



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

M.Tech – CAD/CAM (Part Time)
Curriculum and Syllabus
2013 Regulation

I SEMESTER						
S.No	Subject Code	Title of Subject	L	T	P	C
1	MMA130002	Applied Mathematics for Design Engineers	3	1	0	4
2	MME13DE06	Product Design and Development Strategies	3	1	0	4
3	MME13DE07	Robotics and Sensors	3	0	0	3
4	MME13D009	Advanced Strength of Materials	3	1	0	4
TOTAL			12	3	0	15

II SEMESTER						
S.No	Subject Code	Title of Subject	L	T	P	C
1	MME13C001	Computer Integrated Manufacturing Systems	3	0	0	3
2	MME13C002	Manufacturing Information Systems	3	0	0	3
3	MME13C003	Computer Aided Design	3	0	0	3
4	MME13DL01	Design Analysis Lab	0	0	4	2
TOTAL			12	0	4	11

III SEMESTER						
S.No	Subject Code	Title of Subject	L	T	P	C
1	MME13D003	Advanced Finite Element Analysis	3	1	0	4
2	MME13D004	Design for Manufacturing and Assembly	3	1	0	4
3	MME13C004	Computer Aided Process Planning	3	0	0	3
4	MME13CL01	CAM Laboratory	0	0	4	2
TOTAL			12	2	4	13

IV SEMESTER						
S.No	Subject Code	Title of Subject	L	T	P	C
1	MME13DE02	Optimization in Design	3	1	0	4
2	MME13XXXX	Elective I (CAD)	3	1	0	4
3	MME13XXXX	Elective II (CAD)	3	1	0	4
TOTAL			12	3	0	12



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

V SEMESTER						
S.No	Subject Code	Title of Subject	L	T	P	C
1	MME13DE09	Mechatronics in Manufacturing Systems	3	0	0	3
2	MME13XXXX	Elective III (CAM)	3	0	0	3
3	MME13XXXX	Elective IV (CAM)	3	0	0	3
4	MME13CL02	Project Phase I	0	0	6	3
TOTAL			9	0	6	12

VI SEMESTER						
S.No	Subject Code	Title of Subject	L	T	P	C
1	MME13CL03	Project Phase II*	0	0	24	12
TOTAL			0	0	24	12

Note: Out of 4 Electives, 2 are to be taken from CAD area and 2 from CAM area.

*Student should have presented a paper on the project area in National or International conference/Journals and should attach the certificate in proof and the published paper in the project report.

TOTAL NO. OF CREDITS : 75

List of Electives CAD						
S.No	Subject Code	Title of Subject	L	T	P	C
1	MME13DE03	Computational Fluid Dynamics	3	1	0	4
2	MME13DE04	Tribology in Design	3	1	0	4
3	MME13DE05	Advanced Machine Tool Design	3	1	0	4
4	MME13D007	Advanced Mechanism Design	3	1	0	4
5	MME13D008	Mechanical Vibrations	3	1	0	4
6	MME13D012	Design of Material Handling Equipments	3	1	0	4
7	MME13CE01	Design of Mechanical Drives	3	1	0	4

List of Electives CAM						
S.No	Subject Code	Title of Subject	L	T	P	C
1	MME13CE02	Data Communication in CAD/CAM	3	0	0	3
2	MME13CE03	Manufacturing System and Simulation	3	0	0	3
3	MME13CE04	Performance Modelling and Analysis of manufacturing System	3	0	0	3
4	MME13CE05	Applied Materials Engineering	3	0	0	3
5	MME13CE06	Flexible Competitive manufacturing system	3	0	0	3
6	MME13CE07	Metrology and Non Destructive Testing	3	0	0	3
7	MME13CE08	Concurrent Engineering	3	0	0	3



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MMA130002

APPLIED MATHEMATICS FOR DESIGN ENGINEERS

3 1 0 4

OBJECTIVES: The student will learn

- Analytical functions and different transform methods
- To solve the differential equations using finite difference methods

UNIT I: ANALYTIC FUNCTIONS

12 Hrs

Analytic functions – Cauchy Riemann equations – Construction of analytic functions – Conformal Mapping – Simple Transformations – Standard transformations : $w = z^2$, $w = e^z$, $w = \sin z$, $w = \cosh z$ – Bilinear transformations.

UNIT II: TRANSFORM METHODS

12 Hrs

Laplace Transform methods for one dimensional wave equation – Displacements in a string – Fourier Transform methods – One dimensional heat conduction problems in infinite and semi- infinite rod.

UNIT III: CALCULUS OF VARIATIONS

12 Hrs

Variation and its properties – Euler’s equations – Functional dependent on First and higher order derivatives – Functional depend on functions of several independent variables – Problems with moving boundaries – Direct methods – Ritz and Kantorovich methods.

UNIT IV: FINITE DIFFERENCE METHODS

12 Hrs

Finite difference methods – Solution of Laplace and Poisson equation – Leibmann’s iteration process – Solution of heat equation: Schmidt explicit formula – Crank-Nicolson implicit scheme – Solution of wave equation.

UNIT V: FAST FOURIER TRANSFORMS

12 Hrs

Discrete Fourier transform – linearity and periodicity – Inverse N-point DFT – DFT approximation of Fourier coefficients – Sampled Fourier series – Approximations of Fourier Transform by an N-point DFT – FFT – Computational efficiency of FFT.

