM
REGULATIONS 2015
SYLLABUS

L	T	P	C
3	1	0	4

P15MAT103/ APPLIED MATHEMATICS

Course Outcomes (COs):
After successful completion of the course, the students should be able to

CO1: Apply linear transformation methods for real time problems.

CO2 : Solve problems using classical optimization theory

CO3 : Understand and explain surface modeling for different application

CO4 : Apply the concept of design of experiments

CO5 : Solve problems using neural networks and genetic algorithms

Pre-requisite:
1. Operation Research

Topics covered:

LINEAR TRANSFORMATION: 9+3Hours

Linear Transformation – Properties of linear transformations – Matrix of a linear transformation – Matrix of an identity and a zero transformation – Matrix of the sum of two linear transformation – Scalar multiple of a linear transformation – Matrix of a Composite Transformation – Matrix of an inverse Transformation.(excluding proofs of all theorems).

CLASSICAL OPTIMIZATION THEORY: 9+3Hours

Unconstrained extremal problems- equality constraints – Lagrangian method- Inequality constraints- Kuhn- Tucker conditions- Quadratic programming – Simple problems.

SPACE CURVES AND SURFACES: 9+3Hours

Bezier curves and B – spline curves- Bezier surfaces and B- spline surfaces-Polynomial approximation of surfaces using Cubic spline interpolation and Hermite interpolation.

DESIGN OF EXPERIMENTS: 9+3Hours

Principles of experiments design- Completely Randomized Design- Randomized Block Design- Latin Square Design.

SOFT COMPUTING METHODS: **9+3Hours**

Fuzzy variables - Fuzzy relations – Neural networks – Genetic algorithms (Basic concepts only).

Theory :45Hr Tutorial :15Hr **Total Hours: 60**

REFERENCES:

1. Datta K.B., "Matrix and Linear Algebra", Prentice – Hall of India,2004
2. Sharma J. K., "Operation Research", Laxmi Publications-New Delhi, 5th Edition, 2003.
3. Curtio F. Gerald, P.O.wheatley," Applied Numerical Analysis", Addition Westley Longman, 7th Edition 2006.
4. Richard A. Johnson, " Miller & Freund's Probability and Statistics for Engineers", Prentice- Hall, 8th Edition, 2009
5. Rajasekaran S., VijayalakshmiPai G.A., "Neural Network, Fuzzy Logic and Genetic Algorithm", Synthesis and Applications, Prentice Hall of India – 2008.
6. Sivanandam S. N., Deepa S.N., "Principles of Soft Computing", Wiley India Pvt Limited, 2007.

L	T	P	C
3	0	0	3

P15CC*T*101/ COMPUTER INTEGRATED MANUFACTURING SYSTEMS

Course Outcomes (COs):
After successful completion of the course, the students should be able to

CO 1: Understand and explain the important concepts in manufacturing system.

CO 2: Apply the concepts of GT and CAPP in manufacturing.

CO 3: Familiar with the use of various process control strategies for different manufacturing processes.

CO 4: Apply computer aided quality control in manufacturing systems.

CO 5: Understand and discuss the FMS concepts in manufacturing systems.

Pre-requisite:

1 Manufacturing technology.

Topics covered:

INTRODUCTION 5Hours

Objectives of a manufacturing system-identifying business opportunities and problems classification production systems-linking manufacturing strategy and systems analysis of manufacturing operations.

GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING 10 hours

Introduction-part families-parts classification and cooling - group technology machine cells-benefits of group technology. Process planning function CAPP - Computer generated time standards.

COMPUTER AIDED PLANNING AND CONTROL 10Hours

Production planning and control-cost planning and control-inventory management-Material requirements planning(MRP)-Shop floor control-Factory data collection system-Automatic identification system-barcode technology- automated data collection system.

COMPUTER AIDED QUALITY CONTROL 10Hours

Types of production monitoring systems-structure model of manufacturing process-process control & strategies- direct digital control-supervisory computer control-computer in QC - contact inspection methods non-contact inspection method - computer-aided testing - integration of CAQC with CAD/CAM.

INTEGRATED MANUFACTURING SYSTEM **10Hours**

Definition - application - features - types of manufacturing systems-machine tools-materials handling system- computer control system -DNC systems manufacturing cell. Flexible manufacturing systems (FMS) - the FMS concept-transfer systems - head changing FMS - variable mission manufacturing system - CAD/CAM system - human labor in the manufacturing system-computer integrated manufacturing system benefits.

Theory :45 Hr **Total Hours: 45**

REFERENCES:

1. Groover, M.P., "Automation, Production System and CIM", Prentice-Hall of India, 2008,
2. YoremKoren, "Computer Integrated Manufacturing Systems", McGraw Hill, 2004.
3. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International 1997.
4. R.W. Yeomamas, A. Choudry and P.J.W. Ten Hagen, "Design rules for a CIM system", North Holland Amsterdam, 1986

L	T	P	C
3	0	0	3

P15CC*T*102/ APPLIED MATERIALS ENGINEERING

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Understand and explain elastic, plastic and fracture characteristics of different materials

CO 2: Identify and select materials for engineering applications based on various criteria

CO 3: Explain properties, structure and applications of non metallic materials and ceramics.

CO 4: Select materials for design by evaluating the linkages between material properties, micro-structures and processing.

CO 5: Solve engineering materials problems.

Pre-requisite:

1. Mechanical properties of engineering materials.

Topics covered:

ELASTIC AND PLASTIC BEHAVIOUR 10Hours

Elasticity in metals and polymers - Mechanism of plastic deformation, role of dislocations, yield stress, shear strength of perfect and real crystals - Strengthening mechanisms, work hardening, solid solution strengthening, grain boundary strengthening, poly phase mixture, precipitation, particle, fiber and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviors - Super plasticity - Deformation of non-crystalline material

FRACTURE BEHAVIOUR 10Hours

Griffith theory, stress intensity factor and fracture toughness - Toughening mechanisms - Ductile, brittle transition in steel - High temperature fracture, creep - Larson-Miller parameter - Deformation and fracture mechanism maps - Fatigue, low and high cycle fatigue test, crack initiation and propagation mechanisms and Paris law - Effect of surface and metallurgical parameters on fatigue - Fracture of non metallic materials - Failure analysis, sources of failure, procedure of failure analysis.

SELECTION OF MATERIALS 10Hours

Motivation for selection, cost basis and service requirements - Selection for mechanical properties, strength, toughness, fatigue and creep - 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 and nuclear applications.

MODERN METALLIC MATERIALS: 7Hours

Dual phase steels, Micro alloyed, High strength low alloy (HSLA) steel, Transformation induced plasticity (TRIP) steel, Maraging steel - Intermetallics, Ni and Ti aluminides - Smart materials, shape memory alloys - Metallic glass - Quasi crystal and nano crystalline materials.

NON METALLIC MATERIALS 8Hours

Polymeric materials - Formation of polymer structure - Production techniques of fibers, foams, adhesives and coatings - Structure, properties and applications of engineering polymers - Advanced structural ceramics, WC, TiC, TaC, AI2O3, SiC, Si3N4, CBN and diamond - properties, processing and applications.

Theory :45Hr Total Hours: 45

REFERENCES:

1. Thomas H.Courtney, "Mechanical Behaviour of Materials ", (2nd Edition), McGraw-Hill, 2005.
2. Michael F. Ashby. Materials Selection in Mechanical Design, Third Edition Butterworth-Heiremann, 2005.
3. Flinn, R.A. and Trojan, P.K., Engineering Materials and their Applications ", (4th Edition), Jaico, 1999.
4. George E.Dieter, "Mechanical Metallurgy ", McGraw Hill, 1988.
5. Metals Hand Book, Vol.10, "Failure Analysis and Prevention ", (10th Edition), 1994.
6. www.astm.org/labs/pages/131350.htm
7. www.applied materials.com/carrers/agu-ei.html

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3	0	0	3

P15CC*T*103/ INDUSTRIAL ROBOTICS AND EXPERT SYSTEMS

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Apply the working principle of robotics

CO 2 : Demonstrate the different components used in robots

CO 3 : Understand About the robot programming and AI

CO 4 : Understand the applications of robots

CO 5 : Build a robot

Pre-requisite:

1. Hydraulics and pneumatics

Topics covered:

INTRODUCTION **10Hours**

Definition need and scope of Industrial robots – Robot anatomy-Basic components – Work volume – Precision movement.Robot Classification -Arm geometry –Degrees of freedom-Types of motion-Path control.

ROBOT DRIVES AND CONTROL **9Hours**

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

ROBOT SENSORS AND VISION SYSTEMS **9Hours**

Transducers and Sensors – Sensors in Robot – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Image Gribbing – Image processing and analysis – Image segmentation – Pattern recognition – Training of vision system.

ROBOT CELL DESIGN AND APPLICATION **9Hours**

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

ROBOT PROGRAMMING, ARTIFICIAL INTELLIGENCE AND EXPERT SYSTEMS

8Hours

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 in Robots.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Nicholas Odrey , Mikell Groover , Roger Nagel , Ashish Dutta "Industrial Robotics (SIE): Technology, Programming and Applications", McGraw Hill,23 May 2012
2. Saeed B Niku "Introduction to Robotics: Analysis, Control, Applications", Wiley Student Edition, 2 Nov 2011
3. S.R. Deb, Sankha Deb.” Robotics Technology and Flexible Automation”, Tata McGraw-Hill, 2009
4. Timothy Jordanides et al,”Expert Systems and Robotics “, Springer –Verlag, New York, Dec 2011
5. Fu, K.S. Gonzalez R.C. and Lee, C.S.G. “Robotics Control, Sensing, Vision and Intelligence”, McGraw Hill, 1987.
6. YoramKoren,” Robotics for Engineers’ McGraw-Hill, 1987.
7. Richard. D, Klafter, Thomas, A, Chmielewski, Michael Negin, “Robotics Engineering – An Integrated Approach”, Prentice-Hall of India Pvt. Ltd., 1989

L	T	P	C
3	1	0	4

P15CC*T*104/ INTEGRATED MECHANICAL DESIGN

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Understand the usage of standards and tolerances in design

CO 2: Solve problems in design of shaft

CO 3: Design gears for various application

CO 4: Design the clutches

CO 5: Discuss the working of brakes for automobile, machine tools and material handling equipments and solve problems

Pre-requisite:

1. Design of transmission systems

Topics covered:

FUNDAMENTALS AND DESIGN OF SHAFTS **15hours**

Phases of design–Standardization and interchangeability of machine elements-Process and Function Tolerances–Individual and group tolerances–Selection of fits for different design situations–Design for assembly and modular constructions–Concepts of integration–BIS, ISO,DIN, BS, ASTM Standards. Oblique stresses–Transformation Matrix–Principal stresses–Maximum shear stress-Theories of Failure–Ductile vs. brittle component design-Analysis and Design of shafts for different applications–integrated design of shaft, bearing and casing–Design for rigidity

DESIGN OF GEARS AND GEAR BOXES **15hours**

Principles of gear tooth action–Gear correction–Gear tooth failure modes–Stresses and loads–Component design of spur, helical, bevel and worm gears–Design for sub assembly–Integrated design of speed reducers and multi-speed gearboxes–application of software packages.

