M.E. (CAD / CAM)

2015 Regulations, Curriculum & Syllabi

BANNARI AMMAN INSTITUTE OF TECHNOLOGY

(An Autonomous Institution Affiliated to Anna University, Chennai
Approved by AICTE - Accredited by NBA New Delhi, NAAC with 'A' Grade and ISO 9001:2008 Certified)
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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

I. Students will apply knowledge of Computer aided design, simulation, manufacturing to pursue successful career in the field of Mechanical Engineering.

II. Students will become innovators, entrepreneurs to design and develop products and services to address social, technical and business challenges.

III. Students will able to function effectively on Group projects, leadership roles and good communication skills with ethics.

PROGRAMME OUTCOMES (POs)

a. Apply knowledge of mathematics, science and engineering fundamentals and Production and Industrial Engineering specialization to the solution of complex Production and Engineering problems.

b. Able to design, analyze and interpret data using computer aided tools and techniques

c. Have capability to use latest software in the area of computer aided design for modeling, analysis and manufacturing.

d. Able to design and develop a manufacturing system, process etc. to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability and sustainability

e. Conduct investigations of complex Production and Engineering problems using research-based knowledge and research methods including analysis, interpretation of data and synthesis of information to provide valid conclusions.

f. Apply appropriate techniques, resources and engineering and IT tools for modeling of different Production and Engineering problems with an understanding of the limitations.

g. Able to use the techniques, skills, and modern engineering tools necessary for engineering practice.

h. Apply ethical principles and commit to professional ethics and responsibilities and norms of Production and Engineering practice.

i. Function effectively as an individual, and as a member or leader in diverse teams and in multi disciplinary settings.

j. Formulate relevant research problems; conduct experimental / analytical study and analyzing results with modern mathematical / scientific methods and use of software tools.

MAPPING OF PEOs and POs

PEO(s)	Programme Outcome (s)									
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
I	x	x	x		x					
II						x	x	x		
III				x					x	x

M.E. CAD/CAM (Full Time)
Minimum credits to be earned 77

First Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
15CC11	Advanced Numerical Methods[1]	I,III	(d),(e)	3	2	0	4
15CC12	Advanced Finite Element Analysis[+]	I	(a),(b),(e)	3	2	0	4
15CC13	Advanced Mechanisms Design and Simulation [+]	I,III	(b),(c),(d)	3	2	0	4
15CC14	Computer Numerical Control Machines and Robotics	I, III	(b),(c),(d)	3	0	0	3
15CC15	Modeling and Analysis of Manufacturing Systems	I,II,III	(d),(e),(f)	3	0	0	3
	Elective-I			3	0	0	3
15CC17	Geometric Modelling and Simulation Laboratory[+]	II,III	(f),(g),(h),(i)	0	0	4	2
15CC18	Computer Aided Manufacturing Laboratory	II,III	(f),(g),(h),(i)	0	0	4	2
15GE19	Business English-I[α]	II	(g)	1	0	2	2
			Total	**19**	**6**	**10**	**27**

Second Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	Pos				
15CC21	Research Methodology	I,II,III	(e),(f),(j)	3	0	0	3
15CC22	Design for Manufacture and Assembly[+]	I,II,III	(d),(e),(f)	3	0	0	3
15CC23	Flexible Competitive Manufacturing Systems	I,III	(c),(d),(e)	3	0	0	3
15CC24	Integrated Product and Process Development	I,III	(d),(e)	3	2	0	4
	Elective-II			3	0	0	3
	Elective-III			3	0	0	3
15CC27	Computer Aided Design Engineering Laboratory [+]	II,III	(f),(g),(h),(i)	0	0	4	2
15CC28	Technical Seminar	I	(e)	0	0	2	1
15GE29	Business English-II[α]	II	(g)	1	0	0	1
			Total	**19**	**4**	**6**	**23**

Third Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	Pos				
	Elective-IV			3	0	0	3
	Elective-V			3	0	0	3
	Elective-VI			3	0	0	3
15CC34	Project Work - Phase I	I,II,III	(a),(f),(j)	-	-	-	6
			Total	**9**	**-**	**-**	**15**

Fourth Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	Pos				
15CC41	Project Work - Phase II	I,II,III	(a),(f),(j)	-			12
			Total	-			**12**

[1] Common to CAD/ CAM, Engineering Design & Industrial Automation And Robotics
[+] Common to CAD / CAM and Engineering Design
[α] Common to all M.E. / M.Tech. Programmes

M.E. CAD/CAM (Part Time)

First Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
15CC11	Advanced Numerical Methods[1]	I,III	(d),(e)	3	2	0	4
15CC12	Advanced Finite Element Analysis[+]	I	(a),(b),(e)	3	2	0	4
15CC13	Advanced Mechanisms Design and Simulation [+]	I,III	(b),(c),(d)	3	2	0	4
15CC17	Geometric Modelling and Simulation Laboratory[+]	II,III	(f),(g),(h),(i)	0	0	4	2
15GE19	Business English-I[α]	II	(g)	1	0	2	2
			Total	**10**	**6**	**6**	**16**

Second Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
15CC21	Research Methodology	I,II,III	(e),(f),(j)	3	0	0	3
15CC22	Design for Manufacture and Assembly[+]	I,II,III	(d),(e),(f)	3	0	0	3
15CC23	Flexible Competitive Manufacturing Systems	I,III	(c),(d),(e)	3	0	0	3
15CC27	Computer Aided Design Engineering Laboratory [+]	II,III	(f),(g),(h),(i)	0	0	4	2
15GE29	Business English-II[α]	II	(g)	1	0	0	1
			Total	**10**	**2**	**4**	**12**

Third Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
15CC14	Computer Numerical Control Machines and Robotics	I, III	(b),(c),(d)	3	0	0	3
15CC15	Modeling and Analysis of Manufacturing Systems	I,II,III	(d),(e),(f)	3	0	0	3
15CC24	Integrated Product and Process Development	I,III	(d),(e)	3	2	0	4
15CC18	Computer Aided Manufacturing Laboratory	II,III	(f),(g),(h),(i)	0	0	4	2
			Total	**9**	**2**	**4**	**12**

Fourth Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
	Elective I			3	0	0	3
	Elective II			3	0	0	3
	Elective III			3	0	0	3
15CC28	Technical Seminar	I	(e)	0	0	2	1
			Total	**9**	**0**	**2**	**10**

Fifth Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PE0s	POs				
	Elective IV			3	0	0	3
	Elective V			3	0	0	3
	Elective VI			3	0	0	3
15CC34	Project Work - Phase I	I,II,III	(a),(f),(j)	-	-	-	6
			Total	**9**	**0**	**0**	**15**

Sixth Semester

Code No.	Course	Objectives & Outcomes		L	T	P	C
		PEOs	POs				
15CC41	Project Work - Phase II	I,II,III	(a),(f),(j)	-			**12**

[1] Common to CAD/ CAM, Engineering Design & Industrial Automation And Robotics

[+] Common to CAD / CAM and Engineering Design

[α] Common to all M.E. / M.Tech. Programmes

List of Electives							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**Pos**				
15CC51	Industrial Robotics	I,II,III	(d),(e),(g)	3	0	0	3
15CC52	Productivity Management and Re-Engineering	II	(f),(g),(h)	3	0	0	3
15CC53	Applied Materials Engineering	II,III	(f),(g),(j)	3	0	0	3
15CC54	Computer Aided Process Planning	I,II,III	(e),(f),(j)	3	0	0	3
15CC55	Computer Aided Design and Manufacturing	I,II,III	(c),(d),(e),(f)	3	0	0	3
15CC56	Metrology and Non Destructive Testing	II,III	(f),(g),(i)	3	0	0	3
15CC57	Data communications in Computer Aided Design / Computer Aided Manufacturing	I,III	(b),(c),(j)	3	0	0	3
15CC58	Enterprise resource planning	II,III	(g),(h),(i)	3	0	0	3
15CC59	Product Data Management	I,II	(b),(c),(f)	3	0	0	3
15CC60	Cellular Manufacturing Systems	I,III	(c),(d),(e)	3	0	0	3
15CC61	Tribological Studies on Composite Materials	I,III	(d),(e),(j)	3	0	0	3
15CC62	Geometric Modeling[+]	II	(f),(g),(h)	3	0	0	3
15CC63	Nanomaterials and Nanotechnology	I,II,III	(e),(f),(j)	3	0	0	3
15CC64	Design Optimization of Mechanical Systems[+]	I,II,III	(d),(e),(f)	3	0	0	3
15CC65	Micro Electro Mechanical Systems Design	I,II,III	(d),(e),(f)	3	0	0	3
15CC66	Supply Chain Management	II,III	(g),(h),(i)	3	0	0	3
15CC67	Lean Manufacturing and Implementation	I,II,III	(d),(e),(f)	3	0	0	3
15CC68	Additive Manufacturing Techniques[+]	I,II,III	(d),(e),(f)	3	0	0	3
15CC69	Intelligent Manufacturing Systems	I,II,III	(d),(e),(g)	3	0	0	3
15CC70	Advanced Computer Aided Design	I,III	(b),(c),(d)	3	0	0	3
One Credit Courses							
Code No.	**Course**	**Objectives & Outcomes**		**L**	**T**	**P**	**C**
		PEOs	**POs**				
15CCXA	Automation in Manufacturing	I,II	(e),(f),(g)	1	0	0	1
15CCXB	Advanced Tool Design	I,II	(e),(f),(g)	1	0	0	1
15CCXC	Flexible Manufacturing Systems	I,II,III	(d),(e),(f)	1	0	0	1

[+] Common to CAD / CAM and Engineering Design

15CC11/15ED11/15IR11 ADVANCED NUMERICAL METHODS
(Common to CAD/CAM, Engineering Design & Industrial Automation & Robotics)

3 2 0 4

Course objective

- To impart knowledge on numerical methods to find the numerical solution of the problems that arises in engineering and technology.
- To familiarize the advanced mathematical methods to solve engineering research problems.

Course Outcomes (COs)

The student will be able to

1. understand the advanced numerical methods which are necessary to solve numerically the problems that arise in engineering and technology
2. to find numerical solution of ordinary and partial differential equation by using suitable method that arise in engineering and technology

Unit I

ALGEBRAIC EQUATIONS

Systems of linear equations: Gauss Elimination method , pivoting techniques, Thomas algorithm for tri diagonal system–Jacobi, Gauss Seidel, SOR iteration methods-Systems of nonlinear equations: Fixed point iterations, Newton Method, Eigen value problems: power method, inverse power method, Faddeev–Leverrier Method.

9 Hours

Unit II

ORDINARY DIFFERENTIAL EQUATIONS

RungeKutta Methods for system of Initial value problems, numerical stability, Adams-Bash forth multi step method, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

9 Hours

Unit III

FINITE DIFFERENCE METHOD FOR PARTIAL DIFFERENTIAL EQUATION

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

9 Hours

Unit IV

FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS

Laplace and Poisson's equations in a rectangular region: Five point finite difference schemes, Leibmann's iterative methods, Dirichlet and Neumann conditions – Laplace equation in polar coordinates: finite difference schemes–approximation of derivatives near a curved boundary while using a square mesh.

9 Hours

Unit V

CALCULUS OF VARIATION

Introduction to variation problems - Euler s equation – Functional dependent on First and higher order derivatives – Functional dependent on functions of several independent variables- some applications –Direct methods : Ritz method

9 hours

Unit VI[$]

Applied Numerical Methods with MATLAB for Engineering Problems- Case Studies.

Total 45+30 hours

Reference(s)

1. Saumyen Guhaand Rajesh Srivastava, Numerical methods for Engineering and Science, Oxford Higher Education, NewDelhi, 2010.
2. Burden, R.L., and Faires, J.D., Numerical Analysis – Theory and Applications, Cengage Learning, IndiaEdition,NewDelhi,2009
3. Jain M.K.,Iyengar., S.R.,Kanchi , M.B.,Jain, Computational Methods for Partial Differential Equations, New Age Publishers,1993.
4. MortonK.W.andMayersD.F.,Numerical solution of partial differential equations, Cambridge University press,Cambridge,2002.
5. Steven C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw-Hill, 2012.
6. C.F.Gerald and P.O.Wheatley, Applied Numerical Analysis, Pearson Education 2003
7. Elsgolts.L, Differential equations and Calculus of variation, MIR publishers, 1996

15CC12/15ED12 ADVANCED FINITE ELEMENT ANALYSIS
(Common to CAD/CAM & Engineering Design)

3 2 0 4

Course Objectives

- To impart knowledge on finite element procedures of one, two dimensional and iso- parametric elements to solve structural related problems.
- To understand the procedures of finite element methods to solve fluid, heat transfer and vibration field problems.

Course Outcomes (COs)

The student will be able to

1. Apply the finite elements procedures of one, two dimensional and iso-parametric elements to solve the various structural related engineering problems.
2. Solveheat transfer, fluid flow and vibration related real time engineering problems using advanced finite element methods.