BRAKES **15hours**

Dynamics and thermal aspects of vehicle braking–Integrated design of brakes for machine tools, automobiles and mechanical handling equipments.

INTEGRATED DESIGN **15hours**

Integrated Design of systems consisting of shaft, bearings, springs, motor, gears, belt, rope, chain, pulleys, Cam & Follower, flywheel etc. Example-Design of Elevators, Escalators Gear Box, Valve gear Mechanisms, Machine Tools.

Theory :60Hr **Total Hours: 60**

REFERENCES:

1. Newcomb, T.P. and Spur, R.T., "Automobile Brakes and Braking Systems", Chapman and Hall, 2nd Edition, 1975.
2. Juvinall, RL.C., "Fundamentals of Machine Component Design", John Wiley, 1983.
3. Maitra G.M., "Hand Book of Gear Design", Tata McGraw Hill, 1985.
4. Shigley, J.E., "Mechanical Engineering Design", McGraw Hill, 1988.
5. Tech. P.S.G., "Design Data Book", KalaikathirAchchagam, Coimbatore, 2003.
6. Lingaiah. K. and NarayanaIyengar, "Machine Design Data Hand Book", Vol. 1 & 2, Suma Publishers, Bangalore, 1983
7. http://agma.org/

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L	T	P	C
3	0	0	3

P15CC*T*105/ COMPUTER AIDED PROCESS PLANNING

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Explain process planning techniques using computers

CO 2: Discuss part design representation and process planning.

CO 3: Understand and use latest process planning software.

CO 4: Apply decision making process for appropriate planning idea about various process planning software

Pre-requisite:

1. Production planning or Equivalent

Topics covered:

INTRODUCTION **9Hours**

The Place of Process Planning in the Manufacturing cycle - Process Planning and Production Planning – Process Planning and Concurrent Engineering, CAPP, Group Technology.

PART DESIGN REPRESENTATION **9Hours**

Design Drafting - Dimensioning - Conventional tolerance - Geometric tolerance - CAD - input / output devices - topology - Geometric transformation - Perspective transformation - Data structure - Geometric modelling for process planning - GT coding - The optiz system - The MICLASS system.

PROCESS ENGINEERING AND PROCESS PLANNING **9Hours**

Experienced, based planning - Decision table and decision trees - Process capability analysis - Process Planning - Variant process planning - Generative approach - Forward and Backward planning, Input format, Artificial Intelligence.

COMPUTER AIDED PROCESS PLANNING SYSTEMS **9Hours**

Logical Design of a Process Planning - Implementation considerations -manufacturing system components, production Volume, No. of production families - CAM-I, CAPP, MIPLAN, APPAS, AUTOPLAN and PRO, CPPP.

AN INTERGRADED PROCESS PLANNING SYSTEMS 9Hours

Totally integrated process planning systems - An Overview - Modulus structure - Data Structure, operation - Report Generation, Expert process planning.

Theory :45Hr Total Hours: 45

REFERENCES:

1. Gideon Halevi and Roland D. Weill, "Principles of Process Planning ", A logical approach, Chapman & Hall, 1995.
2. Tien-Chien Chang, Richard A.Wysk, "An Introduction to automated process planning systems ", Prentice Hall, 1985.
3. Chang, T.C., "An Expert Process Planning System ", Prentice Hall, 1985.
4. Nanua Singh, "Systems Approach to Computer Integrated Design and Manufacturing ", John Wiley & Sons, 1996.
5. Rao, "Computer Aided Manufacturing ", Tata McGraw Hill Publishing Co., 2000.
6. http://claymore.engineer.gusu.edu/jackh/eod/automate/capp/capp.htm
7. http://Estraj.ute.sk/journal/engl/027/027.htm

L	T	P	C
0	0	3	1

P15CC*P*101/ CAD LABORATORY

Course Outcomes (COs):

CO 1: Sketch the complex components in orthographic and isometric views using CAD packages.

CO 2: Illustrate assembly drawing of various machine components.

CO 3: Practice the method, meshing, and analysis of simple Components.

Pre-requisite:

1. Engineering Graphics

Topics covered:

1. Preparation of 2-D drawings Orthographic views of standard machine components: Brackets, V Blocks, Screw threads and threaded fasteners.
2. 3D part modeling – protrusion, cut, sweep, draft, loft, blend, rib
3. Preparation of assembled drawing :
   I. Flange coupling
   II. Plummer block bearing
   III. Universal joint
   IV. Piston and connecting rod
   V. Knuckle joint
4. Exercises in modelling using Simulation feature in packages like PRO-E / SOLID EDGE /SOLIDWORKS/CATIA etc
5. Exercises in Modeling and Analysis of simple Components using Parametric and feature based Packages like PRO-E / SOLID EDGE /CATIA / ANSYS / NASTRAN etc.

Practical:45Hr **Total Hour :45**

L	T	P	C
3	1	0	4

P15CC*T*201/ MECHANICAL VIBRATIONS

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO1: Develop the equation of motion for single degree of freedom by using various methods.

CO2: Analyze the vibration effect of two degree of freedom mechanical systems.

CO3: Evaluate the vibration effect of multi-degrees of freedom system by using various methods.

CO4: Analyze the effect of vibration in continuous system.

CO5: Determine the natural frequency of mechanical system by using vibration instruments.

Pre-requisite:

1. Dynamics of machinery

Topics covered:

FUNDAMENTALS OF VIBRATION 8+3Hours

Review of Single degree freedom systems – Response to arbitrary periodic Excitations – Duhamel's Integral – Impulse Response function – Virtual work – Lagrange's equation – Single degree freedom forced vibration with elastically coupled viscous dampers – System Identification from frequency response – Transient Vibration – Laplace transformation formulation.

TWO DEGREE FREEDOM SYSTEM 8+3Hours

Free vibration of spring-coupled system – mass coupled system – Vibration of two degree freedom system – Forced vibration – Vibration Absorber – Vibration isolation.

MULTI-DEGREE FREEDOM SYSTEM 12+3Hours

Normal mode of vibration – Flexibility Matrix and Stiffness matrix – Eigen values and eigen vectors – orthogonal properties – Modal matrix-Modal Analysis – Forced Vibration by matrix inversion – Modal damping in forced vibration – Numerical methods for fundamental frequencies.

VIBRATION OF CONTINUOUS SYSTEM **8+3Hours**

Systems governed by wave equations – Vibration of strings – vibration of rods – Euler Equation for Beams – Effect of Rotary inertia and shear deformation – Vibration of plates.

EXPERIMENTAL METHODS IN VIBRATION ANALYSIS **9+3Hours**

Vibration instruments – Vibration exciters Measuring Devices – Analysis – Vibration Tests – Free and Forced Vibration tests. Examples of Vibration tests – Industrial, case studies.

Theory :45Hr Tutorial :15Hr **Total Hours: 60**

REFERENCES:

1. W. T. Thomson, Marie Dillon Dahleh – "Theory of Vibration with Applications", Pearson; 5 edition,1 November 2013
2. J.S.Rao, K. Gupta – "Introductory Course on Theory and Practice Mechanical Vibration", New Age International (P) Ltd., 1999
3. Singiresu S. Rao, "Mechanical Vibrations," Pearson; Fourth edition, 2003
4. Den Hartog, J.P, "Mechanical Vibrations," Dover Publications, 2013
5. http://www.ecgcorp.com/velav/
6. http://www.auburn.edu/isvd/
7. www.vibetech.com/techpaper.htm

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P15CC*T*202/ ADVANCED FINITE ELEMENT ANALYSIS

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1 : Applying the finite element procedure to solve 1D and 2D structural and heat transfer problems.

CO 2: Describe the finite element formulation of structural and heat transfer problems using 2Dquadratic

CO 3: Solve problems in axisymmetric elements

CO 4: Demonstrate the Iso-parametric formulation

CO 5: Solve structural dynamics problems using1D elements.

Pre-requisite:

1. Strength of materials
2. Numerical Mathematics or Equivalent

Topics covered:

INTRODUCTION **10+3Hours**

Relevance of finite element analysis in design – Modeling and discretization Interpolation, elements, nodes and degrees-of-freedom-applications of FEA One-Dimensional Elements and Computational Procedures: Bar element – beam element – bar and beam elements of arbitrary orientation – assembly of elements – properties of stiffness matrices-boundary conditions-solution of equations-mechanical loads and stresses-thermal loads and stresses-example problems.

TWO DIMENSIONAL PROBLEMS **10+3Hours**

Interpolation and shape functions - element matrixes- triangular elements-CST -LST- quadratic triangular elements- bilinear rectangular elements-quadratic rectangular elements-theory of elasticity-plane stress-plane strain- Heat transfer- torsion problems.

AXISYMMETRIC PROBLEMS **8+3Hours**

Axisymmetric formulation-element stiffens matrix and force vector- body force and temperature effects- stress calculations boundary conditions- Applications to cylindrical under internal or external pressure- rotating disc. Non liner problems- material non linearity- geometric nonlinearity- large displacements.

ISOPARAMETRIC ELEMENTS **8+3Hours**

Introduction-bilinear quadrilateral elements – quadratic quadrilaterals – hexahedral elements – Numerical Integration – gauss quadrature - static condensation – load considerations – stress calculations – examples of 2D and 3D applications.

FINITE ELEMENTS IN STRUCTURAL DYNAMICS APPLICATIONS

9+3Hours

Dynamic equations – mass matrix – natural frequencies and modes – Longitudinal, transverse and torsional systems. Transient vibration analysis- mode super position scheme- direct integration methods - example problems

Theory : 45Hr Tutorial : 15Hr **Total Hours: 60**

REFERENCES:

1. Cook, Robert Davis et al “Concepts and Applications of Finite Element Analysis “, Wiley Student Edition, 2007.
2. J.N. Reddy, " An Introduction to the Finite Element Method" , McGraw Hill, 3 edition, Nov 2005.
3. Segerlind L.J., “Applied Finite Element Analysis”, John Wiley, 1984
4. Belegundu Ashok D & Chandrupatla Tirupathi R “Introduction to Finite Elements in Engineering”, Prentice-Hall; Third edition,2002.
5. George R Buchaman , “ Schaum’s Outline of Finite Element Analysis” , McGraw Hill Company , 1994.
6. Singiresu S. Rao, " Finite Element Analysis ", Butterworth-Heinemann Ltd; 5th Revised edition, December 2010.
7. Logan.L.Daryl.” A first course in the Finite Element Method”,Cengage,5th edition,2012
8. http://www.vector-space.com/
9. http://www.mech.port.ac.uk/sdalby/mbm/CTFRProg.htm

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P15CC*T*203/ COMPUTER APPLICATIONS IN DESIGN

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1 : Explain the fundamentals of computer graphics

CO 2 : Apply different techniques for geometric modelling

CO 3 : Apply different algorithm to create prismatic and lofted parts

CO 4 : Discuss tolerance analysis and mass property calculations

CO 5 : Explain data exchange standards and communication standards

Pre-requisite:

1. Design and drafting

Topics covered:

INTRODUCTION TO COMPUTER GRAPHICS FUNDAMENTALS 10Hours

Output primitives (points, lines, curves etc.,), 2-D & 3-D transformation (Translation, scaling, rotators) windowing, view ports clipping transformation.

TECHNIQUES FOR GEOMETRIC MODELING 10Hours

Representation of curves- Bezier curves- cubic spline curve- B- Spline curves- Rational curves- Surface Modeling techniques- surface patch- Coons patch- bi-cubic patch- Bezier and B- Spline surfaces- Volume modeling- Boundary models- CSG- other modeling techniques.

VISUAL REALISM 10Hours

Hidden – Line – Surface – solid removal algorithms shading – coloring. Introduction to parametric and variational geometry based software's and their principles creation of prismatic and lofted parts using these packages..

ASSEMBLY OF PARTS 8Hours

Assembly of parts, tolerances analysis mass property calculations, mechanism simulation.

GRAPHICS STANDARDS FOR CAD **7Hours**

Graphics and computing standards- GKS- Bitmaps- Open GL Data Exchange standards- IGES-STEP-CALS-DXF-Communications standards-WAN-LAN.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Ibrahim Zeid “CAD/CAM – Theory and Practice” – McGraw Hill, International Edition, 1998.
2. Ibrahim Zeid, R Sivasubramanian, "CAD/CAM : THEORY & PRACTICE: Special Indian Edition" McGraw Hill Education (India) Private Limited, 2 edition, 25 Jun 2009
3. William M Neumann and Robert F.Sproul “Principles of Interactive Computer Graphics”, McGraw Hill Education (India) Private Limited, July 2001.
4. Donald Hearn and M. Pauline Baker “Computer Graphics C Version”, Pearson, Second edition, 1997.
5. Mikell, P. Grooves and Emory W.Zimmers Jr. “CAD/CAM Computer – Aided Design and Manufacturing” Pearson 2008.

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P15CC*T*204/ DESIGN FOR MANUFACTURE, ASSEMBLY AND ENVIRONMENTS

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Select of material, manufacturing process and mechanism for a product

CO 2: Design a component by considering the form design and machining

CO 3: Design a component by considering machining process

CO 4: Design a component based on casting considerations

CO 5: Design a eco-friendly product

Pre-requisite:

1. Manufacturing concepts or Equivalent

Topics covered:

INTRODUCTION 5Hours

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

FACTORS INFLUENCING FORM DESIGN 13Hours

Working principle, Material, Manufacture, Design- Possible solutions - Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.

COMPONENT DESIGN - MACHINING CONSIDERATION 8Hours

Design features to facilitate machining - drills - milling cutters - keyways - Doweling 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 -surface orientation- error free assembly.

COMPONENT DESIGN - CASTING CONSIDERATION 10Hours

Redesign of castings based on parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores.

Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

DESIGN FOR THE ENVIRONMENT **9Hours**

Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Example application – Lifecycle assessment – Basic method – AT&T's environmentally responsible product assessment - Weighted sum assessment method – Lifecycle 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.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Harrypeck, "Design for Manufacture", Pitman, 1973.
2. Robert Moutesk "Engineering Design" Springer; 1963
3. Geoffrey Dewhurst, Peter|Knight, Winston A. Boothroyd,"Product Design for Manufacture and Assembly (Manufacturing Engineering and Materials Processing)", CRC Press; Third edition, 14 Dec 2010
4. James Bralla, "Design for Manufacture handbook", McGraw hill, 1999.
5. O. Molloy and E.A. Warman "Design for Manufacturing and Assembly: Concepts, architectures and implementation", Springer, November 2012
6. Joseph Fiksel,"Design for the Environment", McGraw-Hill Professional; 2 edition., 2011.
7. Graedel T. Allen By. B," Design for the Environment", Prentice Hall, 1996.
8. Kevien Otto and Kristin Wood, Product Design. Pearson Publication, 2004.
9. www.ulrich – Epingar. Net
10. www.dfma.com

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P15CCP201/ CAM LABORATORY

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1 : Simulate the machining process by using simulation software

CO 2 : Generate the G codes and M codes for machining

CO 3 : Measure the dimensions using Co-ordinate Measuring Machine

CO 4 : Machine the component using CNC and VMC

Pre-requisite:
1.Computer integrated manufacturing or Equivalent

Topics covered:

1. Simulation and Machining using CNC / DNC Machine Tools – Use of FEM Packages

- CNC Lathe – 4 exercices

- CNC Milling – 4 exercices

Generation of tool path, generation of NC code, Optimization of tool path

(To reduce machining time) using any CAM software

2. Co-ordinate Measuring Machine :(Computer Aided Measuring Instruments)

Case study: Inspection of a component using Rhinoceros software, generation of report and interface (for example – Gears, Housings, Flywheels)

3. Image Processing – Applications
4. Exercise on Tool optimization using MATLAB program software.

Practical :45Hr **Total Hours: 45**

P15CC*T*E21/ DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS

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Course Outcomes (COs):

CO 1: Demonstrate the working of different types of pumps

CO 2: Explain the working of control components of hydraulics.

CO 3: Draw hydraulic circuits for various applications.

CO 4: Explain the fundamentals of pneumatics and construct pneumatic circuits.

CO 5: Construct special circuits

Pre-requisite:
1.Hydraulic and Pnemuatic systems
Topics covered:

OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS 5Hours
Hydraulic Power Generators – Selection and specification of pumps, pump characteristics. Linear and Rotary Actuators – selection, specification and characteristics.

CONTROL AND REGULATION ELEMENTS 12Hours
Pressure - direction and flow control valves - relief valves, non-return and safety valves - actuation systems.

HYDRAULIC CIRCUITS 5Hours
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.

PNEUMATIC SYSTEMS AND CIRCUITS 16Hours
Pneumatic fundamentals - 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.

INSTALLATION, MAINTENANCE AND SPECIAL CIRCUITS 7Hours

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

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Anthony Esposito,"Fluid Power with Applications", Pearson Education;7th edition 2013.
2. Dudleyt, A. Pease and John J. Pippenger, "Basic fluid power", Prentice Hall, 1987.
3. Andrew Parr, "Hydraulics and Pneumatics: A Technician's and Engineer's Guide", Elsevier, 3rd Revised edition, January 2011
4. James R. Daines "Fluid Power: Hydraulics and Pneumatics" August 2012**.**
5. Bolton. W., "Pneumatic and Hydraulic Systems ", Butterworth –Heinemann, 1997.
6. www.pneumatics .com
7. www.fluidpower.com.tw

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P15CC*T*E22/DATA COMMUNICATION IN CAD / CAM

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1 : Explain the concept of communication between machine and computer.

CO 2 : Discuss the types and functions of operating systems

CO 3 : Understand and explain communication model

CO 4 : Discuss network structure and architecture

CO 5 : Understand and discuss internet services

Pre-requisite:

1. Microprocesser or Equivalent

Topics covered:

DIGITAL COMPUTERS & MICRO PROCESSORS 9Hours

Block diagram - register transfer language - arithmetic, logic and shift micro operations - instruction code - training and control instruction cycle - I/O and interrupt design of basic computer. Machine language - assembly language - assembler.

Registers ALU and Bus Systems - timing and control signals - machine cycle and timing diagram - functional block diagrams of 80 x 86 and modes of operation. Features of Pentium Processors

OPERATING SYSTEM & ENVIRONMENTS 9Hours

Types - functions - UNIX & WINDOWS NT - Architecture - Graphical User Interfaces.

Compilers - Analysis of the Source program - the phases of a compiler - cousins of the compiler, the grouping of phases - compiler construction tools.

COMMUNICATION MODEL 9Hours

Data communication and networking - protocols and architecture - data transmission concepts

and terminology - guided transmission media - wireless transmission - data encoding - asynchronous and synchronous communication - base band interface standards RS232C, RS449 interface.

COMPUTER NETWORKS **9Hours**

Network structure - network architecture - the OSI reference model services - network standardization – example - Managing remote systems in network - network file systems - net working in manufacturing.

INTERNET **9Hours**

Internet services - Protocols - intranet information services - mail based service - system and network requirements - Internet tools – usenet - e-mail - IRC - www - FTP - Telnet.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Andrew S. Tanenbanum "Computer Networks", Pearson, Fifth edition, January 2010.
2. William Stallings, "Data of Computer Communications" Pearson, Nineth edition, 2013.
3. Morris Mano. M., "Computer System Architecture",Pearson, Third edition, 2008.
4. Ramesh Gaonkar, "Microprocessor Architecture, Programming and Applications of 8085", Penram International Publishing, 6th edition, October 2013.
5. Peterson J.L., Galvin P. and Silberschaz, A., "Operating Systems Concepts", Wiley; Eighth & Wiley Student edition, February 2009.
6. Alfred V. Aho, RaviSetjhi, Jeffrey D Ullman, "Compilers Principles Techniques and Tools", Pearson Education, Second edition, 2012.
7. Christian Crumlish, "The ABC's of the Internet", BPB Publication, 1996.

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P15CC*T*E23/ADVANCED STRENGTH OF MATERIALS

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Understand and explain the concept of stress – strain relationship and general equation of elasticity

CO 2: Design and analyze the mechanism of shear flow and stresses and deflection in unsymmetrical loading condition.

CO 3 : Design shafts to transmit required power and to design the rotary sections in engineering application.