Unit I

One Dimensional Elements

Relevance of finite element analysis in design – FEM procedure-Modelling and discretization, Interpolation, elements, nodes, coordinate system and Degrees-of-Freedom - Applications of FEA. Bar, beam, Truss and Frame element–, stiffness matrices, Assembly matrix, Boundary conditions, Solution-Application problems.

10 Hours

Unit II

Two Dimensional Elements

Plane Stress and Strain-Constant strain triangular elements (CST) -Linear strain triangular elements (LST) - Bilinear and Rectangular elements – Tetrahedron, hexahedral and Axisymmetric Elements.

9 Hours

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit III

Iso-parametric Elements

Introduction –Iso-parametric three, four, eight and nine node elements - Bilinear elements – Lagrange polynomial shape function, Jacobian matrix, strain- displacement matrix, stress-strain relationship matrix, stiffness matrix– Applications

9 Hours

Unit IV

Fluid Flow and Heat Transfer Analysis

Finite element formulated equations of basic flow problems - One dimensional fluid flow Finite element formulation - problem. Formulation of two dimensional heat transfer linear triangular elements problems.

8 Hours

Unit V

Dynamic and Plate Analysis

Dynamic equations – Consistent and lumped mass matrices – one dimensional element - stiffness, mass and force matrices - Introduction to thin plate theory, Finite triangular plate - stiffness matrix- Jacobian matrix -shell element- Grid sensitivity test.

9 Hours

Unit VI[$]

Non -linear analysis, Solution Techniques –Case studies –h and p elements formulation.

Total: 45+30 Hours

Reference(s)

1. D. L .Logan, A First Course in the Finite Element Method, Cengage Learning, 2012.
2. S. S. Bhavikati, Finite Element Analysis, New Age International Publishers, 2010.
3. S. S. Rao, The Finite Element Method in Engineering. Elsevier Publishers, 2014.
4. J. N. Reddy, An Introduction to the Finite Element Method, Tata McGraw Hill International, 2009.
5. J. Ramachandran, Boundary and Finite Element Theory and Problems, Narosa Publishing House, 2000.
6. http://nptel.ac.in/courses/112106130

15CC13/15ED13 ADVANCED MECHANISMS DESIGN AND SIMULATION (Common to CAD/CAM & Engineering Design)

3 2 0 4

Course Objectives

- To understand the layout of linkages and kinematic analysis of various links.
- To study the synthesis analysis of four bar, cam and coupler curve based mechanisms.
- To impart the knowledge of kinematics simulations of various mechanisms.

Course Outcomes (COs)

The student will be able to

1. Determine and analyze the kinematics attributes of various links.
2. Design the four bar, cam and coupler curve based mechanisms of real time applications.
3. Model and simulate simple mechanisms used in various applications.

Unit I

Introduction

Introduction to kinematics and mechanisms-Mobility analysis-Formation of one degree of freedom multi loop kinematic chains-Grass motion concepts-compliant and equivalent mechanisms.

8 Hours

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit II

Kinematic Analysis

Position Analysis-vector loop equations for four bar, slider crank, inverted slider crank, geared five bar and six bar links-Analytical and Graphical methods-displacement, velocity and acceleration analysis of simple mechanisms.

10 Hours

Unit III

Path Curvature Theory

Fixed and moving centrodes-Inflection points and inflection circle-Euler Savary equation-Bobillier's construction-Hartmann's construction-cubic of stationary curvature.

8 Hours

Unit IV

Synthesis of Four bar Mechanisms

Type and number synthesis- linkage concept-Dimensional synthesis-Function generation, path generation and motion generation-Graphical methods-Pole technique and inversion technique-Point position reduction-two, three and four position synthesis of four bar mechanisms-Analytical methods-Freudenstein's equation-Bloch's synthesis.

10 Hours

Unit V

Synthesis of CAM and Coupler Curve based Mechanisms

Cognate linkages-parallel motion linkages-design of six bar, Single dwell, double dwell and double stroke-multi dwell -CAM mechanisms - determination of optimum size of cams-mechanism defects.

9 Hours

Unit VI[$]

Case Study-Kinematic analysis of spatial mechanisms-simulation mechanisms using software package.

Total: 45+30 Hours

Reference(s)

1. J. J. Uicker, G. R. Pennock and J.E. Shigley, Theory of Machines and Mechanisms, Oxford University Press, NY, 2011.
2. Amitabha Ghosh and Asok Kumar Mallik, Theory of Mechanism and Machines, East West Press, New Delhi, 2006.
3. Robert L. Nortron, Kinematics and Design of Machinery, McGraw Hill Higher Education, 2nd revised edition, 2012.
4. David H. Myszka, Machines & Mechanisms: Applied Kinematic Analysis, Pearson Education, 4threvised edition, 2011.
5. R.L. Nortron, Design of Machinery, McGraw Hill, 2012.
6. J. Kenneth, Waldron and Gary L. Kinzel, Kinematics, Dynamics and Design of Machinery, John Wiley-Sons, 2004.
7. A. Hernandez, Kinematic analysis of mechanisms via a velocity equation based in a geometric matrix, Mechanism and machine theory, vol. 38(12), pp 1413-1429, 2013.

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CC14 COMPUTER NUMERICAL CONTROL MACHINES AND ROBOTICS

3 0 0 3

Course objective

- To Familiarize in the field of automated machines like computer numerical control and robotics
- To understand and develop a computer numerical control program for lathe and milling machines
- To understand the anatomy of robots and its applications.

Course outcomes (COs)

The student will be able to

1. identify different robotics components in both Lego NXT systems and industrial settings·
2. Apply and practice basic principles of robotic design.
3. Select a suitable configuration of robot for the specified application.

Unit I

Constructional Features of CNC Machines

CNC Machines - Concept, Classifications, working principle, advantages and limitation – Constructional features – Machine structure – Friction and Antifriction LM guide ways – Recirculating ball bearings, Linear motion bearings – Feed and spindle drives – Tool turret – Tool changer – ATC, APC – Chip conveyors

8 Hours

Unit II

Feedback and Control Systems

Open loop and closed loop systems – Interpolator – Feedback devices – Digital absolute and incremental measuring system – Incremental rotary encoder, Moiré fringes and absolute rotary encoders – Configuration of CNC system and Interfacing

8 Hours

Unit III

Part Programming of CNC lathe and Milling

Tooling – Preset, semi-qualified and qualified tooling – Absolute and incremental programming – Gand M codes for Lathe and Milling machine

CNC Lathe –Single and multipass canned cycle programming – Turning, profile turning, grooving, threading and drilling cycle programming – Tool offset – Tool nose radius compensation

CNC Milling – Profile and pocket milling, drilling, boring cycle programming – Cutter diameter compensation

10 Hours

Unit IV

Fundamental Concept of Robotics

History, Robot Anatomy – work volume – drive system – Control system and Dynamic performance – End effector, Gripper - Mechanical, hydraulic and Pneumatic gripper and Tool as end effector – Robotic sensor, Tactile and Proximity sensors – Robot applications in material handling, processing and assembly

10 Hours

Unit V

Robot motion control and Programming

Introduction to manipulator kinematics – Homogeneous co-ordinates and Homogeneous transformations for the manipulator – Manipulator path control, motion types – Robot dynamics – Methods of robot programming – Lead through and Robot programming languages – Simple commands in VAL

9 Hours

Unit VI[$]

Working and configurations of five axis CNC machines – Latest CNC tool materials – Applications of robots in automotive industry

Total: 45 Hours

Reference(s)

1. Mikell P Groover, Mitchell weiss, Roger N Nagel G Odrey, Industrial Robotics, TATA Mc-Graw Hill, 2012
2. P Radhakrishnan , Computer Numerical Control CNC machines, New central book agency, 2007
3. YoramKoren, Computer control of manufacturing systems, Mc-Graw Hill book co, 2009.
4. HMT, Mechatronics, Tata McGraw Hill Publications, 2009
5. PM Agarwal and VJ Patel, CNC Fundamentals and Programming, Charotar Publishing house, 2014.
6. Richard D Klafter, Thomas A cmielewski, Michael Negin, Robotic Engineering, An Integrated Approach, Eastern economy edition prentice hall Pvt. Ltd., 2005.
7. http://nptel.ac.in/courses/112103174/35
8. http://www.public.iastate.edu/~mebbs/courses/ME322/CNC.html

15CC15 MODELLING AND ANALYSIS OF MANUFACTURING SYSTEMS

3 0 0 3

Course Objectives

- To impart modeling skills on manufacturing systems.
- To provide knowledgeon flexible manufacturing system and automation principles
- To create proficiency in analysis of manufacturing and synchronous manufacturing.

Course Outcomes (COs)

Students will be able to

1. Create mathematical and physical model for a given component.
2. Generate the group technology code for the given part.
3. Design the storage system for the given set of components in a company

Unit I

Manufacturing Systems and Models

Types and principles of manufacturing systems, types and uses of manufacturing models, physical models, mathematical models, model uses, model building.

8 Hours

Unit II

Material Flow Systems

Assembly lines-Reliable serial systems, approaches to line balancing, sequencing mixed models. Transfer lines and general serial systems-paced lines without buffers, unpaced lines. Shop scheduling with many products. Flexible manufacturing systems-system components, planning and control. Facility layout-Quadratic assignments problem approach, graphic theoretic approach.

10 Hours

Unit III

Supporting Components

Machine setup and operation sequencing-integrated assignment and sequencing. Material handling systems-conveyor analysis, AGV systems. Warehousing-storage and retrieval systems, order picking

9 Hours

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit IV

Generic Modeling Approaches

Analytical queuing models, a single workstation, open networks, closed networks. Empirical simulation models-even models, process models, simulation system, and example of manufacturing system. Systems, order picking.

9 Hours

Unit V

Synchronization Manufacturing

Synchronization Vs Optimization, defining the structure, identifying the constraint, exploitation, buffer management. Basic definitions-dynamics of Petri nets, transformation methods, event graphs, modeling of Manufacturing systems.

9 Hours

Unit VI[$]

Issues related to layout design, paced and unpaced lines. Case studies on petri nets, assembly line balancing, FMS and material handling systems.

Total: 45 Hours

Reference(s)

1. G.RonaldAskin, Modeling and Analysis of Manufacturing Systems, John Wiley and Sons, Inc, 2004.
2. Mengchu Zhou, Modeling, Simulation, and Control of Flexible Manufacturing Systems: A Petri Net Approach, Worlds Scientific Publishing Company Pvt Ltd., 2000.
3. P. Brandimarte, A. Villa, Modeling Manufacturing Systems, Springer Verlag, Berlin, 2003.
4. Jean Marie Proth and XiaolanXie, Petri Nets: A Tool for Design and Management of Manufacturing Systems, John Wiley and Sons, New York, 2001.
5. N. Viswanadam and Y. Narahari, Performance modeling of automated manufacturing systems, PHI, New Delhi, 2006.
6. Johann G. Demmel, Ronald G. Askin, Integrating Financial, Strategic, and Tactical Factors in Advanced Manufacturing System Technology Investment Decisions, Manufacturing Research and Technology, Vol. 14, pp. 209-243, 2002.
7. Johann G Demmel, Ronald G Askin, A multiple-objective decision model for the evaluation of advanced manufacturing system technologies, Journal of Manufacturing Systems, Vol. 11, Issue 3, pp. 179-194, 2003.

15CC17/15ED17 GEOMETRIC MODELLING AND SIMULATION LABORATORY (Common to CAD/CAM & Engineering Design)

0 0 4 2

Course Objectives

- To provide hand on training to create surface, two and three dimensional modeling of machine components using modeling software.
- To provide the hands on training to simulate various simple mechanisms.

Course Outcomes (COs)

Students will be able to

1. Model and assembly of various components of mechanical products using modelling software.
2. Draw the different kind of mechanism and assembly of machine part.

List of Experiments

1. Assembly modelingof various parts of the clamping device which are used in machines.
2. Assembly modeling of various parts of the center lathe.

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

3. Assembly modeling of piston, gudgeon pin and the crank shaft of IC engine with limits and tolerance.
4. Assembly modeling ofvarious parts of the butterfly valve.
5. Assembly modeling of various parts of pulley supports.
6. Assembly modeling of various parts of Fixtureparts with limits and tolerances.
7. Assembly modeling of various parts of the shapertoolheadparts
8. Surface modeling a piston of an I.C. engine.
9. Assembly modeling and simulation of a valve operating mechanism of internal combustion engine.
10. Assembly modeling and simulation of a Mechanismof Hand Pump.
11. Assembly modeling and simulation of a Mechanism of wiper.
12. Assembly modeling and simulationof a transmission system used in automobiles

Total: 60 Hours

15CC18 COMPUTER AIDED MANUFACTURING LABORATORY

0 0 4 2

Course Objectives

- To impart hands on training to operate a computer numerical control machine tool.
- To understand part programs for turning and milling machines.
- To acquire practical knowledge through intensive practice on computer numerical control machines and related software.