CO 4 : Analyze the problems in torsion of non circular cross sections

CO 5 : Analyze the problems in contact stresses

Pre-requisite:
1. Strength of Materials or equivalent

Topics covered:

ELASTICITY 7Hours

Stress-Strain relations and general equations of elasticity in Cartesian, 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.

SHEAR CENTER AND UNSYMMETRICAL BENDING 10Hours

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

CURVED FLEXIBLE MEMBERS AND STRESSES IN FLAT PLATES 12Hours

Circumference and radial stresses-deflections-curved beam with restrained ends-closed ring subjected to concentrated load and uniform load-chain links and crane hooks.-Stresses in circular and rectangular plates due to various types of loading and end conditions -buckling of plates.

TORSION OF NON-CIRCULAR SECTIONS 7Hours

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

STRESSES DUE TO ROTARY SECTIONS AND CONTACT STRESSES 9Hours

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.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Timoshenko and Goodier, "Theory of Elasticity", McGraw Hill Education (India) Private Limited, 3 edition, February 2010.
2. Seely and Smith, "Advanced Mechanics of Materials", John Wiley International Edn 1952.
3. Rimoahwnko, "Strength of Materials", Van Nostrand.
4. Wang, "Applied Elasticity", McGraw Hill.
5. Cas, "Strength of Materials", Edward Arnold, London 1957. Robert D. Cook, Warren C. Young, "Advanced Mechanics of Materials", Mc-millanpub. Co.,1985.

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P15CC*T*E24/ INTEGRATED PRODUCT AND PROCESS DEVELOPMENT

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1 : Recall product development process

CO 2 : Discuss product planning process

CO 3 : Explain product specifications

CO 4 : Analyze the concept selection

CO 5 : Explain product architecture

Pre-requisite:
1. Manufacturing technology

Topics covered:

INTRODUCTION 9Hours

Characteristics of Successful Product Development-Who Designs and Develops Products-Duration and Costs of Product Development- Challenges of Product Development -Development Processes and Organizations-A Generic Development Process-Concept Development: The Front-End Process Adapting the Genetic Product Development Process- Product Development Process Flows-The AMF Development Process-Product Development Organizations-The AMF Organization.

PRODUCT PLANNING 9Hours

Product Planning Process- Identify Opportunities- Evaluating and Prioritizing Projects-Allocating Resources and Timing- Pre-Project Planning-Reflect on the Results and the Process-Identifying Customer Needs- Raw Data from Customers- Interpreting Raw Data in Terms of Customer Needs-Organizing the Needs into a Hierarchy-Establishing the Relative Importance of the Needs-Reflecting on the Results and the Process.

PRODUCT SPECIFICATIONS **9Hours**

What Are Specifications -When Are Specifications Established-Establishing Target Specifications-Setting the Final Specifications-Concept Generation-The Activity of Concept

Generation-Clarify the Problem- Search Externally-Search Internally-Explore Systematically-Reflect on the Results and the Process.

CONCEPT SELECTION **9Hours**

Concept Selection- Overview of Methodology-Concept Screening-Concept Testing-Define the Purpose of the Concept Test- Choose a Survey Population- Choose a Survey Format-Communicate the Concept- Measure Customer Response-Interpret the Results- Reflect on the Results and the Process.

PRODUCT ARCHITECTURE **9Hours**

Product Architecture-Implications of the Architecture-Establishing the Architecture-Delayed Differentiation-Platform Planning-Related System-Level Design Issues.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Product Design and Development, Karl T.Ulrich and Steven D.Eppinger, McGraw–Hill International Edns.2014.
2. Concurrent Engg. /Integrated Product Development. Kemnneth Crow, DRM Associates, 26/3,Via Olivera, Palos Verdes, CA90274(310) 377-569,Workshop Book
3. Stephen Rosenthal "Effective Product Design and Development", Irwin Professional Publishing, February 1999.
4. Tool Design – Integrated Methods for successful Product Engineering, Stuart Pugh, Addison Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41639-5
5. www.me.mit/2.7444

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P15CC*T*E25/ MICRO ELECTRO MECHANICAL SYSTEMS DESIGN

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Explain the working of micro systems

CO 2: Classify the materials based on its application.

CO 3: Discuss about micromechanics

CO 4 : Understand and explain micro system manufacturing

CO 5 : Explain micro system design

Pre-requisite:

1. Manufacturing

Topics covered:

INTRODUCTION **9Hours**

Overview-Microsystems and microelectronics - Working principle of Microsystems -micro actuation techniques-micro sensors-types-microactuators-types-micropump-micromotors-micro-valves-microgrippers-scaling laws-scaling in geometry-scaling in rigid body dynamics- scaling in electrostatic forces- scaling in electricity- scaling in fluid mechanics- scaling in heat transfer.

MATERIALS AND FABRICATION PROCESS **9Hours**

Substrates and wafer-single crystal silicon wafer formation-ideal substrates-mechanical properties-silicon compounds - Sio_2, SiC, Si_3N_4 and polycrystalline silicon - Silicon piezo resistors - Gallium arsenide, Quartz-piezoelectric crystals-polymers for MEMS -conductive polymers – Photolithography - Ion implantation - Diffusion – Oxidation –CVD - Physical vapor deposition - Deposition by epitaxy - etching process

MICROMECHANICS **9Hours**

Introduction-static bending of thin plates-circular plates with edge fixed - rectangular plate with all edges fixed and square plate with all edges fixed – Mechanical vibration-resonant vibration-

micro accelerometers-design theory and damping coefficients- thermo mechanics-thermal stresses-fracture mechanics-stress intensity factors, fracture toughness and interfacial fracture mechanics.

MICRO SYSTEM MANUFACTURING 9Hours

Clean room technology-Bulk Micro manufacturing- surface micro machining –LIGA-SLIGA-Micro system packaging-materials-die level-device level-system level-packaging techniques-die preparation-surface bonding-wire bonding-sealing

MICRO SYSTEM DESIGN 9Hours

Design considerations-process design-mask layout design- mechanical design-applications of micro system in -automotive industry-bio medical –aero space-telecommunications.

Theory : 45Hr TotalHours: 45

REFERENCES:

1. Mohamed Gad-el-Hak, The MEMS Hand book, CRC press 2002.
2. Julian W.Gardner,VijayK.Varadan,OsamaO.AwadelKarim, Micro sensors MEMS and Smart Devices, John Wiby& sons Ltd.,2001.
3. Fatikow, S. Rembold, U.“Microsystem Technology and Microrobotics“,Springer, December 2010.
4. Tai-Ran Hsu, MEMS & Microsystems Design and Manufacture,Tata McGraw-Hill, 2006. Francis E.H Tay and W.O Choong, Microfludics and BioMEMS Applications, Springer, 2002.

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P15CC*T*E26/ CONCURRENT ENGINEERIG

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Understand and explain the basic concepts of concurrent engineering and application of computer in concurrent engineering

CO 2: Develop the Process models

CO 3 : Discuss system design procedure for manufacturing system.

CO 4: Explain about automated fabrication systems

CO 5 : Design and analysis of manufacturing cost

Pre-requisite:

1.Manufacturing System

Topics covered:

CONCURRENT ENGINEERING 9Hours

Introduction - basic concepts - traditional Vs concurrent approach -schemes and tools of concurrent engineering - application of computers in the practice of concurrent engineering.

BASIC PROCESS ISSUES 9Hours

Process models - types - importance. Relation between models, specifications, technology, automation and process improvement. Fabrication processes – assembly processes - models of manufacturing, testing and inspection.

CONCURRENT ENGINEERING APPROACH IN MANUFACTURING SYSTEMS 9Hours

System design procedure - features - intangibles - assembly resource alternatives - task assignment - tools and toolchanging - material handling alternatives.

CONCURRENT AUTOMATED FABRICATION SYSTEMS 9Hours

Introduction - methodology -preliminary and detailed work content analysis - alternatives - human resource considerations. "Technical -Economic" performance evaluation – concurrent assembly work station - strategic issues - technical issues - economic analysis.

ECONOMIC ANALYSIS OF SYSTEMS **9Hours**

Types of manufacturing cost - pro-forma, cash-flow,determining allowable investment - evaluation of investment alternatives - sensitivity analysis - effect ofrecycling and rework.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. James L Nevins and Daniel E Whitney, "Concurrent Design of Products and Processes", McGraw HillPublishing Company,1989.
2. David D Bedworth, Mark R Handerson and Philip M Wilze, "Computer Integrated Design andManufacturing", McGraw HillInternational Edition, 1991.
3. Proceedings of the "Summer School on Applications of Concurrent Engineering to Product Development" held at PSG College of Technology, May 1994.
4. Josip Stjepandic, Nel Wognum , Wim J.C. Verhagen "Concurrent Engineering in the 21st Century: Foundations, Developments and Challenges", Springer ,January , 2015

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P15CC*T*E27/ ARTIFICIAL INTELLIGENCE SYSTEMS

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1 : Understand and explain the issues related to simulate intelligence.
CO 2: Discuss different type of AI
CO 3 : Explain the fundamentals of knowledge representation
CO 4 : Demonstrate working knowledge of reasoning in the process of incomplete or uncertain information.
CO 5 : Apply the Expert system for manufacturing process

Pre-requisite:

1. Basics of product architecture

Topics covered:

SCOPE OF ARTIFICIAL INTELLIGENCE 9Hours

Games, theorem proving, natural language processing, vision and speech processing, robotics, expert systems, Artificial Intelligent techniques- search knowledge, abstraction

PROBLEM SOLVING 9Hours

State space search, Production systems, search space control, depth-first, breadth-first search, heuristic search - Hill climbing, best-first search, branch and bound, Problem Reduction, Constraint Satisfaction End, Means-End Analysis

KNOWLEDGE REPRESENTATION 9Hours

Predicate Logic - Unification, modus pones, resolution, dependency directed backtracking, Rule based Systems, Forward reasoning, conflict resolution, backward Reasoning, use of no backtrack, Structured Knowledge Representation, Semantic Nets, slots, exceptions and default frames, conceptual dependency, scripts.

HANDLING UNCERTAINTY AND LEARNING 9Hours

Non-Monotonic Reasoning, Probabilistic reasoning, use of certainty factors, fuzzy logic, Concept of learning, learning automation, genetic algorithm, learning by inductions, neural nets.

EXPERT SYSTEMS 9Hours

Need and justification for expert systems, knowledge acquisition, Introduction to machine learning, Intelligence for manufacturing tools, manufacturing brain, eye and hand. Trends in robot intelligence. Case studies in the application of Artificial Intelligence in manufacturing.

Theory : 45Hr **Total Hours: 45**

REFERENCES:

1. Elaine Rich and Kevin Knight “Artificial intelligence”, McGraw Hill Education (India) Private Limited; 3 edition, October 2008
2. Nilsson N.J., “Principles of Artificial Intelligent”, Morgan Kaufmann Publishers, Inc.; 1 edition, April, 1998)
3. Patterson D. "Introduction to Artificial Intelligence and Expert Systems", PHI, 1997
4. Stuart Russell "Artifical Intelligence: A Modern Approach: A Modern Approach" Pearson; Third edition, 2013
5. Peter Jackson, “Introduction to Expert Systems”, Addison-Wesley;December,1998
6. Schalkoff R.J., “Artificial Intelligence - an Engineering Approach”, McGraw Hill Int. Ed., Singapore, 1992.
7. Sasikumar, M. Ramani, S. “Rule Based Expert Systems”, Narosa Publishing House, 1994.
8. Radhakrishnan, P. Subramanyam, S. “CAD/CAM/CIM”, New Age International Pub, New Delhi

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P15CC*T*E31/ FLEXIBLE MANUFACTURING SYSTEMS

Course Outcomes (COs):

CO 1 : Understand and explain automation of manufacturing processes
CO 2: Explain about part families
CO 3 : Discuss the components of FMS
CO 4 : Explain the selection and specification of FMS software
CO 5 : Understand and discuss JIT

Pre-requisite:
1.Computer integrated Manufacturing

Topics covered:

MANUFACTURING IN A COMPETITIVE ENVIRONMENT 9Hours

Automation of manufacturing process - Numerical control - Adaptive control - material handling and movement - Industrial robots - Sensor technology - flexible, fixturing - Design for assembly, disassembly and service.

GROUP TECHNOLOGY 9Hours

Part families - classification and coding -Production flow analysis - Machine cell design- Benefits.

FLEXIBLE MANUFACTURING SYSTEMS 9Hours

Introduction - Components of FMS - Application workstations - Computer control and functions - Planning, scheduling and control of FMS - Scheduling - Knowledge based scheduling - Hierarchy of computer control - Supervisory computer.

COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS 9Hours

System issues - Types of software - specification and selection - Trends - Application of simulation - software - Manufacturing data systems - data flow - CAD/CAM considerations - Planning FMS database.

JUST IN TIME 9Hours

Characteristics of JIT - Pull method - quality -small lot sizes - work station loads - close supplier ties - flexible work force - line flow strategy - preventive maintenance - Kanban system - strategic implications - implementation issues - MRD JIT - Lean manufacture.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Groover M.P., " Automation, Production Systems and Computer Integrated Manufacturing ", Prentice-Hall of India Pvt. Ltd., New Delhi, 2008.
2. Jha, N.K. " Handbook of Flexible Manufacturing Systems ", Academic Press Inc., 1991.
3. Kalpakjian, "Manufacturing Engineering and Technology ", Pearson., 2001.
4. Taiichi Ohno, Toyota, " Production System Beyond Large-Scale production ", Productivity Press (India) Pvt. Ltd., 1998.

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P15CC*T*E32/ OPTIMIZATION TECHNIQUES IN DESIGN

Course Outcomes (COs):

CO 1 : Understand and explain the fundamentals of optimum design

CO 2 : Solve problems in optimum design for constrained and unconstrained problems

CO 3 : Solve problems in direct and indirect methods

CO 4 : Use genetic algorithms for optimum design

CO 5 : Design components for static and dynamic application

Pre-requisite:
1. Numerical Mathematics or Equivalent

Topics covered:

INTRODUCTION TO OPTIMUM DESIGN AND NON-LINEAR PROGRAMMING

SINGLE VARIABLES 9Hours

General Characteristics of mechanical elements, adequate and optimum design, principles of optimization, formulation of objective function, design constraints – Classification of optimization problem. Single variable optimization: Elimination methods – Unrestricted, Exhaustive, Dichotomous, Interval halving, Fibonacci and golden section – Interpolation methods – Quadratic, cubic interpolation – Newton method.

MULTIVARIABLE -UNCONSTRAINED TECHNIQUES 9Hours

Single variable and multivariable optimization, Techniques of unconstrained minimization – Golden section, Random, pattern and gradient search methods – Interpolation methods; Optimization with equality and inequality constraints. Direct search methods – Random. Search methods, Grid search, univariate method, pattern Directions, Hookes and Jeeves, Powells, simple's method.

MULTIVARIABLE – GRADIENT METHODS AND CONSTRAINED TECHNIQUES 9Hours

Gradient (Descent) methods – Gradient of a function, steepest descent, conjugate gradient, Newton's method. Constrained technique: Direct methods – Random search, simplex method. Indirect methods – Transformation techniques- Interior penalty function method – Concept of Augmented LaGrange multiplies method.

INTELLIGENT TECHNIQUE **9Hours**

Genetic Algorithms: Concept, algorithm - Reproduction operations: Roulette wheel selection, Rant order selection – Crossover and Mutation operators – Particle Swarm optimization, simulated annealing algorithm, Ant corny optimization, concept – Algorithms – Applications.

STATIC AND DYNAMIC APPLICATIONS **9Hours**

Structural applications – Design of simple truss members - 2 bars and 3 bars. Design applications – Design of simple axial, transverse loaded members for minimum cost, maximum weight – Design of shafts and torsionally loaded members – Hollow torsional rod. Design of springs, Dynamic Applications – Optimum design of gears, Optimum design of simple linkage mechanisms.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Jasbir.S.Arora, “Introduction to optimum design”, Academic Press Inc; October 2011.
2. Saravanan.R, “Manufacturing optimization through intelligent techniques”, Taylor and Francis Publications, CRC Press, 2006.
3. Rao.S.S, “Engineering optimization”, New Age International publishers, 2006.
4. Kalyanamoy Deb, “Optimization for Engineering design algorithms and Examples”, Prentice Hall of India Pvt. 2002
5. Johnson Ray, C., “Optimum design of mechanical elements”, Wiley, John & Sons, 1990.
6. Goldberg, D.E., “Genetic algorithms in search, optimization and machine”, Barnen, Addison-Wesley, New York, 2003.

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P15CC*T*E33/ TRIBOLOGY IN DESIGN

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Demonstrate the basic concepts of friction, lubrication and wear processes.

CO 2: Perform analysis in fluid film bearings

CO 3: State the design aspects and kinematics of rolling element bearings.

CO 4: Explain the concepts of tribology instrumentation.

CO 5: Recognize the vibration measurement techniques of bearings.

Pre-requisite:

1. Fundamentals of applied mechanics.

Topics covered:

SURFACES, FRICTION AND WEAR **8Hours**

Topography of Surfaces – Surface features – Surface interaction – Theory of Friction – Sliding and Rolling Friction, Friction properties of metallic and non-metallic materials – friction in extreme conditions – wear, types of wear – mechanism of wear – wear resistance materials – surface treatment – Surface modifications – surface coatings.

LUBRICATION THEORY **8Hours**

Lubricants and their physical properties lubricants standards – Lubrication Regimes Hydrodynamic lubrication – Reynolds Equation, Thermal, inertia and turbulent effects – Elasto hydrodynamic and plasto hydrodynamic and magneto hydrodynamic lubrication – Hydro static lubrication – Gas lubrication.

DESIGN OF FLUID FILM BEARINGS **12Hours**

Design and performance analysis of thrust and journal bearings – Full, partial, fixed and pivoted journal bearings design – lubricant flow and delivery – power loss, Heat and temperature rotating loads and dynamic loads in journal bearings – special bearings – Hydrostatic Bearing design.

ROLLING ELEMENT BEARINGS **10Hours**

Geometry and kinematics – Materials and manufacturing processes – contact stresses – Hertzian stress equation – Load divisions – Stresses and deflection – Axial loads and rotational effects, Bearing life capacity and variable loads – ISO standards – Oil films and their effects – Rolling Bearings Failures.

TRIBO MEASUREMENT IN INSTRUMENTATION 7Hours

Surface Topography measurements – Electron microscope and friction and wear measurements – Laser method – instrumentation - International standards – bearing performance measurement – bearing vibration measurement.

Theory :45Hr Total Hours: 45

REFERENCES:

1. Cameron, A. “Basic Lubrication Theory”, Ellis Horwood Ltd; August 1983.
2. Halling, J.“Principles of Tribology “, Macmillian – 1984.
3. Williams J.A. “Engineering Tribology”, OxfordUniv. Press, 1995.
4. Neale, M.J. “Tribology Hand Book”, Butterworth Heinemann, 1995.
5. Michael M.Khonsari, E.Richard Booseer, “Applied Tribology: Bearing design and lubrication”, 2nd Edition, wiley 2008.
6. Tadeusz Stolarski, “Tribology in Machine design”, Butterworth Heinemann, 1999.
7. Gwidon Stachowiak,Andrew W Batchelor Engineering Tribology, Butterworth-Heinemann, Fourth Edition, October 2013

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P15CC*T*E34/ ADVANCED MECHANISMS DESIGN AND SIMULATION

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Understand and discuss the kinematic analysis of linkages in an assembly.

CO 2: Calculate the displacement, velocity and acceleration at any point in a link of a mechanism.

CO 3: Predict the motion resulting from a specified set of linkages in a mechanism.

CO 4: Recognize the mechanism of cams and to find their optimum sizes.

CO 5: Perform analysis for special mechanisms and robotic manipulations.

Pre-requisite courses:

1. Basics of mechanics and kinematics of machinery or Equivalent.

Topics covered: **Hrs**

INTRODUCTION **5Hours**

Review of fundamentals of kinematics – mobility analysis – formation of one D.O.F. multi loop kinematics chains, Network formula – Gross motion concepts.

KINEMATIC ANALYSIS **5Hours**

Position Analysis – Vector loop equations for four bar, slider crank, inverted slider crank, geared five bar and six bar linkages. Analytical methods for velocity and acceleration Analysis– four bar linkage jerk analysis. Planar complex mechanisms.

PATH CURVATURE THEORY **6Hours**

Fixed and moving centrodes, inflection points and inflection circle. Euler Savary equation, graphical constructions – cubic of stationary curvature.

SYNTHESIS OF MECHANISMS **15Hours**

Type synthesis – Number synthesis – Associated Linkage Concept. Dimensional synthesis – function generation, path generation, motion generation. Graphical methods. Cognate linkages -

Coupler curve synthesis, design of six-bar mechanisms. Algebraic methods. Application of instant center in linkage design. Cam Mechanisms – determination of optimum size of Cams.