Course Outcomes (COs)

Students will be able to

1. Operate CNC lathe and milling machine
2. Write part programs for CNC lathe and Milling machine and simulate tool path using software
3. Write programs for pick and place robots
4. Set tool and work offset for any CNC machine

List of Experiments

1. Select a cutting parameter and cutting tool to carryout rough/finish turning and threading operation on OHNS/EN 24 steel rod.
2. Study the effect of variation of cutting parameters in surface integrity in turning processing of an EN xx steel /AISI 304 stainless steel.
3. Locate an optimum cutting condition for taper turning operation on EN xx steel/AISI D2 steel material considering any two cutting fluids.
4. Set the parameters to achieve minimum tool wear and lowest surface temperature while milling medium carbon AISI 1020 steel.
5. Calculate the tool life and suggest the cutting fluid (among the given) for better surface finish to drill the given work piece.
6. Record the machining time for a pocket milling operation using different programming technique and infer the results achieved.
7. Analyse the cutting forces developed while machining the given profile using force dynamometer and validate with the mathematical model.
8. Study the chip formation and correlate with the cutting conditions during grooving operation.
9. Compare surface roughness and MRR while machining HCHCR, EN8 and Mild steel using CNC EDM machine.

Total: 60 Hours

15GE19 BUSINESS ENGLISH – I

1 0 2 2

Course Objectives

- To acquire skills for using English in workplace effectively.
- To communicate for essential business needs.
- To prepare students for taking BEC Vantage level examination which is an International Benchmark for English language proficiency of Cambridge English Language Assessment (CELA).

Course Outcomes (COs)

The students will be able to

1. Enable students to get International recognition for work and study.
2. Use English confidently in the International business environments.
3. Take part in business discussion, read company literature, write formal and informal business correspondences and listen and understand business conversations.

Unit I

Grammar and Vocabulary

Comparison of adjectives – forming questions – asking complex questions – expressing purpose and function – tenses – conditionals – time statements – modal verbs – active and passive voice – articles – direct and indirect speech – cause and effect – relative pronouns – expressions followed by – ing forms – countable / uncountable – acronyms – marketing terms / vocabulary – financial terms – collocations – discourse markers.

10 Hours

Unit II

Listening

Purposes of listening – features of listening texts – potential barriers to listening – specific listening skills – strategies to use when listening– distinguishing relevant from irrelevant information – gap filling exercise – multiple-choice options – note completion – matching and multiple choice questions – listening for specific information, gist, topic, context and function.

7 Hours

Unit III

Speaking

Word and sentence stress – clear individual sounds – turn taking – initiating and responding - intonation patterns – pronunciation – mother tongue intrusion– conversation practice – turn-taking and sustaining the interaction by initiating and responding appropriately.

10 Hours

Unit IV

Reading

Purposes of reading – potential barriers to reading – paraphrasing – identifying facts and ideas – skimming and scanning for information – matching statements with texts– spotting reference words – understanding text structure – understanding the ideas in a text – distinguishing between the correct answer and the distractor – understanding cohesion in a text – deciphering contextual meaning of words and phrases – cloze – proof reading – transcoding.

9 Hours

Unit V

Writing

Paragraphing a text – using appropriate connectives – editing practice –Longer Documents: writing a proposal.

10 Hours
Total: 45 Hours

Reference(s)

1. Guy Brook-Hart, BEC VANTAGE: BUSINESS BENCHMARK Upper-Intermediate – Student's Book, 1st Edition, Cambridge University Press, New Delhi, 2006.
2. Cambridge Examinations Publishing, Cambridge BEC VANTAGE – Self-study Edition, Cambridge University Press, UK, 2005.

15CC21 RESEARCH METHODOLOGY

3 0 0 3

Course Objectives

- To understand some basic concepts of engineering research and its methodologies.
- To identify various sources of information for literature review and data collection.
- To families the various procedures to formulate appropriate research problem and design of experiments.

Course Outcomes (COs)

The students will be able to

1. Demonstrate the concepts of engineering research and its methodologies.
2. Understand the various methods used to collect the data to research.
3. Formulate appropriate research problem and conduct the experiments using systematics methods.

Unit I

Introduction

Definition, mathematical tools for analysis, Types of research, exploratory research, conclusive research, modeling research, algorithmic research, Research process- steps.

Data collection methods- Primary data – observation method, personal interview, telephonic interview, mail survey, questionnaire design. Secondary data- internal sources of data, external sources of data.

9 Hours

Unit II

Sampling Methods

Scales – measurement, Types of scale – Thurstone's Case V scale model, Osgood's Semantic Differential scale, Likert scale, Q- sort scale. Sampling methods- Probability sampling methods – simple random sampling with replacement, simple random sampling without replacement, stratified sampling, cluster sampling. Non-probability sampling method – convenience sampling, judgment sampling, quota sampling.

9 Hours

Unit III

Hypotheses Testing

Testing of hypotheses concerning means -one mean and difference between two means -one tailed and two tailed tests, concerning variance – one tailed Chi-square test.

9 Hours

Unit IV

Design of Experiments

Introduction, Types - Full and Fractional factorial Design- Orthogonal Array Design - Taguchi techniques - Regression Models - Response Surface Methods.

9 Hours

Unit V

Optimization and Report Writing

Optimization – classification- methods- genetic, particle swarm and artificial bee colony algorithms. Report writing- Types of report, guidelines to review report and typing instructions - oral presentation.

9 Hours

Unit VI[$]

Case Study: apply Research Methodology principles into design and manufacturing field.

Total: 45 Hours

Reference(s)

1. Kothari, C.R., Research Methodology –Methods and techniques, New Age Publications, New Delhi, 2009.
2. Panneerselvam, R., Research Methodology, Prentice-Hall of India, New Delhi, 2004.

15CC22/15ED22 DESIGN FOR MANUFACTURE AND ASSEMBLY
(Common to CAD/CAM & Engineering Design)

3 0 0 3

Course objective

- To understand the selection of materials, methods, fit and tolerance concepts to design a product.
- To familiarize the basic concept of design for castings, welding, sheet metal, forging and manufacturing Processes.
- To understand the basic procedure of design for assembly and environments.

Course outcomes (COs)

The student will be able to

1. Select the materials, methods, fit and tolerance to design of a product.
2. Demonstrate the design procedure for castings, welding, forging, sheet metal and manufacturing Processes.
3. Demonstrate the guidelines to minimize the environmental impacts using Recyclability and remanufacture concepts.

Unit I

Introduction to Tolerances

Tolerances- Limits, Fits, tolerance Chains, Charts and identification of functional dimensions- Design for manufacturability considerations - Geometric tolerances- Indian standards, ASME standards and Applications- surface finish.

7 Hours

Unit II

Design for Castings, Welding, Sheet Metal and Forging Processes

Materials- Selection Factors- Space factor - Size - Weight - Surface properties and Manufacturing methods. Design for castings- parting line, Minimization of core – Design for welding process - Welding defects – Design for Sheet metal operations- Design for Forging process- Case Studies.

12 Hours

Unit III

Design for Machining Processes

Design features for machining – Lathe, Drilling, Milling operations- Keyways - Doweling, Counter sunk screws - Simplification by separation and amalgamation- Design for machinability, economy, clamp ability and accessibility- factors for reducing machining area.

12 Hours

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit IV

Design for Assembly

Rules and methodologies to design components-manual, automatic and flexible assembly- DFMA Tools- concurrent engineering – Redesign, DFA-index, poke-yoke, lean and six sigma concepts, design for manual and automatic assembly.

7 Hours

Unit V

Design for the Environment

Introduction – Environmental objectives – Global issues – Regional and local issues – Guide lines, Methods and applications – Lifecycle assessment –Techniques to reduce environmental impact – Design to minimize material usage – Design for disassembly – Design for Recyclability – Design for remanufacture.

7 Hours

Unit VI[$]

Computer aided design for assembly and Environment using software- Case Studies Problems.

Total: 45 Hours

Reference(s)

1. A. K. Chitale and R. C. Gupta, Product Design and Manufacturing, Prentice Hall Inc. 2007.
2. G. Boothroyd, P. Dewhurst and W. Knight, Product Design for Manufacture and Assembly, Marcell Dekker, 2002.
3. Bryan R. Fischer, Mechanical Tolerance stackup and analysis, Marcell Dekker, 2004.
4. M. F. Spotts, Dimensioning and Tolerance for Quantity Production, Prentice Hall Inc., 2002.
5. J. G. Bralla, Hand Book of Product Design for Manufacturing, McGraw Hill Publications, 2000.
6. J. Lesko, Industrial Design, Materials and Manufacture Guide, John Willy and Sons, Inc, 2000.
7. http://nptel.ac.in/courses/107103012.

15CC23 FLEXIBLE COMPETITIVE MANUFACTURING SYSTEMS

3 0 0 3

Course objective

- To impart knowledge on competition environment in manufacturing.
- To create expertise on Flexible manufacturing system, JIT and simulation techniques.

Course outcomes (COs)

The student will be able to

1. Understand the concept of various flexible manufacturing systems.
2. Apply the concepts of production planning and control, group technology to the development of flexible manufacturing system.
3. Identify various workstations, system support equipments and hardware components of FMS

Unit I

Manufacturing in a Competitive Environment

Automation of manufacturing process - Numerical control - Adaptive control – material handling and movement - Robots in industry application– Introduction to design for manufacture

6 Hours

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit II

Group Technology

Part families, parts classification and coding, types of classification and coding systems. Machine cell design: The composite part concept, types of cell designs, determining the best machine arrangement, benefits of group technology

10 Hours

Unit III

Flexible Manufacturing Systems

Components of an FMS, types of systems, where to apply FMS technology, FMS work stations. Material handling and storage system: Functions of the handling system, FMS layout configurations. Material handling equipment. Computer control system: Planning the FMS, analysis methods for FMS, applications and benefits.

11 Hours

Unit IV

Computer Software, Simulation and Database of FMS

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

9 Hours

Unit V

Just in Time

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

9 Hours

Unit VI[$]

Origin of lean production system – Customer focus – Muda (waste) – Standards – 5'S System – Total Productive Maintenance –standardized work – Man power reduction – Overall efficiency

Total: 45 Hours

Reference(s)

1. M.P.Groover, Automation, Production Systems and Computer Integrated Manufacturing, Prentice-Hall of India Pvt. Ltd., New Delhi, 2001.
2. N. K. Jha, Handbook of Flexible Manufacturing Systems, Academic Press Inc., 2000.
3. Kalpakjian, Manufacturing Engineering and Technology, Addison-Wesley Publishing Co., 2002.
4. T.O. Toyota, Production System Beyond Large-Scale production, Productivity Press (India) Pvt.Ltd., 2004.
5. H. K. Shivanand, M. M. Benal, V. Koti, Flexible Manufacturing System,1st Edition, New Age International (2006)
6. http://nptel.iitm.ac.in/courses/110106044
7. Raouf, A. and Ben-Daya, M., Editors, Flexible manufacturing systems: recent development, Elsevier Science, 2005.
8. Pascal Dennis, Lean Production Simplified: A Plain - Language Guide to the World's Most Powerful Production System, (Second edition), Productivity Press, New York, 2007.

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CC24 INTEGRATED PRODUCT AND PROCESS DEVELOPMENT

3 2 0 4

Course Objectives

- To experience many aspects of the design process and demonstrate competence in the skills required to participate successfully in this distributed team design process.
- To develop a comprehensive understanding of how to use the design and analysis methods and tools acquired throughout the Mechanical Engineering curriculum.
- To stretch the design capabilities of student teams to achieve innovation in some aspect of their product.

Course Outcomes (COs)

The student will be able to

1. Develop a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
2. Conduct experiments, as well as to analyze and interpret the process data.

Unit I

Introduction

Characteristics of Product Development-Interdisciplinary activity-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 Generic Product Development Process- The AMF Development Process-Product Development Organizations.

9 Hours

Unit II

Product Planning

Product Planning Process- Identifying 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.

10 Hours

Unit III

Product Specifications

Specifications - 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.

9 Hours

Unit IV

Concept Selection

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.

9 Hours

Unit V

Product Architecture

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

8 Hours

Unit VI[$]

Integrate process design - Managing costs -Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically

Total: 60 Hours

Reference(s)

1. K.T. Ulrich and S.D. Epinger, Product Design and Development, McGraw - Hill International Edns, 2012
2. K Otto and K Wood, Product Design, Pearson Publication, 2008.
3. Stuart Pugh, Tool Design–Integrated Methods for successful Product Engineering, Addison Wesley Publishing, NY, 2005.
4. S Rosenthal, Effective Product Design and Development, Business One Orwin, Homewood, 2004.
5. G. Dieter and L. Schmidt, Engineering Design, 4th ed., McGraw-Hill, 2009.
6. J G Bralla, Handbook of Product Design for Manufacture, McGrawhillNewYork, 2002.
7. Stephen Rosenthal, Effective Product Design and Development, Business One Orwin, Homewood, 2002, ISBN, 1-55623-603-4
8. Stuart Pugh, Tool Design – Integrated Methods for successful Product Engineering, Addison Wesley Publishing, Neyourk, NY, 1991, ISBN 0-202-41639-5

15ED27/15CC27 COMPUTER AIDED DESIGN ENGINEERING LABORATORY (Common to CAD/CAM & Engineering Design)

0 0 4 2

Course Objectives

- To understand the finite element procedures to solve one, two and three dimensional problems using software.
- To provide training to solve the structural, thermal, fluid flow and vibration related real world problems using software.
- To understand the interpretation concepts of results obtained from finite element post process.

Course Outcomes (COs)

The student will be able to

1. Create model, mesh and analyze of mechanical components using finite element analysis software.
2. Solve the structural, thermal, fluid flow and vibration related real world problems using software.
3. Simulate and Interpret results obtained from finite element post process.

List of Exercises

1. When a truss is subjected to certain temperature,what happens to the truss?When another truss is loaded in all the three axes, how will be its behavior?
2. When one end of a rigid body is hinged and other end loaded with two supports in between by a copper rod and a steel rod,what will be the member forces and stresses?
3. Contemplate, how the shear stress and bending stress will occur a beam of 'I'section which is simply supported at the ends and load acting at the center?
4. If a closed cylinder made of steel is subjected to an internal pressure, how far the axial stress and hoop stress will influence the cylinder wall?
5. When a Belleville spring is subjected to a load on the inner edge of the spring,how does the spring deflect?

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

6. Considering a culvert in which load is distributed uniformly at top, symmetric and assuming plain strain condition, find the maximum stress and deflection that occurring the culvert.
7. A thermal storage device with a phase change material (PCM) is used to conserveenergy during high energy demand periods.The PCM used is paraffin wax which is surrounded by a metallic pipe subjected to a constant temperature. Estimate the time required to completely melt the wax from its solid-state.
8. When a solid stepped cantilever bar of circular cross section is subjected to a twisting moment, how will be the maximum twist and shear stress?
9. Conduct a harmonic forced response test by applying a cyclic load (harmonic) at the end of a cantilever beam with load acting in a range of frequency. Suggest a suitable method in which maximum displacement to occur.
10. Perform various hardness testing methods for a given material and suggest a suitable method for the given load range.
11. Contemplate when steady state conduction will be attained for a given component with the specified boundary condition.

Total: 60 Hours

15CC28 TECHNICAL SEMINAR

0 0 2 1

Course Objectives

- To expose students to the real working environment and get acquainted with the organization structure, business operations and administrative functions.
- To set the stage for future recruitment by potential employers.

Course Outcomes (COs)

1. Apply effective strategies in literature searches using libraries resources, an other e-databases.
2. Critical thinking within Seminar is grounded on the processes of analysis, synthesis and evaluation necessary to read with understanding.

The students are expected to make a presentation on the state of research on a particular topic based on current journal publications in that topic. A faculty guide is to be allotted and he / she will guide and monitor the progress of the student and maintain attendance also. Students are encouraged to use various teaching aids such as over head projectors, power point presentation and demonstrative models.

15GE29 BUSINESS ENGLISH – II

1 0 0 1

Course Objectives

- To acquire skills for using English in business environment.
- To communicate appropriately in business contexts.
- To prepare students for taking BEC Vantage level examination conducted by the Cambridge English Language Assessment (CELA).

Course Outcomes (COs)

The students will be able to

1. Enable students to acquire business terms for communication.
2. Use English confidently in the business contexts.
3. Take part in business discussion and write formal and informal business correspondences.

Unit I

Speaking

Non-verbal communication – agreeing / disagreeing, reaching decisions, giving and supporting opinions – making mini presentations – extending on conservations – collaborative task – tongue twisters.

6 Hours

Unit II

Writing

Business letters – fax – Shorter Documents: e-mail - memo – message - note – report writing – formal / informal styles.

9 Hours

Total: 15 Hours

Reference(s)

1. Guy Brook-Hart, BEC VANTAGE: BUSINESS BENCHMARK Upper-Intermediate – Student's Book, 1st Edition, Cambridge University Press, New Delhi, 2006.
2. Cambridge Examinations Publishing, Cambridge BEC VANTAGE – Self-study Edition, Cambridge University Press, UK, 2005.

15CC51 INDUSTRIAL ROBOTICS

3 0 0 3

Course Objectives

- To impart the design concepts, parts and types of robots
- To make the students familiar in various drive systems of robot, sensors and their applications.

Course Outcomes (COs)

The student will be able to

1. Learn the automation techniques and brief history of robot and applications.
2. Familiar in kinematic motions of robot.
3. Gather good knowledge about robot and their design concepts.

Unit I

Introduction and Robot Kinematics

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

8 Hours

Unit II

Robot Control, Drives & End Effectors

Controlling the Robot motion – Design of drive systems –Hydraulic and Pneumatic drives – Linear and rotary actuators and control valves – Electro hydraulic servo valves – Electric drives – Motors – Designing of end effectors – Vacuum – Magnetic and air operated grippers.

9 Hours

Unit III

Robot Sensors

Sensors in Robot – Tactile sensor – Proximity and range sensors – Sensing joint forces – Robotic vision system – Machine vision - Image components - Representation - Hardware - Picture coding - Object recognition and categorizations - Software consideration.-Training of vision system

9 Hours

Unit IV

Work Cell Design and Applications

Robot work cell design and control – Safety in Robotics – Robot cell layouts – Multiple Robots and machine interference – Robot cycle time analysis - Industrial application - Material handling – Loading and unloading – Processing – Welding, Coating and Painting – Assembly and Inspection.

10 Hours

Unit V

Robot Programming, AI and Expert Systems

Methods of Robot Programming – Computer control and Robot Software - VAL system and Language -Artificial intelligence – Basics – Goals of artificial intelligence – AI techniques – Problem representation in AI Problem reduction and solution techniques - Application of AI and KBES in Robots.

9 Hours

Unit VI[$]

Robot Intelligence-Advanced Sensor Capabilities - Telepresence and related technology - Characteristics of future Robot tasks - Future Manufacturing Application of Robots.

Total: 45 Hours

Reference(s)

1. YoramKoren, Robotics for Engineers, McGraw-Hill, 2004.
2. K.S.Fu, R.C. Gonzalez and C.S.G. Lee, Robotics Control Sensing, Vision and Intelligence, TMH, 2003.
3. T.U.Kozyrey, Industrial Robots, MIR Publishers Moscow, 2002.
4. D.Richard, K. A. Thomas, Chmielewski and Michael Negin, Robotics Engineering – An Integrated Approach, Prentice-Hall of India Pvt. Ltd., 2001.
5. S. R.Deb, Robotics Technology and Flexible Automation, Tata McGraw-Hill, 2003.
6. http://www.robotics.com
7. http://nptel.iitm.ac.in/video.php?courseId=1052

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CC52 PRODUCTIVITY MANAGEMENT AND RE-ENGINEERING

3 0 0 3

Course Objectives

- To impart knowledge on productivity models and organizational transformations.
- To gather knowledge in reengineering process improvement models & their tools and implementation.
- To study the product outcome of an industry.

Course Outcomes (COs)

The student will be able to

1. Demonstrate the meaning and function of the following fundamental concepts of quality: definition of quality, dimensions of quality, cost of quality.
2. Explain the applications of statistical quality control in manufacturing and service industries.
3. Obtain the ratio measures and use data envelopment analysis (DEA) for benchmarking productivity.

Unit I

Introduction

Productivity concepts - Macro and Micro factors of productivity, Productivity benefit model, productivity cycle.

7 Hours

Unit II

Productivity Models

Productivity measurement at International-National and Organizational level, total models. Productivity management in manufacturing and service sector. Evaluation models, improvement models and techniques.

10 Hours

Unit III

Organizational Transformation

Principles of organizational transformation and re-engineering, fundamentals of process re-engineering, preparing the workforce for transformation and re-engineering, methodology, guidelines, DSMCQ and PMP model.

10 Hours

Unit IV

Re-Engineering Process Improvement Models

PMI models, Edosomwan model, Moen and Nolan strategy for process improvement, LMICIP model, NPRDC model.

8 Hours

Unit V

Re-Engineering Tools and Implementation

Analytical and process tools and techniques - Information and communication technology – Enabling role of IT, RE-opportunities, process redesign - cases. Software methods in BPR - specification of BP, case study - Order, processing, user interfaces, maintainability and reusability

10 Hours

Unit VI[$]

To study the feasibility of implementing business process re-engineering (BPR) in supply chain management of a manufacturing company.

Total: 45 Hours

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Reference(s)

1. J AEdosomwan, Organizational transformation and process re-engineering, British Library cataloging in pub. data, 2007.
2. S K Srivatsava, Industrial Maintenance Management, S Chand and Company, 2007
3. D J Sumanth, Productivity engineering and management, TMH, New Delhi, 2006.
4. R C Mishra and K Pathak, Maintenance Engineering and Management, PHI, 2005.
5. P N Rastogi, Re-Engineering and Re-inventing the enterprise, Wheeler Publishers New Delhi, 2004.
6. G D Premvrat, Sardana and B S Sahay, Productivity Management - A systems approach, Narosa Publishers, New Delhi, 2008.
7. R. P. Mohanty and S. G. Deshmukh, Reengineering of a supply chain management system: A case study, Production Planning & Control, 2000, VOL. 11, NO. 1, 90-94.
8. http://nptel.ac.in/courses/112102106/

15CC53 APPLIED MATERIALS ENGINEERING

3 0 0 3

Course Objectives

- To learn the advanced materials used for engineering applications
- To impart knowledge on elastic and fracture behaviour of materials
- To acquire knowledge on the properties, processing and implement it for the applications of advanced materials

Course Outcomes (COs)

The student will be able to

1. Understand about the elastic, plastic and fracture behaviour of different materials
2. Select suitable metal for different engineering applications based on various operating criteria
3. Select suitable metal for industrial applications.

Unit I

Elastic and Plastic Behaviour

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 sectioning, grain boundary strengthening, poly phase mixture, precipitation, particle, fibre and dispersion strengthening. Effect of temperature, strain and strain rate on plastic behaviours.

8 Hours

Unit II

Fracture Behaviour

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, structural features and Paris law - Effect of surface and metallurgical parameters on fatigue-Corrosion fatigue

10 Hours

Unit III

Selection of Materials

Motivation for selection, cost basis, service requirements and availability - 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, steam generators/boilers and nuclear applications.

10 Hours

Unit IV

Modern Metallic Materials

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

8 Hours

Unit V

Non Metallic Materials

Polymeric materials - Formation of polymer structure - Production techniques of fibres, foams, adhesives and coatings - Structure, properties and applications of engineering polymers – Advanced structural ceramics, WC, TiC, TaC, Al_2O3, SiC, Si_3N_4, CBN and diamond - properties, processing and applications

9 Hours

Unit VI[$]

Case Studies: Corrosion and degradation of engineering materials-Corrosion control and monitoring, corrosion in boilers, Microscopy - principle and methods.

Total: 45 Hours

Reference(s)

1. Norman E. Dowling, Mechanical Behaviour of Materials, McGraw-Hill, 2012.
2. J.A.Charles, F.A.A. Crane and J.A.G. Furness, Selection and use of Engineering Materials, Butterworth-Heiremann, 2008.
3. R.A.Flinn and P.K.Trojan, Engineering Materials and their Applications, Wiley, 2006.
4. G. E.Dieter, Mechanical Metallurgy, McGraw Hill, 2007.
5. Michael F. Ashby, Materials Selection in Mechanical Design, Butterworth-Heinemann, UK, 4 Edition, 2010.
6. Deborah D. L. Chung, Applied Mechanics and Materials, CRC Press; 1 edition, June 13, 2001.
7. Deborah D. L. Chung,Applied Materials Science, CRC Press; 1 edition, June 13, 2001.

15CC54 COMPUTER AIDED PROCESS PLANNING

3 0 0 3

Course Objectives

- To impart knowledge on part design representation and computer aided process planning techniques
- To acquire knowledge in computer aided process planning and develop computer aided process planning system

Course Outcomes (COs)

The student will be able to

1. Generate the structure of automated process planning system and uses the principle of generative and retrieval CAPP systems for automation
2. Select the manufacturing sequence and explains the reduction of total set up cost for a particular sequence
3. Predict the effect of machining parameters on production rate, cost and surface quality and determines the manufacturing tolerances

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit I

Introduction

Introduction to Process and Production Planning – Process Planning in the Manufacturing cycle and Concurrent Engineering, CAPP, Group Technology.