DYNAMICS OF MECHANISMS , SPATIAL MECHANISMS AND ROBOTICS

14Hours

Static force analysis with friction – Inertia force analysis – combined static and inertia force analysis, shaking force, Kinetostatic analysis. Introduction to force and moment balancing of linkages.Kinematic Analysis of Spatial RSSR mechanism – Denavit – Hartenberg Parameters. Forward and inverse Kinematics of Robotic Manipulators.

Study and use of Mechanism using Simulation Software packages.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Arthur G. Erdman,George N. SandoR,"Mechanism Design: Analysis and Synthesis", Prentice Hall Mar 2001
2. Shigley, J.E., and Uicker, J.J., “Theory of Machines and Mechanisms”, McGraw Hill, 2003.
3. AmitabhaGhosh and Asok Kumar Mallik, “Theory of Mechanism and Machines”, EWLP, Delhi, 1999.
4. Norton R.L., “Design of Machinery”, McGraw Hill, 2003
5. Kenneth J, Waldron, Gary L. Kinzel, “Kinematics, Dynamics and Design of Machinery”, John Wiley-sons, 2007
6. Uicker.J.J, Pennock.G.R, Shighley.J.E, “Theory of machines and mechanisms”, Oxford university press, 2005.
7. Ramamurti.V, “Mechanics of machines”, Nacosa, 2005.

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P15CC*T*E35/ DESIGN OF MATERIAL HANDLING EQUIPMENT

Course Outcomes (COs):

CO 1: Describe the importance of proper material handling techniques and regarding hoisting and conveying equipment.

CO 2: List hazards associated with hoisting and conveying.

CO 3: Learn about various hoisting gear drives used in various applications.

CO 4: Knowledge and attention on various types of conveyor designs.

CO 5: State the different types of elevators and trucks and their design.

Pre-requisite:

1. Basic mechanics and kinematics of machinery

Topics covered:

MATERIAL HANDLING EQUIPMENT **5Hours**

Types, selection and applications

DESIGN OF HOISTS **10Hours**

Design of hoisting elements: 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.

DRIVES OF HOISTING GEAR **10Hours**

Hand and power drives - Traveling gear - Rail traveling mechanism - cantilever and monorail cranes - slewing, jib and bluffing gear - cogwheel drive - selecting the motor ratings.

CONVEYORS **10Hours**

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

ELEVATORS **10Hours**

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

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Rudenko, N., Materials handling equipment, ELnvee Publishers, 1970.
2. Spivakovsy, A.O. and Dyachkov, V.K., LConveying Machines, Volumes I and II, MIR Publishers, 1985.
3. Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.
4. Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.
5. P.S.G Tech., “Design Data Book”, KalaikathirAchchagam, Coimbatore, 2003.
6. Lingaiah. K. and NarayanaIyengar, “Machine Design Data Hand Book”, Vol. 1 & 2, Suma Publishers, Bangalore, 1983

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P15CC*T*E36/ COMPUTATIONAL FLUID DYNAMICS

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Recall the Finite difference method and formulation of governing equation

CO 2: Compute the problems for conduction heat transfer.

CO 3: Model the heat transfer and incompressible fluid flow for analysis

CO 4: Model and analyze convective heat transfer and turbulence

Pre-requisite:

1. Numerical methods

Topics covered:

GOVERNING DIFFERENTIAL EQUATION AND FINITE DIFFERENCE METHOD 10Hours

Classification, Initial and Boundary conditions, Initial and Boundary value problems. Finite difference method, Central, Forward, Backward difference, Uniform and non-uniform Grids,Numerical Errors, Grid Independence Test.

CONDUCTION HEAT TRANSFER 10Hours

Steady one-dimensional conduction, Two and Three-dimensional steady state problems, Transient one-dimensional problem, Two-dimensional Transient Problems.

INCOMPRESSIBLE FLUID FLOW 10Hours

Governing Equations, Stream Function – Verticity method, Determination of pressure for viscous flow, simple procedure of Patankar and spalding, Computation of Boundary layer flow, Finite difference approach.

CONVECTION HEAT TRANSFER AND FEM 10Hours

Steady One-Dimensional and Two-Dimensional Convection – Diffusion, Unsteady one-dimensional convection – Diffusion, Unsteady two-dimensional convection – Diffusion – Introduction to finite element method – Solution of steady heat conduction by FEM – Incompressible flow – Simulation by FEM.

TURBULENCE MODELS: 5Hours

Algebraic Models – One equation model, K - ∈ Models, Standard and High and Low Reynolds number models, Prediction of fluid flow and heat transfer using standard codes.

Theory : 45Hr **Total Hours: 45**

REFERENCES:

1. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", NarosaPublishing House, New Delhi, 2009.
2. Ghoshdasdidar, P.S., "Computer Simulation of flow and heat transfer" Tata McGraw-Hill Publishing Company Ltd., 1998.
3. Subas, V.Patankar "Numerical heat transfer fluid flow", Hemisphere Publishing Corporation, 1980.
4. Taylor, C and Hughes, J.B. "Finite Element Programming of the Navier Stock Equation., Pineridge Press Limited, U.K., 1981.
5. Anderson, D.A., Tannehill, J.I., and Pletcher, R.H., "Computational fluid Mechanics and Heat Transfer ",CRC Press; 3rd edition ,2011
6. Fletcher, C.A.J. "Computational Techniques for Fluid Dynamics 1", Fundamental and General Techniques, Springer – Verlag, 2012
7. Fletcher, C.A.J. "Computational Techniques for Fluid Dynamics 2", Specific Techniques for Different Flow Categories, Springer – Verlag, 2013.

Bose, T.X., "Numerical Fluid Dynamics", Narosa Publishing House, 1997.

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P15CC*T*E37/ GEOMETRIC MODELING

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Develop the mathematical model of curves and surface.

CO 2: Develop the mathematical representation of surface.

CO 3: Develop the mathematical model of solid based on the design application.

CO 4: Develop visual realization algorithm.

CO 5: Design the animation of product.

Pre-requisite:
1. Mathematical modelling or Equivalent

Topics covered:

TYPES AND MATHEMATICAL REPRESENTATION OF CURVES 9Hours

Introduction,Wireframemodels,parametricrepresentationofcurves(analytic&synthetic),curvemanipulation,designexamples.

MATHEMATICAL REPRESENTATION OF SURFACES 9Hours

Surface models, parametric representation, surface manipulation, design applications.

MATHEMATICAL REPRESENTATION OF SOLIDS 11Hours

Fundamentalsofsolidmodeling,Boundaryrepresentation,constructivesolidgeometry,sweeprepresentation,analyticsolidmodelers,designapplications.

VISUAL REALISATION 8Hours

Model cleanup, hidden line removal, hidden surface removal, shading, colouring.

COMPUTER ANIMATION 8Hours

Computer animation, animation systems types and techniques, design applications, Computer Graphics Standard.

Theory :45Hr Total Hours: 45

REFERENCES:

1. DavidSolomon,"ComputerGraphicsandGeometricModeling",Springer Verlag,1999
2. IbrahimZeid,"CAD/CAMTheoryandPractice",McGrawHillInc.,NewYork,1991.
3. RadhakrishnanP&KothandaramanCP,"ComputerGraphicsandDesign", DhanpatRaiandSons,1997.
4. RadhakrishnanP&SubramanyanS,“CAD/CAM/CIM”,NewAgeInternational(P)Ltd.,1997.
5. Michael EMortenson,"GeometricModeling”, JohnWiley&SonsInc.,SecondEdition,1997

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P15CC*T*E38/ ERGONOMICS IN MANUFACTURING

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1 : Recognize the need, requirements and applications of ergonomics in design

CO 2 : Summarize the requirements and applications of ergonomics and design

CO 3: Illustrate the importance of work space design

CO 4: Contrast influence of human performance over ergonomics

CO 5: identify methodology for best job production.

Pre-requisite:

1. manufacturing Technology or equivalent

Topics covered:

INTRODUCTION **5Hours**

Interdisciplinary nature of ergonomics, modern ergonomics.

HUMAN PERFORMANCE **10Hours**

Information input and processing, factors affecting human performance, physical work load and energy expenditure, heat stress, manual lifting.

WORK SPACE DESIGN **10Hours**

Anthropometry, Work-space design for standing and seated workers, arrangement of components within a physical space, interpersonal aspect of workplace design.

DESIGN OF EQUIPMENT **10Hours**

Ergonomic factors to be considered, design of displays and controls, design for maintainability.

DESIGN OF ENVIRONMENT **10Hours**

Illumination – Climate – Noise – Motion.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Martin Helander, “A Guide to Ergonomics of Manufacturing”, CRC Press, 2 edition, December 2005.
2. Bridger, R.S., “Introduction to Ergonomics, CRC Press, 3 edition, August 2008.
3. McCormick, J., “Human Factors in Engineering and Design”, McGraw-Hill, 7 edition, January 1993.

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P15CC*T*E39/ INTEGRATED PRODUCT DESIGN AND DEVELOPMENT STRATEGIES

Course Outcomes (COs):

CO 1 : Explain the importance of product development and organization process management

CO 2 : Apply concept generation, selection and testing

CO 3 : Explain product architecture

CO 4 : Discuss robust design and assess the selection of robust design

CO 5 : Explain design for manufacturing and product development

Pre-requisite:
1. Basics of product architecture
2. Concept generation, selection and testing or Equivalent

Topics covered:

INTRODUCTION **9Hours**

Need for IPPD-Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements - Organization process management and improvement

CONCEPT GENERATION, SELECTION AND TESTING **9Hours**

Plan and establish product specifications. Task - Structured approaches - clarification - search-externally and internally-Explore systematically - reflect on the solutions and processes - concept selection - methodology - benefits. Implications - Product change - variety - component standardization - product performance - manufacturability – Concept Testing Methodologies.

PRODUCT ARCHITECTURE **9Hours**

Product development management - establishing the architecture - creation - clustering - geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

INDUSTRIAL DESIGN 9Hours

Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically - Need for industrial design-impact – design process - investigation of customer needs - conceptualization - refinement - management of the industrial design process - technology driven products - user - driven products - assessing the quality of industrial design.

DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 9Hours

Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping - Planning for prototypes - Economic Analysis - Understanding and representing tasks baseline project planning - accelerating the project-project execution.

Theory :45Hr **Total Hours: 45**

REFERENCES:

. 1. Karl T.Ulrich and Steven D.Eppinger “Product Design and Development, , McGraw – Hill International Edns.1999.

2. Kemnneth Crow, “Concurrent Engg./Integrated Product Development”., DRM Associates, 6/3,Via Olivera, Palos Verdes, CA 90274(310) 377-569,Workshop Book.

3. Stephen Rosenthal, “Effective Product Design and Development”, Irwin Professional Publishing, February 1999.

4. Stuart Pugh,”Tool Design – Integrated Methods for successful Product Engineering”, Addison Wesley Publishing,Neyourk,NY,1991, ISBN 0-202-41639-5

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P15CC*T*E40/NEURAL NETWORKS AND FUZZY LOGIC

Course Outcomes (COs):

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CO 1: Understand and explain about neural networks.
CO 2: Discuss artificial Intelligence methods, algorithms and results.
CO 3: Classify the classical and fuzzy sets.
CO 4: Solve the issues involved in simulations.
CO 5: Apply the fuzzy logic concept in the analysis and evaluation of complicated systems.

Pre-requisite:

1.Design of Experiments

Topics covered:

INTRODUCTION TO NEURAL NETWORKS 9Hours

Artificial Neural Networks, Basic properties of Neurons, Neuron Models, Learning Paradigm and Rule, single unit mapping and the perception. Feed forward networks – Perceptions, widrow-Hoff LMS algorithm; Multilayer networks – Exact and approximate representation, back propagation algorithm, variants of Back propagation.

RECURRENT NETWORKS 9Hours

Unsupervised and Reinforcement learning; Symmetric Hopfield networks and Associative memory; Competitive learning and self organizing networks, Boltzmann machine, Adaptive Resonance Networks PCA, SOM, LVQ, Hopfield Networks, Associative Memories, RBF Networks, Applications of Artificial Neural Networks to Function Approximation, Regression, Classification, Blind Source Separation, Time Series and Forecasting, Hybrid Learning; Computational complexity of ANNs.

CLASSICAL AND FUZZY SETS 9Hours

Overview of Classical Sets, Membership Function, a-cuts, Properties of a-cuts, Decomposition Theorems, Extension Principle. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.

FUZZY ARITHMETIC AND RELATIONS 9Hours

Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations, Crisp & Fuzzy Relations, Projections &Cylindric Extensions,

Binary Fuzzy Relations, Binary Relations on single set, Equivalence, Compatibility & Ordering Relations, Morphisms, Fuzzy Relation Equations, Possibility Theory - Fuzzy Measures, Evidence & Possibility Theory, Possibility versus Probability Theory.

FUZZY LOGIC **9Hours**

Classical Logic, Multivalued Logics, Fuzzy Propositions, Fuzzy Qualifiers, Linguistic Hedges. Uncertainty based Information: Information & Uncertainty, Nonspecificity of Fuzzy & Crisp sets, Fuzziness of Fuzzy Sets.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Gunjan Goswami., "An Introduction to Neural Networks", S.K. Kataria & Sons, 2012.
2. Bose and Liang, Artificial Neural Networks, Tata Mcgraw Hill, 1996.
3. Kosco B, Neural Networks and Fuzzy Systems: A Dynamic Approach to MachineIntelligence, Prentice Hall of India, New Delhi, 1992.
4. Timothy J. Ross, "Fuzzy Logic: With Engineering Applications", Wiley, 2nd Ed, July 2007.
5. Klir G.J and Folger T.A, Fuzzy sets, Uncertainty and Information, Prentice Hall of India, New Delhi 1994.

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P15CC*T*E41/ ADDITIVE MANUFACTURING

Course Outcomes (COs):

CO 1 : Identify the product design and development concept related with RPT

CO 2 : Explain the functions and facilities involved in selective laser sintering

CO 3 : Discuss the principle of fusion deposition modeling

CO 4 : Explain the operation of laminated object manufacturing

CO 5 : Understand and explain rapid tooling and RP softwares

Pre-requisite:
1. Manufacturing Technology

Topics covered:

INTRODUCTION **5Hours**

Introduction: Need for time compression in product development, Product development – conceptual design – development – detail design – prototype – tooling. Material to be added for all the units

STEREOLITHOGRAPHY SYSTEMS **9Hours**

Principle, Process parameters, Process details, Data preparation, Data files and Machine details, Applications. Selective Laser Sintering - Types of machines, Principle of operation, Process parameters, Data preparation for SLS, Applications.

FUSION DEPOSITION MODELING **9Hours**

Principle, Process parameters, Path generation, Applications.Solid Ground Curing:Principle of operation, Machine details, Applications.

LAMINATED OBJECT MANUFACTURING **11Hours**

Principle of operation, LOM materials, Process details, Applications. Concept Modelers - Principle, Thermo jet printer, Sander's model market, 3-D printer, GenisysXs printer, JP system 5, Object Quadra System**.** Laser Engineered Net Shaping (Lens) **–** principle –applications.

RAPID TOOLING AND SOFTWARE FOR RAPID PROTOTYPING **11Hours**

Indirect Rapid Tooling - Silicone rubber tooling, Aluminum filled epoxy tooling, Spray metal tooling, etc. Direct Rapid Tooling - Direct AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, ProMetal, Sand casting tooling, Laminate tooling, soft tooling vs hard tooling.

STL files, Overview of Solid view, Magics, mimics, magics communicator. Application of Rapid prototyping in Medical field.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Vijay K. Varadan, Xiaoning Jiang, V. V. Varadan, “Microstereolithography and o
2. ther Fabrication Techniques for 3D MEMS”, Wiley-Blackwell, 29 Jan 2001
3. Paul. F. Jacobs, "Stereo lithography and other RP & M Technologies", SME, NY, 1996.
4. Pham. D. T. &Dimov. S. S., "Rapid Manufacturing", Verlag, London, 2001.
5. Terry Wohlers, "Wohlers Report 2006", Wohlers Associates, 2006.

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P15CC*T*E42/ MECHANICS OF COMPOSITE MATERIALS

Course Outcomes (COs):

CO 1: Explain the basic concepts of different types of Composites with its applications.

CO 2: Understand and discuss the basic principle behind the various fabrication techniques in Composites.

CO 3: Develop models the mechanical behavior of Composites in both micro and macro level.

CO 4: Understand and explain the specifications of mechanical behavior of layered composites compared to isotropic materials.

CO 5: Determine stresses and strains in composites.

Pre-requisite:

1. Mechanical properties of engineering materials.
2. Parameters and factors considered while designing the material for engineering application.
3. Various failures under different load conditions.

Topics covered:

INTRODUCTION **8Hours**

Definition – Need – General Characteristics, Applications. Fibers – Glass, Carbon,Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices– Characteristics of fibers and matrices. Fiber surface treatments, Fillers and additives,Fiber content, density and void content.

MECHANICS **12Hours**

Rule of mixture -volume and mass fractions – density - void content, Evaluation of four elastic moduli based on strength of materials approach and Semi- Empirical model-Longitudinal Young's modulus-transverse Young's modulus–major Poisson's ratio-Inplane shear modulus, Ultimate strengths of a unidirectional lamina. Characteristics of Fiber-reinforced lamina–laminates–lamination theory, Interlaminar stresses

PERFORMANCE **5Hours**

Static Mechanical Properties – Fatigue and Impact Properties – Environmental effects –Long term properties, Fracture Behavior and Damage Tolerance.

MANUFACTURING: 8Hours

Bag Moulding – Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes – Quality Inspection methods. Processing of MMC –diffusion bonding – stir casting – squeeze casting.

DESIGN 12Hours

Failure Predictions, Laminate Design Consideration-design criteria-design allowable - design guidelines, Joint design-Bolted and Bonded Joints, Design Examples-Design of a tension member – design of a compression member – design of a beam-design of a torsional member, Application of FEM for design and analysis of laminated composites.

Theory :45Hr Total Hours: 45

REFERENCES:

1. Mallick, P.K., “Fiber Reinforced Composites: Materials, Manufacturing and Design”, CRC Press, 3 edition, November 2007.
2. Autar K. Kaw, “Mechanics of Composite Materials” CRC Press, 2006
3. Agarwal, B.D., and Broutman L.J., “Analysis and Performance of Fiber Composites”, Wiley India Private Limited, Third edition, 2012.
4. Ronald Gibson, “Principles of Composite Material Mechanics", CRC Press, 2 edition, May 2007.
5. Chawla K.K., “Composite materials”, Springer – Verlag, 2006.

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P15CCTE43/ADVANCED TOOL DESIGN

Course Outcomes (COs):

CO 1 : Compare the various tool design methods and solutions.

CO 2 : Analyze Select various tool material

CO 3 : Understand and explain various sheet treatment methods for different materials.

CO 4 : Develop design of drill jigs, Fixtures, dies

CO 5 : Discuss the tool design of NC machine tools.

Pre-requisite courses:

1. Design of machine element

Topics covered:

TOOL-DESIGN METHODS 5Hours

Introduction – The Design Procedure – Statement of the problem – The Needs Analysis – Research and Ideation – Tentative Design Solutions – The Finished Design – Drafting and Design Techniques in Tooling drawings – Screws and Dowels – Hole location – Jig-boring practice – Installation of Drill Bushings – Punch and Die Manufacture – Electro-discharge machining – Electro-discharge machining for cavity.

TOOLING MATERIALS AND HEAT TREATMENT 9Hours

Introduction – Properties of Materials – Ferrous Tooling Materials – Tool steels – Cast Iron – Mild, or low-carbon Steel – Nonmetallic Tooling Materials – Nonferrous Tooling Materials – Metal cutting Tools – Single-point cutting tools – Milling cutters – Drills and Drilling – Reamer classification – Taps – Tap classification- the selection of carbide cutting tools – Determining the insert thickness for carbide tools

DESIGN OF DRILL JIGS 9Hours

Introduction – Fixed Gages – Gage Tolerances – The 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.

DESIGN OF FIXTURES AND DIES **14Hours**

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

TOOL DESIGN FOR NUMERICALLY CONTROLLED MACHINE TOOLS

8Hours

Introduction – The need for numerical control – A basic explanation of numeric control – Numerical control systems in use today – 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

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Cyrll Donaldson, George H.LeCain, V.C. Goold, “Tool Design”, Tata McGraw Hill Publishing Company Ltd., 2000.
2. PrakashHiralal Joshi, “Tooling data”, Wheeler Publishing, 2000.
3. www.irdi.on.ca/irdi/front.htm
4. www.techsolve.org/flashhome.htm

L	T	P	C
3	0	0	3

***P15CCTE44*/ DESIGN AND ANALYSIS OF EXPERIMENTS**

Course Outcomes (COs):

CO 1: Apply the experimental design, using statistical design concepts in simple comparative experiments

CO 2: Apply factorial design concept experimentation

CO 3: Use regression models for experimental analysis

CO 4: Use taguchi method for experiment design

CO 5: Apply analysis of variance for various application

Pre-requisite:

1.statistics or equivalent

Topics covered:

SIMPLE COMPARATIVE EXPERIMENTS **9Hours**

Strategy of experimentation, applications of experimental design, using statistical design in experimentation. Basic statistical concepts, Sampling and sampling Distribution, Inferences about the Differences in means, randomized designs, Inferences about the Differences in means, Paired comparison Designs, Inferences about the Variances of Normal Distributions.