8 Hours

Unit II

Part Design Representation

Design Drafting - Dimensioning - Conventional tolerance - Geometric tolerance - CAD – input / output devices –topology - Geometric transformation - Perspective transformation – Data structure - Geometric modeling for process planning - GT layout, GT coding - OPTIZ system – MICLASS system- CODE system**.**

10 Hours

Unit III

Process Engineering and Process Planning

Experience based planning - Decision table and decision trees - Process capability analysis – Process boundaries – Process parameters – Process optimization. Process Planning - Variant process planning - Generative approach - Forward and Backward planning, Input format, Artificial intelligence.

9 Hours

Unit IV

Computer Aided Process Planning Systems

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

9 Hours

Unit V

An Intergraded Process Planning Systems

Totally integrated process planning systems - An Overview – TIPPS Design philosophy-CAD Interface, Modulus structure – Interactive surface identification, Process knowledge- Description language - Data Structure - operation - Input and Display of CAD model- surface identification – select process- select process parameters- Report Generation- Testing results, Expert process planning**.**

9 Hours

Unit VI[$]

Interfacing of Computer Aided Design / Computer Aided Manufacturing to develop Computer Aided Process Planning system – Applications of ERP

Total: 45 Hours

Reference(s)

1. I. Alevi and R.D. Weill, Principles of Process Planning, A logical approach, Chapman & Hall, 2008.
2. Tien-Chien Chang and Richard A.Wysk, An Introduction to automate process planning systems, Prentice Hall, 2005.
3. T.C.Chang, An Expert Process Planning System, Prentice Hall, 2006.
4. Nanua Singh, Systems Approach to Computer Integrated Design and Manufacturing, John Wiley & Sons, 2008.
5. P.N.Rao, Computer Aided Manufacturing, Tata McGraw Hill Publishing Company, 2010.

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CC55 COMPUTER AIDED DESIGN AND MANUFACTURING

3 0 0 3

Course Objectives

- To understand the basics of computer aided design and manufacturing and transfer of product data in various capstan turning and milling software
- To learn the concept and algorithms of visual realism so as to create a real rendered models using software
- To understand about computer aided process planning and integrated computer aided design and manufacturing system.

Course Outcomes (COs)

The student will be able to

1. Program an algorithm for visual enhancement in computer aided design and manufacturing packages.
2. Apply computer aided process planning and interface with computer aided design and manufacturing into production.
3. Generate part programming.

Unit I

Introduction

Introduction - computer aided design and manufacturing Hardware –Types of systems – Evaluation criteria – Input Devices – Output devices – Hardware integration and networking – Hardware trends. Software – Graphics standards – User Interface –Modules – Modeling and Viewing – Documentation and Development.

9 Hours

Unit II

Three dimensional computer graphics

Viewing transformations – Orthographic and Perspective projection – Techniques for visual realism – Hidden line, Surface and curve removal – Algorithms for shading and Rendering.

8 Hours

Unit III

Data communications in CAD and CAM

Networking – Networking techniques, Local area network - Components, wiring methods – Network interface cards – Network standards – Graphics standards – Data exchange format – Features of various interfaces JT file format, IGES, DXF, PDES, STEP – Collaborative Design

9 Hours

Unit IV

Computer aided process planning

Introduction to Process Planning and Production Planning – Process Planning in the Manufacturing cycle – Process Planning and Concurrent Engineering – Manual Approach, Computer Aided process planning – Variant, generative and Hybrid approaches – Group Technology.

10 Hours

Unit V

CAD-CAM integration

Introduction – Part production cycle – Manufacturing Systems – Manufacturing Processes – Integration Requirements – Part programming – Tool path generation and Verification – Design and Engineering Applications

9 Hours

Unit VI[$]

Computer aided Quality control – Product life cycle Management

Total: 45 Hours

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Reference(s)

1. R Ibrahim Zeid, Sivasubramanian, "CAD/CAM theory and Practice", Tata McGraw Hill, 2014.
2. Groover, Mikell P Automation, "Production system and Computer integrated Manufacturing", Prentice Hall of India Pvt. Ltd., 2014.
3. Kevin Otto and Kristin Wood, "Product Design", Pearson Education, 2014
4. A Aluvadeen and N Venkateshwaran, "Computer Integrated Manufacturing", Prentice Hall of India Pvt. Ltd., 2008
5. Ibrahim Zeid, "Mastering CAD/CAM", Tata McGraw Hill, 2011.
6. Donald Hearn and M. Pauline Baker, "Computer Graphics, Prentice Hall of India.", New Delhi 2014
7. http://nptel.ac.in/courses/Webcoursecontents/IITelhi/Computer%20Aided%20Design%20&%20ManufacturingI

15CC56 METROLOGY AND NON DESTRUCTIVE TESTING

3 0 0 3

Course Objectives

- To expose the students on latest measuring systems such as laser metrology.
- To interpret knowledge on the optoelectronic devices and also to stress upon the quality standards
- To get fundamental knowledge on non destructive testing methods and their applications

Course Outcomes (COs)

The student will be able to

1. Understand the latest method of measurements on Laser Metrology and Optoelectronic devices.
2. Select suitable method of testing for various defects in manufacturing Engineering.
3. Select and measure variables using appropriate sensors and transducers

Unit I

Laser Metrology

Introduction – types of lasers – laser in engineering metrology – metrological laser methods for applications in machine systems – Interferometer applications – speckle interferometer – laser interferometers in manufacturing and machine tool alignment testing – calibration systems for industrial robots laser Doppler technique – laser Doppler anemometry.

10 Hours

Unit II

Opto Electronics and Vision System

Opto electronic devices – charge-coupled device – On-line and in-process monitoring in production –applications image analysis and computer vision – Image analysis techniques – spatial feature– Image extraction – segmentation – digital image processing – Vision system for measurement – Comparison laser scanning with vision system**.**

9 Hours

Unit III

Quality Standards

General cares and rules in measurement, International standardization, SI units and quantities, BIS-NPL – advantages, ISO 9000 quality standards, QS 9000 standards, Environment Standards, Metrology room measuring standards room.

8 Hours

Unit IV

Liquid Penetrant Test and Magnetic Particle Test

Liquid Penetrant test -physical principles, Penetrant testing materials, procedure for penetrate testing, - water washable, Post – Emulsification methods, Applications.

Magnetic Particle Test-Methods of production of magnetic fields - Principles of operation of magnetic particle test -Applications – Advantages and Limitations.

9 Hours

Unit V

Ultrasonic and Radiography Testing

Ultrasonic testing – basic properties of sound beam, ultrasonic transducers, inspection methods, technique for normal beam inspection, flaw characterization technique.

X-ray film – structure and types for industrial radiography - use of film - latent image formation on film - radiographic exposure, reciprocity law, photographic density -X-ray and gamma ray exposure charts - exposure time calculations.

9 Hours

Unit VI[$]

Computer controlled systems used in inspection –Six sigma concepts -Applications of NDE in Nuclear, Automotive and petroleum Industries.

Total: 45 Hours

Reference(s)

1. John A. Bosch, Giddings and Lewis Dayton, Co-ordinate Measuring Machines and Systems, CRC Press, 2009.
2. J.M. Juran and F.M.Gyna, Quality Planning and Analysis, Tata-McGraw Hill, New Delhi,2003.
3. Zuech, Nello, Understanding and Applying Machine Vision, Marcel Dekker, Inc, 2000.
4. C Elanchezhian, B VijayaRamnath and T Sunder Selwyn, Engineering Metrology, Eswar Press, Chennai, 2004.
5. Baldev Raj, T Jeyakumar, M Thavasimuthu, Practical Non Destructive Testing, Narosa publishing house, New Delhi, 2002
6. J Krautkramer, Ultrasonic Testing of Materials, 1st Edition, Springer – Verlag Publication, New York, 2006.
7. www.ndt.net
8. K.M. Nasr, A.B. Forbes, B. Hughes and A. Lewis, International Journal of Metrology and Quality Engineering, Volume 3, Issue 02, January 2012, pp 89-95.

15CC57 DATA COMMUNICATIONS IN COMPUTER AIDED DESIGN / COMPUTER AIDED MANUFACTURING

3 0 0 3

Course Objectives

- To impart knowledge on the principles of digital computers and microprocessors.
- To learn about data communication with the help of computers which related to computer aided design and manufacturing.

Course Outcomes (COs)

The student will be able to

1. Utilize digital computers and microprocessors for industry product development.
2. Apply and interpret the suitable communication method for human machine interfacing.
3. Utilize internet service for product development in CAD/CAM.

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit I

Digital Computers & Micro Processors

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 8086 and modes of operation. Features of Pentium Processors

10 Hours

Unit II

Operating System & Environments

Types - functions – UNIX and WINDOWS - Architecture - GUI. Compilers - Analysis of the Source program - phases and cousins of compiler, grouping of phases - compiler construction tools.

8 Hours

Unit III

Communication Model

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.

9 Hours

Unit IV

Computer Networks

Network structure and architecture - OSI reference model services – network standardization– example - Managing remote systems in network - network file systems - networking in manufacturing.

9 Hours

Unit V

Link with CAD-CAM

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

9 Hours

Unit VI[$]

Case studies-Data mining – Cloud data – Big data

Total: 45 Hours

Reference(s)

1. M.Morris Mano, Computer System Architecture, Prentice Hall of India, 2011.
2. R.S.Gaonkar, Microprocessor Architecture, Programming and Applications of 8085, Penram International, 2013.
3. J. L.Peterson, P. Galvin and A.Silberschaz, Operating Systems Concepts, Addison Wesley, 2008.
4. W. Stallings, Data of Computer Communications, Pearson Educational Pvt. Ltd, 2007.
5. Andrew S. Tanenbanum, Computer Networks, Prentice Hall of India, 2008.
6. C. Crumlish, The ABC's of the Internet, BPB Publication, 2009.
7. http://nptel.ac.in/courses/117101001/

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CC58 ENTERPRISE RESOURCE PLANNING

3 0 0 3

Course Objectives

- To acquire knowledge on technology and architecture of Enterprise Resource Planning.
- To learn about ERP system packages and procurement issues
- To understand the data base management in oracle.

Course Outcomes (COs)

The student will be able to

1. Understand the importance of ERP system in an Organization
2. Identify the various packages of a typical ERP system
3. Recognize the various economical issues related to ERP system

Unit I

Enterprise Resource Planning

Principle – ERP framework – Business Blue Print – Business Engineering Vs Business process Re-Engineering – Tools – Languages – Value chain – Supply and Demand chain – Extended supply chain management – Dynamic Models –Process Models

10 Hours

Unit II

Technology and Architecture

Client/Server architecture – Technology choices – Internet direction – Evaluation framework – Customer Relationship Management (CRM) – CRM pricing – chain safety – Evaluation framework.

8 Hours

Unit III

ERP System Packages

SAP - People soft, Baan and Oracle – Comparison – Integration of different ERP applications – ERP as sales force automation – Integration of ERP and Internet – ERP Implementation strategies – Organizational and social issues.

9 Hours

Unit IV

Oracle

Overview – Architecture – AIM – applications – Oracle SCM. SAP: Overview – Architecture – applications -Before and after Y2k – critical issues – Training on various modules of IBCS ERP Package-Oracle ERP and MAXIMO, including ERP on the NET

10 Hours

Unit V

ERP Procurement Issues

Market Trends – Outsourcing ERP – Economics – Hidden Cost Issues – ROI – Analysis of cases from five Indian Companies.

8 Hours

Unit VI[$]

Various Case Studies on SAP and Oracle in industries.

Total: 45 Hours

Reference(s)

1. Gar and Venkitakrishnan, ERP Implementation Framework, Prentice Hall, 2008.
2. J. A. Fernandez, The SAP R/3 Handbook, Tata McGraw Hill, 2007.
3. Khalid Sheikh, Manufacturing Resources Planning (MRP II) with introduction to ERP, SCM, and CRM, Tata McGraw Hill, 2001.

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

4. S.Sadagopan, ERP-A Managerial Perspective, Tata McGraw Hill, 2006.
5. T. E. Vollmann and B. Whybark, Manufacturing and Control Systems, Galgothia Publications, 2004.
6. Vinod Kumar Crag and N.K.Venkitakrishnan, Enterprise Resource Planning – Concepts and Practice, Prentice Hall of India, 2005.
7. MohammadrezaBabaei, Zahra Gholami and SoudabehAltafi, Challenges of Enterprise Resource Planning implementation in Iran large organizations, Information Systems, Vol.54, pp.15–27, 2015.

15CC59 PRODUCT DATA MANAGEMENT

3 0 0 3

Course Objectives

- To impart knowledge about product data management and understand the process, importance of product data management in an industry
- To understand need of product data management through various industrial applications.

Course Outcomes (COs)

The student will be able to

1. Experience product data management from the product manager perspective, including product definition and project management.
2. Demonstrate an understanding of product life cycle concepts, particularly product data management, change management, workflows and configurations

Unit I

Introduction

Introduction to product data management - present market constraints-need for collaboration - internet and developments in server-client computing.

9 Hours

Unit II

Components of PDM

Components of a typical PDM setup-hardware and software-document management creation and viewing of documents-creating parts-versions and version control of parts and documents-case studies

9 Hours

Unit III

Configuration Management

Base lines- product structure- configuration management- case studies.

8 Hours

Unit IV

Projects and Roles

Creation of projects and roles- life cycle of a product- life cycle management-automating information flow-work flows- creation of work flow templates-life cycle-work flow integration case studies.

9 Hours

Unit V

Change Management and Generic Products and Variants

Change issue- change request- change investigation- change proposal - change activity - case studies. Data Management Systems for FEA data - Product configuration - comparison between sales configuration and product configuration – generic product modeling in configuration modeler-use of order generator for variant creation-registering of variants in product register - case studies.

10 Hours

Unit VI[$]

Intelligent Information Systems - Knowledge based product and process models - Advanced database design for integrated manufacturing.

Total: 45 Hours

Reference(s)

1. K. Otto and K. Wood, Product Design, Pearson, 2014.
2. D. Amor, The E-Business Revolution, Prentice-Hall, 2000.
3. David Bed worth, Mark Henderson and Phillip Wolfe, Computer Integrated Design and Manufacturing, McGraw Hill Inc, 2009.
4. T. Quatrain, Visual Modeling with Rational Rose and UML, Addison Wesley, 2005.
5. Wind-Chill R5.0 Reference Manuals, 2004.

15CC60 CELLULAR MANUFACTURING SYSTEMS

3 0 0 3

Course Objectives

- To acquire knowledge about cellular manufacturing systems.
- To understand the implementation of cellular manufacturing systems.
- To impart knowledge on advanced cellular manufacturing systems.

Course Outcomes (COs)

The students will be able to

1. Implement the concept of intelligent manufacturing systems in engineering
2. Handle real time industrial manufacturing problems.
3. Understand the nature of intelligent manufacturing systems in industry.

Unit I

Cellular manufacturing

Introduction, types of manufacturing cell, Design of cellular manufacturing systems, determination of best cell arrangement, key machine concept. Cell formation approach- Machine component group analysis, similarity coefficient based approach, exceptional parts and bottleneck machines

10 Hours

Unit II

Cell formation techniques

Design and Manufacturing Attributes, Cell Design and Representation of the Problem. Cell Formation Techniques–Traditional methods, Similarity coefficient methods, Array based methods. Cell Design Considerations, Data Structure and Influence on the Solution.

10 Hours

Unit III

Planning and design of cellular manufacturing system

Problems in GT/CMS - Design of CMS - Models, traditional approaches and nontraditional approaches -Genetic Algorithms, Simulated Annealing, Neural networks.

8 Hours

UNIT IV

Implementation of GT/CMS

Inter and Intra cell layout, cost and non-cost based models, establishing a team approach, Managerial structure and groups, batch sequencing and sizing, life cycle issues in GT/CMS.

8 Hours

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit V

Scheduling in Cellular Manufacturing

Petrov's Approach, Integrated approach, MRP, EconomicsL ot Scheduling, Dynamic scheduling, Similarity Coefficientbased Scheduling, Priority Based schedulingmethods, Comparisons.

9 Hours

Unit VI[$]

Various Case Studies of implementation of cellular manufacturing systems.

Total: 45 Hours

Reference(s)

1. B S Nagendra Parashar, Cellular Manufacturing systems, PHI Learning PvtLtd,2009.
2. Andrew Kusaik, Intelligent Manufacturing System, Prentice Hall, 2002.
3. MPGroover, Automation, Production Systems, CIM, Prentice Hall Press Upper Saddle River, NJ, 2007
4. IraniSA, Cellular Manufacturing systems, Wiley-Interscience publications, 2007.
5. KamraniAK, ParsaeiHR and Liles DH, Planning, Design and Analysis of CellularManufacturingsystems, Elsevier publication,2005.

15CC61 TRIBOLOGICAL STUDIES ON COMPOSITE MATERIALS

3 0 0 3

Course Objectives

- To make the knowledgeable students in the field of wear
- To describe fundamental fabrication processes for polymer matrix, metal matrix, and ceramic matrix composites.

Course Outcomes (COs)

The student will be able to

1. Categorize hygrothermal properties of long fiber composite materials
2. Classify elastic properties of long fiber and short fiber composites

Unit I

Introduction

Introduction to composites: basic concepts, structural applications, classification, strength and stiffness advantages, manufacturing aspects of composites.

8 Hours

Unit II

Characterization of Composite

Stress and failure analysis of multidirectional laminates, hydrothermal effects, experimental methods for characterization and testing of composite materials.design of laminates.

8 Hours

Unit III

Manufacturing Methods

Manufacture of composite materials: Manufacturing: Stamp moulding, diaphragm forming, thermoforming, filament winding, pultrution, compression moulding, injection moulding.

7 Hours

Unit IV

Testing of Composite

Testing of composite materials: Determination of physical properties such as density, fibre volume ratio, void volume ratio, coefficient of thermal expansion, determination of tensile, compressive

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

and shear properties of unidirectional lamina, determination of interlaminar and intralaminar strength, biaxial testing, characterisation of composites with stress concentration.

10 Hours

Unit V

Topography of Composite

Composite materials friction and wear Surface Topography measurements – Electron microscope and friction and wear measurements – Instrumentation – International standards – Bearings performance measurements – wear and friction measurements.

12 Hours

Unit VI[$]

Instrumentation – International standards -Wear and friction measurements- Bearings performance measurements

Total: 45 Hours

Reference(s)

1. P.K.Mallick, Fiber–Reinforced Composites: Materials, Manufacturing and Design, Maneel Dekker Inc,2007.
2. J. C.Halpin, Primer on Composite Materials, Analysis, Techomic Publishing Co, 2006.
3. A. K. Kaw, Mechanics of Composite Materials, CRC Press, NY, 2006.
4. Tribology - a System Approah to the Science and Technology of Friction, Lubrication and Wear by Horst Czichos, Elsevier Scientific Publishing Co, 2011.
5. BharathBhooshan and B. K. Gupta, Handbook of Tribology: Materials, Coatings and Surface Treatments, McGrawhill, 2001.
6. B.Bhushan, Principles and Application of Tribology, John Wiley & sons, 2006.
7. A.Cameron, Basic Lubrication Theory, Ellis Hardwoods Ltd., UK, 2008.
8. S.K.Basu, S. N.Sengupatha and D. B.Ahuja, Fundamentals of Tribology, Prentice Hall of India Pvt. Ltd., 2009.
9. J. A.Williams, Engineering Tribology, Oxford Univ. Press, 2007.
10. B. C. Majumdar, Introduction to Tribology in bearings, Wheeler Publishing, 2004.

15CC62/15ED62 GEOMETRIC MODELLING
(Common to CAD/CAM & Engineering Design)

3 0 0 3

Course Objectives

- To impart the knowledge of mathematical representation of curves, surfaces and solids and their relationship with computer graphics.
- To familiarize the mass property calculation and finite element modelling and meshing

Course Outcomes (COs)

The student will be able to

1. Understand the mathematical representation of curves, surfaces and solids and their relationship with computer graphics.
2. Understand the mass property calculation and finite element modelling and meshing.

Unit I

Overview of CAD Systems and Graphics Transformations

Conventional and computer aided design processes, subsystems of CAD-CAD hardware and software, Analytical and graphics packages, CAD workstations. Networking of CAD systems, generative, cognitive and image processing graphics, static and dynamic data graphics. Transport

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

of graphics data. Graphic standards, generation of graphic primitives, display and viewing, transformations customizing graphics software.

10 Hours

Unit II

Mathematical Representation of curves and Surfaces

Introduction, Wire frame models – surface models – parametric representation of analytic and synthetic surfaces – surface manipulations

8 Hours

Unit III

Mathematical Representation of Solids

Fundamentals of solid modelling – boundary representation (B-Rep) – constructive solid geometry (CSG) – sweep representation – analytical solid modelling – design and engineering applications in wire frame, surface and solid modelling.

9 Hours

Unit IV

Principles of Computer Graphics

Transformation and mapping of geometric models - inversion transformations and mappings – projection of geometric models – design and engineering applications.

9 Hours

Unit V

Mass Property Calculations

Introduction-geometricalpropertyformulation-masspropertyformulation – finite element modelling – mesh generation – design and engineering applications.

9 Hours

Unit VI[$]

Case study: geometric and finite element modelling of automotive andsheet metal components-geometric programming for design and cost optimization.

Total: 45 Hours

Reference(s)

1. Ibrahim Zeid, CAD/CAM Theory and Practice, McGraw Hill Inc., New Delhi, 2014.
2. P. Radhakrishnanand C.P.Kothandaraman, Computer Graphics and Design, DhanpatRai and Sons, 2002.
3. P. Radhakrishnanand S.Subramanyan, CAD/CAM/CIM, New Age International, 2016.
4. D. Solomon, Computer Graphics and Geometric Modelling, Springer Verlag, 2006.
5. Donald Hearn and M Pauline Baker, "Computer Graphics", Prentice Hall, 2001
6. http://nptel.ac.in/courses/112102101/44
7. http://nptel.ac.in/video.php?subjectId=112102101

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CC63 NANOMATERIALS AND NANOTECHNOLOGY

3 0 0 3

Course Objectives

- To impart knowledge on the general issues relating to nanotechnology and nanofabrication.
- To understand the behavior of these nanomaterials, quantum phenomena and the limitations of basic principles of nanomaterial development.

Course Outcomes (COs)

The student will be able to

1. Understand the fabrication of nonmaterial and their use in the upcoming industry applications.
2. Apply the knowledge on the current trends in nonmaterial technology and their potential applications in the industry.
3. Apply interdisciplinary approach towards materials selection and implementation of technology for futuristic applications.

Unit I

Zero – Dimensional Nanostructures

Nanoparticles through homogenous nucleation, nanoparticles through the heterogeneous nucleation, kinetically confined synthesis of nanoparticles, epitaxial core – shell nanoparticles; One Dimensional Nanostructure-Nano wires And Nanorods: Spontaneous growth, template based synthesis

9 Hours

Unit II

Two-Dimensional Nanostructures-Thin Films

Fundamentals of film growth, vacuum science, physical vapor deposition (PVD), Chemical Vapor Deposition(CVD), Atomic Layer Deposition (ALD), Electrochemical Deposition

8 Hours

Unit III

Nanostructures Fabrication

Lithography, nano manipulation and nanolithography, soft lithography, assembly of nanoparticles and nanowires, other methods of micro fabrication,.Nanomechanics: A high speed review of motion: Displacement, velocity, acceleration and force, nano mechanical oscillation, feeling faint forces.

9 Hours

Unit IV

Nano Electronics: Electron Energy Bands, Electrons In Solids

Conductors, insulation and semi conductors, fermi energy, the density of states for solids, quantum confinement, tunneling, single electron phenomenon, molecular electronics. Nanophotonics: Photonics properties of nanomaterials, near-field light, optical tweezers, photonic crystals.

10 Hours

Unit V

Nano scale heat transfer

Nanoscale heat, conduction, convection, radiation. Nanoscale Fluid Mechanics: Fluids at the nanoscale: major concepts, flow fluids flow at the nanoscale, sonication, applications of nanofludics.

9 Hours

Unit VI[$]

Other methods of production of nanomaterials - sol-gel synthesis, inert gas condensation, mechanical alloying or high-energy ball milling, electro spinning.

Total: 45 Hours

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Reference(s)

1. Ben Rogers, Pennathur and Adams, Nanotechnology: Understanding Small System, CRC Press, 2008.
2. Bhushan, Bharat (Ed.) Handbook of Nanotechnology, Springer 2006.
3. Guozhong Cao, Nanostructures and Nanomaterials, Imperial College Press, 2006.
4. Lundstrom, Mark, Guo, Jing, Nanoscale transistors, Device physics, modeling and simulation, Springer, 2006.
5. S.M. Lindsay, Introduction to Nanoscience, Hardback-Nov 2009 or Paperback-Dec 2009.
6. X. Liu, Z. Zhong, Y. Tang and B. Liang, Review on the Synthesis and Applications of Nanomaterials, Journal of Nanomaterials, Vol. 2013, 2013, Article ID 902538.

15CC64/15ED64 DESIGN OPTIMIZATION OF MECHANICAL SYSTEMS
(Common to CAD/CAM & Engineering Design)

3 0 0 3

Course Objectives

- To acquire concepts of design optimization, and model the engineering problem mathematically.
- To impart knowledge on various optimization methods for obtaining approximate structural design solutions.
- To familiarize the selecting algorithms for solving multi-objective and non-traditional optimization problems.

Course Outcomes (COs)

The student will be able to

1. Formulate the mathematical models of real world problems.
2. Understand the various traditional optimization theories applied to solve structural problems.
3. Solve the engineering problems using suitable optimization techniques.