FACTORIAL DESIGN **9Hours**

Basic definition and principles, Advantages of factorials, two factor factorial design, General factorial design, Fitting response curves and surfaces, Blocking in a factorial design.

FITTING REGRESSION MODELS **9Hours**

Introduction, Linear regression models, Estimate of parameters in linear regression models, Hypothesis testing in multiple regression, Confidence intervals in multiple regression, Prediction of new response observations, Regression model diagnostics, Testing for lack of fit.

TAGUCHI METHOD OF DESIGN OF EXPERIMENTS **9Hours**

Concept design, Parameter design, Tolerance design, Quality loss function, Signal-to- Noise ratio, Orthogonal array experiments, Analysis of Mean(ANOM), Quality characteristics,

Selection and testing of noise factors, Selection of control factors, Parameter optimization experiment, Parameter design case study.

ANALYSIS OF VARIANCE (ANOVA) 9Hours

Introduction, Example of ANOVA process, Degrees of freedom, Error variance and pooling, Error variance and application, Error variance and utilizing empty columns, the F-test.

Theory :45Hr Total Hours: 45

REFERENCES:

1. Douglas C Montgomery, “Design and Analysis of Experiments”, Wiley” Eighth edition’ February 2013.
2. George E. P. Box, J. Stuart Hunter, William G. Hunter Statistical Design and Analysis of Experiments, Wiley-Interscience; 2nd edition, 2005
3. MontgomeryD.C., Runger G. C., Introduction to Linear Regression Analysis, Wiley India Pvt Ltd, 3 edition, December 2006.
4. Raymond H. Myers, Douglas C. Montgomery, Christine M. Anderson-Cook, “Response Surface Methodology: Process Ang Product Optimization Using Designed Experiments, Myres R.H., Montgomery D. C., Wiley-Blackwell; 4th Edition, February 2016
5. Taguchi,G., “Introduction to Quality Engineering”, Asian Productivity Organization, UNIPUB, White Plains, New York, 1986.

L	T	P	C
3	0	0	3

***P15CCTE45*/ ENGINEERING ECONOMIC ANALYSIS**

Course Outcomes (COs):

After successful completion of the course, the students should be able to

CO 1: Understand and discuss the *i*mportance of economic analysis in business.

CO 2: Explain about the Value of money, banking and capital budgeting

CO 3: Categorize the money and banking functions.

CO 4: Discuss the cost analysis concepts.

CO 5: Examine the capital budgeting and depreciation

Pre-requisite:

1. Marketing Management

Topics covered:

DEMAND AND SUPPLY ANALYSIS **9Hours**

Nature and scope of engineering economics – definition and scope of study- importance of economic analysis in business. Demand and supply analysis – demand determinants-Law of demand – elasticity of demand – demand forecasting. Law of supply – elasticity of supply – market price.

COST ANALYSIS **9Hours**

Types of cost - Fixed cost, variable cost, marginal cost. Cost output relationship in short and long run. Pricing decisions – situations demanding pricing decisions, pricing techniques in practice – full cost pricing, marginal cost pricing, going rate pricing, bid pricing, price fixing for a rate of return. Statutory requirements.

MONEY AND BANKING **9Hours**

Value of money – inflation – defla tion, banking- commercial bank and its functions, central bank and its functions. New economic environment – globalisation, liberalisation and privatisation.

CAPITAL BUDGETING **9Hours**

Need for capital budgeting – method of apprising project profitability – rate of return method, payback period method, present value comparisons method, cost benefit analysis. Preparation

of feasibility report, appraisal process, economic and commercial feasibility, financial feasibility, technical l feasibility.

DEPRECIATION AND COST ANALYSIS **9Hours**

Causes of depreciation, objectives, methods of computing depreciation, simple problems. Breakeven analysis, break even point – assumptions, breakeven chart, uses of breakeven analysis, simple problems. Financial statements – cash flow statement, profit and loss account, balance sheet and evaluation of projected financial statements.

Theory :45Hr **Total Hours: 45**

REFERENCES:

1 .D.N. Dwivedi, Managerial Economics, Vikas Publishing House, Seventh edition, 2010.

2. Samuelson P A and Nordhaus W D, Economics, Tata McGraw Hill, 2001

3. Prasanna Chandra, "Projects", Tata McGraw Hill, 2003

4. James Riggs, David D. Bedworth, Engineering Economics, McGraw Hill Education, (India) Private Limited, 4 edition, January 2004

5. Patel Bhavesh . M, Project Management, Strategic Financial Planning Evaluation and Control, Vikas Publishing House, New Delhi, 2000.

6. G.J.Thuesen, Wolter J.Fabrycky, Engineering economy, 9th edition, Prentice hall international series in industrial and systems engineering, 2001.

Aryasri, Managerial Economics and financial analysis,3rd edition, Tata Mc Graw-hill Education, 2008.

L	T	P	C
3	0	0	3

P15CCTE46/MECHATRONICS IN MANUFACTURING SYSTEM

Course Outcomes (COs):

CO 1 : Recognize and proficiently apply the relevant sciences and scientific methods to mechatronics engineering, to design solutions to complex problems
CO 2 : Identify, interpret and critically appraise current developments and advanced technologies and apply them to mechatronics engineering

CO 3: Analyze and to apply theoretical and numerical analysis of phenomena to predict, design, control and optimize the performance of mechatronics engineering systems.

CO 4 : Understand and explain the working of sensors and transducers

CO 5 : Explain the structure of programme logic controllers

Pre-requisite:

1.Mechatronics

Topics covered:

INTRODUCTION **9Hours**

Introduction to Mechatronics - Systems - Mechatronics in Products - Measurement Systems - Control Systems - Traditional design and Mechatronics Design.

SENSORS AND TRANSDUCERS **9Hours**

Introduction - Performance Terminology - Displacement, Position and Proximity - Velocity and Motion - Fluid pressure - Temperature sensors - Light sensors - Selection of sensors - Signal processing - Servo systems.

MICROPROCESSORS IN MECHATRONICS **9Hours**

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.

PROGRAMMABLE LOGIC CONTROLLERS **9Hours**

Introduction - Basic structure - Input / Output processing - Programming -Mnemonics Timers, Internal relays and counters - Data handling - Analog input / output - Selection of PLC.

DESIGN AND MECHATRONICS **9Hours**

Designing - Possible design solutions - Case studies of Mechatronic systems., PLC, Microcontroller, Labview

Theory :45Hr **Total Hours: 45**

REFERENCES:

1. Michael B.Histand and David G. Alciatore, “Introduction to Mechatronics and Measurement Systems", McGraw-Hill Science/Engineering/Math; 3 edition, November 2005.
2. W. Bolton, "Mechatronics ", Prentice Hall; 5 edition, February 2013.
3. Ramesh.S, Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085” Penram International Publishing, 6th edition, October 2013.
4. Lawrence J.Kamm, " Understanding Electro-Mechanical Engineering, An Introduction to Mechatronics ", Prentice-Hall, 2000.
5. Ghosh, P.K. and Sridhar, P.R., 0000 to 8085, “Introduction to Microprocessors for Engineers and Scientists ", Second Edition, Prentice Hall, 1995.

P15CCIN01 ADVANCED GEOMETRICAL DIMENSIONING AND TOLERANCING

L	T	P	C
1	0	0	1

Course outcomes

After successful completion of the course, the students should be able to

CO 1: Understand and explain the concepts of advanced geometrical dimensioning and tolerancing

Pre-requisite courses:

1. Nil

Course Content

1. Introduction, Concepts (Limits, Fits & Tolerance)
2. Types of Tolerances
3. Tolerancing methods
4. Hole Basis & Shaft Basis
5. Statistical Symbols – Capability & Stat Tolerancing
6. Orientation Tolerances
7. Position Tolerances
8. Cost v/s Tolerance

Total: 15 Hrs

P15CCIN02 GOOD SHOP FLOOR PRACTICES FOR MANUFACTURING EXCELLENCE

L	T	P	C
1	0	0	1

Course outcomes

After successful completion of the course, the students should be able to

CO 1: Understand the concepts of floor practices

Pre-requisite :

1. Nil

Course Content

1. 5S work place management
2. Waste elimination
3. Problem Solving Tools
4. Measurement System Analysis (MSA)
5. Process Capability /Machine Capability studies
6. Process Audits
7. Engineering metrology
8. Training of new employees on shop floor
9. Poke yoke techniques
10. PPAP production part approval process

Total: 15 Hrs

P15CCIN03 **TEAM DYNAMICS**

L	T	P	C
1	0	0	1

Course outcomes

After successful completion of the course, the students should be able to

CO 1: Understand the concepts of Team dynamics

Pre-requisite:

1. Nil

Course Content

In this course the main text and lectures will cover theories and findings on topics that students will also explore through group exercises in class. Two tests will assess learning of the basic concepts and findings. Students will also demonstrate their ability to apply what they are learning by writing two essays analyzing case studies. One recounts the story of a group expedition to Antarctic (intergroup dynamics); the other is a first-person account of ethnic conflict in Bosnia (intergroup dynamics). Finally, class groups will each focus in depth on a particular topic and read primary articles reporting empirical studies. Groups will give a short presentation to the class on this topic and turn in a review paper. An optional final exam will give students who are unhappy with their grades on the tests a chance to improve their scores.

Total: 15 Hrs

P15CCIN04 **LEAN MANAGEMENT TOOLS**

L	T	P	C
1	0	0	1

Course outcomes

After successful completion of the course, the students should be able to

CO 1: Understand the concepts of lean management tools

Pre-requisite :

1. Nil

Course Content

In this course students will bring information on specific company projects to be worked on during this training for real application of these concepts, tools and techniques. First, the basics of Lean Manufacturing are discussed to gain a common¬ understanding of the standard practices, tools and techniques that are utilized in multiple industries. Next, participants will focus on gaining an understanding the standard practices,¬ tools and techniques that are applied. The Toyota Production System (TPS) is examined and understood as the way to effectively implement Lean Manufacturing in the automotive industry. Lastly, participants will apply these tools on specific company projects utilizing¬ Lean Manufacturing methodologies and techniques

Total: 15 Hrs