Unit I

Introduction

Introduction to optimum design - Principles of optimization - Conventional versus Optimal design process - Problem formulation - Classification of Engineering optimization problem

6 Hours

Unit II

Single Variable Optimization Techniques

Optimality Criteria - Bracketing Methods: Exhaustive search method - Bounding phase method - Region Elimination Methods: Interval halving method - Fibonacci search method - Golden section search method - Gradient based Methods: Newton - Raphson method - Bisection method - Cubic search method

9 Hours

Unit III

Multi Variable and Constrained Optimization Techniques

Unconstrained optimization techniques: Direct search Method: Simplex search methods - Hooke-Jeeve's pattern search method - Powell's conjugate direction method - Gradient based method: Cauchy's method - Newton's method - Conjugate gradient method. Constrained optimization techniques: Kuhn - Tucker conditions - Penalty Function methods - Solution by the method of Lagrangian multiplier.

12 Hours

Unit IV

Design of Experiments and Modelling

Introduction- ANOVA- Factorial Design, Fractional factorial Design, Regression Approach- Two, and multi variable Design, Orthogonal Array Design, Response Surface Methods- Simple Problems

9 Hours

Unit V

Non Traditional Optimization

Introduction to non-traditional optimization - Genetic Algorithm - Bee Colony Algorithm - Particle Swarm Optimization (PSO) and Neural Networks in optimization, Simple Applications

9 Hours

Unit VI[$]

Case studies: Using any modelling software.

Total: 45 Hours

Reference(s)

1. S. S. Rao, Engineering Optimisation: Theory and Practice, Wiley- Interscience, 2009.
2. K. Deb, Optimization for Engineering Design Algorithms and Examples, Prentice Hall of India Pvt. 2010.
3. Jasbir S. Arora, Introduction to Optimum Design, McGraw Hill International, 2011.
4. Panos Y. Papalambros and Douglass J. Wilde, Principles of Optimal Design: Modelling and Computation, Cambridge University Press, 2000.
5. R. PanneerSelvam, Design and Analysis of Experiments, PHI Learning Private Limited, 2012.
6. Ashok D. Belegundu, R. Tirupathi and Chandrupatla, Optimization Concepts and Applications in Engineering, Pearson Education, 2014.
7. G. V. Reklaitis, A. Ravindram and K. M. Ragsdell, Engineering Optimization - Methods & Application, Wiley, 2006.
8. http://nptel.ac.in/courses/111105039/

15CC65 MICRO ELECTRO MECHANICAL SYSTEMS DESIGN

3 0 0 3

Course Objectives

- To get an exposure on the application of MEMS in various domains
- To impart knowledge on MEMS with their manufacturing techniques

Course Outcomes (COs)

The student will be able to

1. Apply the techniques for building microdevices in silicon, polymer, metal and other materials.
2. Analyze microsystems technology for technical feasibility as well as practicality
3. Understand the limitations and current challenges in microsystems technology.

Unit I

Introduction

Introduction to MEMS and Microsystems, typical products, Microsystems and micro electronics – applications of Microsystems in automobile and other industries, working principle of Microsystems – types of micro sensors, Micro actuation techniques —MEMS with micro actuators – micro pump – micro motors – micro valves – micro grippers – micro accelerometers, micro fluids. MEMS gyroscope, Electrostatic fluid accelerator

10 Hours

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit II

Materials for MEMS and Microsystems

Substrates and wafer – active substrate materials, silicon as a substrate material, silicon compounds- silicon dioxide, silicon carbide, silicon nitride, polycrystalline silicon, silicon piezo-resistors,– - Gallium arsenide, quartz, - piezoelectric crystals – polymers as industrial materials, polymers for MEMS and Microsystems, conductive polymers – Langmuir-Blodgett films, packing materials. Glass, Tungsten film and Sillimanite

10 Hours

Unit III

Fabrication Processes

Photolithography – photoresists and application, light sources, phoresist development, removal and postbacking, Ion implantation, diffusion, oxidation process, chemical vapor deposition-working principle, chemical reactions, rate of deposition, physical vapor deposition –sputtering, deposition by epitaxy, etching- chemical etching and plasma etching. Electron beam lithiography and HF etching

7 Hours

Unit IV

Micromanufacturing

Bulk micromanufacturing- etching, isotropic and anisotrotpic etching, wet and dry etching, surface micro machining, – LIGA process- general description materials, electroplating, SLIGA process, Process design- photolithography, thin film fabrication, geometry shaping. Micro cutting and Chemical mechanical planarization

9 Hours

Unit V

Microsystem Packaging

Mechanical packaging of microelectronics, Micro system packaging – general considerations, three levels of packaging-die level, device level and system level, interfaces in microsystem packaging, essential packaging technologies, three dimensional packaging, assembly of Microsystems, selection of packaging materials, signal mapping and transduction. Zero level packaging

9 Hours

Unit VI[$]

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon – Application.

Total: 45 Hours

Reference(s)

1. Tai- Ran Hsu, MEMS & Microsystems Design and Manufacture, TMH, education, 2010.
2. N.P.Mahalik, MEMS, McGraw-Hill Companies, 2010
3. Gardner, W.Julian, K. Varadan Vijay and O.Awadelkarim, Osama, Micro sensors MEMS and Smart Devices, Jhon Wiley & Sons Ltd, 2001.
4. Gad-el-Hak, Mhamed, The MEMS Handbook, CRC Press 2002.
5. S.Fatikow, U.Rembold, Microsystem Technology and Microrobotics, Springer–Verlag, Berlin, Heidelberg, 2007.
6. E.H. Tay, Francis and W.O.Choong ,Micrfluids and Bio MEMS applications, Springer, 2002.

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CC66 SUPPLY CHAIN MANAGEMENT

3 0 0 3

Course Objectives

- To impart knowledge on supply chain models and organizational transformations.
- To teach the reengineering process improvement models & their tools and implementation.
- To improve the overall organization performance and customer satisfaction by improving product or service delivery to consumer.

Course Outcomes (COs)

The students will be able to

1. Understand key theories of supply chain management and logistics in contemporary organizations.
2. Know the initiative and judgment in planning, problem solving, decision making in supply chain management.
3. Distinguish theories; models to interpret transmit responses to sometimes complex supply chain management problems.

Unit I

Introduction

Logistics- concepts, definitions, approaches, factors affecting logistics. Supply chain - basic tasks of the supply chain - the new corporate model.

8 Hours

Unit II

Supply Chain Management and Inventory

The new paradigm, the modular company, the network relations, supply process, procurement process - Distribution management, Role of cycle inventory & safety stock in supply chain, Inventory replenishment policies.

10 Hours

Unit III

Evolution of Supply Chain Models

Strategy and structure - factors of supply chain - Manufacturing strategy stages, supply chain progress - model for competing through supply chain management - supply chain redesign - Linking supply chain with customer.

9 Hours

Unit IV

Supply Chain Activity Systems

Structuring the supply chain, new products, functional roles, supply chain design framework - Collaborative product commerce.

9 Hours

Unit V

Supply Chain Management organization and Information System

The management task, logistics organization, the logistics information systems- topology of supply chain application- Resource planning, Enterprise Resource planning, Warehouse management system, product data management- cases.

9 Hours

Unit-VI[$]

Issues in international supply chain, regional differences in logistics. Local issues in supply chain.

Total: 45 Hours

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Reference(s)

1. S.Chopra, and P. Meindl, Supply chain Management: Strategy, Planning and Operations, Sixth Edition, Prentice Hall, 2015.
2. M.Christopher., Logistics Supply Chain Management –Strategies for Reducing Cost and Improving Service, FT Press, Fourth Edition, 2011
3. G.Srinivasan, Quantitative models in operations and supply chain management, PHI learning pvt. Ltd-New Delhi, 2010.
4. D.K.Agarwal, A text book of logistics and supply chain management, Macmillan, 2009.
5. Simchi-Levi, D. Kaminsky, P. Simchi-Levi, E. and Ravi Shankar, Designing & Managing the Supply Chain: Concepts, Strategies & Case Studies, Third Edition, Tata McGraw-Hill, 2007.
6. Yulan Wang, Stein W. Wallace, Bin Shen, Tsan-Ming Choi, Service supply chain management: A review of operational models, European Journal of Operational Research, pp. 1-14, 2015.
7. XunXu, DoganGursoy, Influence of sustainable hospitality supply chain management on customers attitudes and behaviors, International Journal of Hospitality Management, Vol.49, pp. 105-116, August 2015
8. http://nptel.iitm.ac.in /courses/110106045

15CC67 LEAN MANUFACTURING AND IMPLEMENTATION

3 0 0 3

Course Objectives

- To impart knowledge on globally competitive manufacturing organisation using lean manufacturing principles
- To teach the skills to implement lean manufacturing in industry and manage the productivity.
- To understand the key requirements and concepts in lean manufacturing according to industry requirements.

Course Outcomes (COs)

The students will be able to

1. Understand the manufacturing systems approach, manufacturing strategy, quality systems, and design for manufacture.
2. Understand the implementation of lean manufacturing concept.
3. Work in teams and professional networks project management, conflict resolution, negotiation, professional networking, persuasion, organization, communication, interpersonal skills.

Unit I

Introduction to Lean Manufacturing

Conventional Manufacturing versus Lean Manufacturing, Principles of Lean Manufacturing, Basic elements of lean manufacturing ,Introduction to LM Tools.

9 Hours

Unit II

Cellular Manufacturing, JIT, TPM

Cellular Manufacturing, Types of Layout, Principles of Cell layout, Implementation, Just in Time (JIT), Principles of JIT and Implementation of Kanban, Pillars of Total Productive Maintenance (TPM), Principles and implementation of TPM.

10 Hours

Unit III

Setup Time Reduction, TQM, 5S, VSM

Set up time reduction, Definition, philosophies and reduction approaches, Total Quality Maintenance Principles and implementation, 5S Principles and implementation, Value stream mapping, Procedure and principles.

9 Hours

UNIT IV

Six Sigma – Tools & Techniques

Cost of Quality – Conformance and Non-conformance cost – Basic quality control tools – Seven management tools – Failure mode and effect analysis.

8 Hours

Unit V

Six Sigma Methodology

Need for Six Sigma - Six Sigma Team – Define, Measure, Analyze, Improve and Control Methodology: Define Measure, Analyze, Improve and control – Lean Six Sigma.

9 Hours

Unit VI[$]

Various Case Studies of implementation of lean manufacturing in industries.

Total: 45 Hours

Reference(s)

1. Dennis P. Hobbs, LEANManufacturing Implementation, APICS, 2009.
2. Mikell P. Groover, Automation, Production Systems and CIM, Pearson International Edition, 2002.
3. Rich Charron, H. James Harrington, Frank Voehl and Hal Wiggin,The Lean Management Systems Handbook Hardcover, CRC Press, 2004.
4. Ronald G. Askin and Jeffrey B. Goldberg, Design and Analysis of Lean Production Systems, John Wiley & Sons, 2003.
5. M. Rother and J Shook, Learning to See: Value Stream Mapping to Add Value and Eliminate Muda, Lean Enterprise Institute, Brookline, 2004.
6. Nor Azian Abdul Rahman, SariwatiMohd Sharif and Mashitah Mohamed Esa, "Lean Manufacturing Case Study with Kanban System Implementation", Procedia Economics and Finance, Vol. 7, pp.174 – 180, 2013.
7. http://nptel.ac.in/courses/110106044

15CC68 / 15ED69 ADDITIVE MANUFACTURING TECHNIQUES
(Common to CAD/CAM & Engineering Design)

3 0 0 3

Course Objectives

- To provide an exhaustive knowledge of various Rapid Prototyping Techniques
- To make familiar about materials and process parameters in prototype development
- To introduce the recent trends and applications of Additive Manufacturing technology

Course Outcomes (COs)

The student will be able to

1. Develop three-dimensional models for RP machines
2. Create new file conversion technique and file formats for RP systems
3. Select the suitable process for respective application

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit I

Introduction

Needs - Impact of Rapid Prototyping (RP) and Tooling on Product Development- RP process chain - CAD Model - Input file formats - Generation and Conversion of STL file - File Verification and Repair - Build File Creation - Part Construction - Part Cleaning and finishing - RP Benefits- Classification of RP systems.

9 Hours

Unit II

Liquid Based and Solid Based Rapid Prototyping Systems

Stereolithography Apparatus SLA Principle, Part building processes, Photo polymerization of SL resins, Part quality, Recoating issues, Materials. Solid Ground Curing, Fused Deposition Modeling and Laminated Object Manufacturing Working Principle - Process parameters and Materials.

10 Hours

Unit III

Powder Based and Other Rapid Prototyping Systems

Selective Laser Sintering Principle, Process Variables, Indirect and direct SLS - Powder structures, Materials, Post processing, Surface deviation and Accuracy.

Three dimensional Printing Principle, Physics of 3DP, Types, Process capabilities, Solid, Liquid and Powder based 3DP systems.

10 Hours

Unit IV

Materials Properties

Role of materials - Viscous flow – Photo polymerization - Sintering - Infiltration - Materials for AM Processes - Mechanical Properties of AM Parts - Material properties, Colour, Dimensional accuracy, Stability, Surface finish, Machinability, Environmental resistance, Operational properties of products developed

Direct Metal Deposition, Ballistic Particle Manufacturing, Electron Beam Melting and Laser Engineered Net Shaping Working Principle.

9 Hours

Unit V

Applications of Rapid Prototyping

Introduction to rapid tooling - Direct and indirect method - Application of Rapid prototyping in Medical field, Manufacturing, Automotive industries, Aerospace and Electronics and Retail industries. Software for RP - STL file creation from CAD model using Magics, Mimics, Streamics.

7 Hours

Unit VI[$]

Case studies: Rapid Manufacturing in industrial applications. Articles on developments in Additive Manufacturing.

Total: 45 Hours

Reference(s)

1. D. T.Pham and S. S.Dimov, Rapid manufacturing, Springer-Verlag, London, 2001.
2. I. Gibson, D. W. Rosen, and B. Stucker, Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2010
3. C. K. Chua, K. F. Leong and C. S. Lim, Rapid prototyping: Principles and applications, Cambridge University Press, 2010.
4. L.W. Liou, F.W. Liou, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press, 2013.
5. A. K. Kamrani, E. A. Nasr, Rapid Prototyping: Theory and practice, Springer, 2006.
6. N. Hopkinson, R. J. M. Hague, P. M. Dickens, Rapid Manufacturing - An Industrial Revolution for Digital Age, John Wiley & Sons Limited, 2006.

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CC69 INTELLIGENT MANUFACTURING SYSTEMS

3 0 0 3

Course Objectives

- To acquire the concepts of computer integrated manufacturing systems and manufacturing communication systems
- To teach various components of knowledge based systems
- To explain the concepts of artificial intelligence and automated process planning

Course Outcomes (COs)

The students will be able to

1. known the selected methods applied for creating and solution of mathematical models in manufacturing system
2. Understand the necessary information and will gain practical experience with algorithms used for these methods.
3. Use various methods to solve group technology problems.

Unit I

Structure and functional areas

Computer Integrated Manufacturing Systems Structure and functional areas of CIM system, - Computer aided design, Computer aided process planning, Computer aided manufacturing**,** CAQC, ASRS. Advantages of Computer integrated manufacturing. Manufacturing Communication Systems -MAP/TOP, OSI Model, Data Redundancy, Top-down and Bottom-up Approach, Volume of Information. Intelligent Manufacturing System Components, System Architecture and Data Flow, System Operation.

10 Hours

Unit II

Knowledge Based Systems

Components of Knowledge Based Systems -Basic Components of Knowledge Based Systems, Knowledge Representation, Comparison of Knowledge Representation Schemes, Interference Engine, Knowledge Acquisition.

8 Hours

Unit III

Artificial networks

Machine Learning-Concept of Artificial Intelligence, Conceptual Learning, Artificial Neural Networks- Biological Neuron, Artificial Neuron, Typesof Neural Networks, Applicationsin Manufacturing.

7 Hours

UNIT IV

Process Planning

Automated Process Planning- Variant Approach, Generative Approach, Expert Systems for Process Planning, Feature Recognition, Phases of Process planning. Knowledge Based System for Equipment Selection (KBSES)-Manufacturing system design. Equipment Selection Problem, Modeling the Manufacturing Equipment Selection Problem, Problem Solving approaches in KBSES, Structure of theKRSES.

10 Hours

Unit V

Models and Algorithms methods

Group Technology-Models and Algorithms Visual Method, Coding Method, Cluster Analysis Method, Matrix Formation – Similarity Coefficient Method, Sorting-based Algorithms, Bond Energy Algorithm, Cost Based method, Cluster Identification Method, Extended CI Method. Knowledge Based Group Technology- Group Technologyin AutomatedManufacturing System. Structure of Knowledge based system for group technology (KBSCIT)-Data Base, Knowledge

Base, Clustering Algorithm.

10 Hours

Unit VI[$]

Case Studies of implementation of intelligent manufacturing systems in automobile industries.

Total: 45 Hours

Reference(s)

1. Cihan H. Dagli,Artificial Neural Networks for Intelligent Manufacturing, Springer science business media,2004.
2. Gérard Morel, Botond Kadar, Laszlo Monostori, Intelligent Manufacturing Systems 2003: (IMS 2003) a Proceedings Volume 7, 2003.
3. Mohammed Jamshidi,Design and Implementation Of Intelligent Manufacturing Systems, pearson education,2005
4. Mikell P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing", 8thedition, PHI, 2008.
5. Yagna Narayana, "Artificial Neural Networks", PHI, 2009.
6. Andre Kusaic, "Intelligent Manufacturing Systems", PHI, 2001.
7. Hamid R. Parsaei and Mohammad Jamshidi, "Design and Implementation of Intelligent Manufacturing Systems", PHI, 2009.

15CC70 ADVANCED COMPUTER AIDED DESIGN

3 0 0 3

Course Objectives

- To impart knowledge on advanced aspects of enabling computer aided technologies used in design, manufacturing and rapid product development
- To teach degree of competency in the development and application of modern computer aided design and manufacturing system.
- To gather knowledge on advances in modern techniques of rapid prototyping and rapid tooling

Course Outcomes (COs)

The students will be able to

1. Evaluate mathematical transformation and projection of rigid bodies
2. Design and model curves, surfaces and solids.
3. Apply the concepts to develop codes for geometric modeling and manufacturing.

Unit I

PRINCIPLES OF COMPUTER GRAPHICS

Introduction,graphicprimitives,pointplotting,lines,Bresenham'scirclealgorithm,ellipse,transformati oningraphics,coordinatesystems,viewport, 2D and 3D transformation, hidden surface removal, reflection, shading and generation of characters.

8 Hours

Unit II

CAD TOOLS

Definition of CAD Tools, Types of system, CAD/CAM system evaluation criteria, brief treatment of input and output devices. Graphics standard, functional areas of CAD, Modeling and viewing, software documentation, efficient use of CAD software. Geometric modeling: Types of mathematical representation of curves, wire frame models wire frame entities parametric representation of synthetic curves her mite cubic splines Bezier curves, B-splines, rational curves.

10 Hours

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

Unit III

SURFACE MODELING

Mathematical representation surfaces, Surface model, Surface entities surface representation, Parametric representation of surfaces, plane surface, rule surface, surface of revolution, Tabulated Cylinder.

8 Hours

UNIT IV

PARAMETRIC REPRESENTATION OF SYNTHETIC SURFACES

Hermite Bicubic surface, Bezier surface, B-Spline surface, COONssurface,BlendingsurfaceSculpturedsurface,Surfacemanipulation Displaying, Segmentation, Trimming, Intersection, Transformations(both2Dand3D).

9 Hours

Unit V

GEOMETRICMODELLING-3D

Solid modeling, Solid Representation, Boundary Representation (13-rep), Constructive Solid Geometry (CSG). CAD/CAM Exchange: Evaluation of data—exchange format, IGES data representations and structure, STEP Architecture, implementation, ACIS&DXF. Design Applications: Mechanical tolerances, Mass property calculations, Finite Element Modeling and Analysis and Mechanical Assembly.

10 Hours

Unit VI[$]

Case Studies of implementation of advanced computer aided design systems.

Total: 45 Hours

Reference(s)

1. IbrhimZeid, Mastering CAD/CAM (Engineeringseries), McGrawHill International, 2004
2. P.N.Rao, CAD/CAM Principles and Applications, Published by Tata McGraw-Hill Education Pvt. Ltd., 2012
3. M. Groover , E. Zimmers, CAD/CAM computer aided design and manufacturing, pearsonindia, 1998.
4. AlavalaChennakesava R, CAD/CAM Concepts and Applications, Pearson India,2008.
5. Radhakrishnan and Subramanian,Raju, CAD/CAM/CIM, New Age International, 2008.
6. FaridM.Amirouche,PrinciplesofComputerAidedDesignandManufacturing,Pearson india,2004
7. Warren. Seames, Computer Numerical Control Concepts and programming, 4th edition, Thomson learning, 2002.

$ Includes Self Study topics of all 5 units and considered for Continuous Assessment only.

15CCXA AUTOMATION IN MANUFACTURING

1 0 0 1

Course Objectives

- To acquire knowledge in modern manufacturing operations, including their capabilities and limitations.
- To learn how to analyze products and be able to improve their manufacturability and lower costs
- To teach the relationship between customer desires, product materials, product design, and manufacturing process selection.

Course Outcomes (COs)

The students will be able to

1. Provide the knowledge and skills to use computer-driven control systems.
2. Emphasize programming, design, and operation of automated equipment and robotics systems
3. Implicate with many stages and aspects of an automation system.

Automation of assembly lines

Concept of automation, mechanization and automation,Concept of automation in industry, mechanization and automation, classification, balancing of assembly line using available algorithms. Transfer line-monitoring system (TLMS) using Line Status, Line efficiency. Buffer stock Simulation in assembly line.

10 Hours

Automation using hydraulic systems

Design aspects of various elements of hydraulic systems such as pumps, valves, filters, reservoirs, accumulators, actuators, intensifiers etc. Selection of hydraulic fluid, practical case studied on hydraulic circuit design and performance analysis. Servo valves, electro hydraulic valves, proportional valves and their applications.

10 Hours

Total: 20 Hours

Reference(s)

1. YoramKoren, Robotics for Engineers- McGraw Hill 2002.
2. Paul, R.P., Robot Manipulators- MIT Press 2003.
3. Andrew Parr, " Hydraulic and Pneumatics ", (HB), Jaico Publishing House, 2003.
4. 4. Bolton. W. “Pneumatic and Hydraulic Systems ", Butterworth - Heineman, 2004.

15CCXB ADVANCED TOOL DESIGN

1 0 0 1

Course Objectives

- To acquire knowledge in design process in approach to problem solving that yields design solutions.
- To impart the design process includes defining a problem, brainstorming and generating ideas.
- To teach the design problems are seldom presented in a clearly defined form.

Course Outcomes (COs)

The students will be able to

- Understand the tool design methods and punch and die manufacturing techniques
- Know the fixtures for milling, boring, lathe, grinding and welding for NC machine tools
- Select material for cutting tools and gages; classify various cutting tools and gages and identify their nomenclature

Tooling materials

Introduction, properties of tool materials, metal cutting tools, single point cutting tools, milling cutters, drills and drilling, reamer classification, taps, tap classification, the selection of carbide cutting tools, various heat treatments Gages and gage design: Fixed gages, gage tolerances, the selection of material for gages.

10 Hours

Design of jigs

Principles of clamping, drill jigs, chip formation in drilling, general considerations in the design of drill jigs, drill jigs and modern manufacturing, computer aided jig design

10 Hours

Total: 20 Hours

Reference(s)

1. DonaldsonCyrll, George H.LeCainandGooldV.C.,"ToolDesign",TataMcra Hill, 36thReprint, 2006.
2. Wilson F.W., "Fundamentals of Tool Design", ASTME, Prentice Hall, India, 2010.
3. G.C. Sen and A. Bhattacharya, "Principles of Machine Tools", New Central Book Agency, Kolkata, 2009.

15CCXC FLEXIBLE MANUFACTURING SYSTEMS

1 0 0 1

Course Objectives

- To understand the concept of group technology and various models of manufacturing systems.
- To impart knowledge about the design, operation, and selection of Flexible Manufacturing Systems and their integration in today's production environments
- To understand the integration of components of FMS under different production management approaches.

Course Outcomes (COs)

The students will be able to

1. Apply the concepts of PPC and GT to the development of FMS
2. Identify various workstations, system support equipments and hardware components of FMS
3. Select suitable database and software required for FMS

Evolution of Manufacturing Systems

FMS definition and description, General FMS considerations, Manufacturing cells, Cellular versus Flexible Manufacturing.Systems Planning: Objective, introduction planning, preparation guidelines, the project team, supplier selection, system description and sizing, facility preparation planning, FMS layouts.

10 Hours

Manufacturing Driving Force

Definition, description and characteristics. Just in-time manufacturing, definition and description, benefits and relationship to FMS, implementation cornerstones, quality and quantity application principles.

10 Hours
Total: 20 Hours

Reference(s)

1. Shivanand H.K., Benal MM, Koti V, Flexible Manufacturing System, New age international (P) Limited, New Delhi, 2006
2. Mikell P. Groover Automation, Production Systems and Computer Integrated Manufacturing, Pearson India, 2008.
3. M.Baudin: Manufacturing Systems Analysis with Application to Production Scheduling, Yourdon Press, 2002.
4. S.B. Joshi, and J.S. Smith., Computer Control of Flexible Manufacturing Systems, Research and Development, Chapman & Hall, 2004.