Total No. of Hrs : 60

REFERENCES

1. Grewal.B.S (2012) “Higher Engineering Mathematics”, Khanna Publishers.
2. Kreyszig E (2011) “Advanced Engineering Mathematics (9th ed.)”, John Wiley & Sons.
3. Sneddon I.N (2006) “Elements of Partial Differential Equations”, Dover Publications.
4. Sankara Rao K (2010) “Introduction to Partial Differential Equations (3rd ed.)”, Prentice Hall of India.
5. Gupta A.S (2004) “Calculus of variations with applications”, Prentice Hall of India.
6. James G (2007) “Advanced modern Engineering Mathematics (3rd ed.)”, Pearson.
7. Sastry S.S (2003) “Introductory Methods of Numerical Analysis”, Prentice Hall of India.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13DE06

PRODUCT DESIGN AND DEVELOPMENT STRATEGIES

3 1 0 4

OBJECTIVE: The student will learn

- Product design considerations and strategies of innovative product development

UNIT I: INTRODUCTION

12 Hrs

Essential factors of product design- requirements of good design- factors affecting product design- product development process tools- Design by evolution and innovation- Asimow's model- Journeys in product development- product engineering – nature and scope- Product design practice in industry.

UNIT II: CREATIVITY

12 Hrs

Creative thinking and organizing for product innovation criteria – method and tools for directed creativity – challenges of quality management – Case studies – Mumbai's Dabbawalas – creativity by less learned- Creativity on wheel chair – MARICO (case study)- Patent –design patents- patent application steps – sale of patent rights.

UNIT III: DESIGN CONSIDERATIONS

12 Hrs

Functional and production design – form design – influence of basic design, mechanical loading and material on form design – Design for manufacture and assembly – Design for robustness – Design for production – Design for stiffness and rigidity – strength consideration in product design – optimization in design – Project analysis – Mechanical estimating and costing.

UNIT IV: PRODUCT DEVELOPMENT STRATEGIES

12 Hrs

Planning and preparation – Resources – Talent –striving, thinking, relating – Quality assurance in product design – Strategy for product development – Case studies.

UNIT V: HUMAN AND VALUE ENGINEERING

12 Hrs

Human beings as applicator of forces – Anthropometry – design of controls and displays – man/machine information exchange – aesthetic and ergonomic considerations – Value engineering – maximum value-Normal degree of value – value analysis of job plan – Idea generation check-list – Cost reduction through value engineering case study on tap switch control assembly – Economic factors influencing design – Material and process selection

Total No. of Hrs : 60

REFERENCES

1. Kavin & Krishn "*Product Design Techniques in reverse engineering & New product Development*", Pearson Education.
2. Paul E. Dlesk "*Creativity, Innovation and Quality*", Prentice - Hall of India Private Limited.
3. Jones J.C (1970) "*Design Methods*", Interscience.
4. Buhl. H.R (1960) "*Creative Engineering Design*", Iowa State University Press.
5. Dieter. G.E (1983) "*Engineering Design*", McGraw Hill.
6. Niebel. B.W. & Draper, A.B (1991) "*Product Design and Process Engineering*", McGraw Hill.
7. Harry Peck (1973) "*Designing for Manufacturing*", Sir Issac Pitman and Sons Ltd.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13DE07

ROBOTICS AND SENSORS

3 0 0 3

OBJECTIVE: The student will learn

- Concepts, design, application and control of robotics

UNIT I: INTRODUCTION

9 Hrs

Basic concepts-Robot anatomy-robot configurations-Basic Robot motions-Types of drives-Applications Material Handling-Processing-Assembly and Inspection -Safety considerations.

UNIT II: TRANSFORMATIONS AND KINEMATICS

9 Hrs

Vector operations-Translational transformations and Rotational transformations-Properties of transformation Matrices-Homogeneous transformations and Manipulator-Forward solution-Inverse solution

UNIT III: CONTROLS AND END EFFECTORS

9 Hrs

Control system concepts-Analysis-control of joints-Adaptive and optimal control-End effectors- Classification-Mechanical-Magnetic-Vacuum-Adhesive-Drive systems-Force analysis and Gripper design

UNIT IV: ROBOT PROGRAMMING

6 Hrs

Methods -Languages-Computer control and Robot Software-VAL system and Language

UNIT V: SENSORY DEVICES

12 Hrs

Non-optical and optical position sensors-Velocity and Acceleration-Range-Proximity-touch-Slip-Force-Torque-Machine vision-Image components-Representation - Hardware-Picture coding-Object recognition and Categorization-Software consideration- Case Studies

Total No. of Hrs : 45

REFERENCES

1. Fu .K.S, Gonzalez. R.C, Lee. C.S.G (1987) "*Robotics control, sensing, vision, and Intelligence*", McGraw Hill Book Co.
2. Klafter .R.D, Cmielewski T.A and Negin M (1994) "*Robot Engineering An Integrated approach*", Prentice Hall of India, New Delhi.
3. Deb .S.R (1994) "*Robotics Technology and Flexible Automation*", Tata McGraw Hill Publishing Co., Ltd.
4. Craig .J.J "*Introduction to Robotics Mechanics and Control*", Addison Wesley.
5. Groover. M.P (1995) "*Industrial robotics Technology, programming and applications*", McGraw Hill Book Co.
6. <http://www.robotics.com>



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13D009

ADVANCED STRENGTH OF MATERIALS

3 1 0 4

OBJECTIVE: The student will learn

- Behaviour of the material under different types of loads

UNIT I: INTRODUCTION

12 Hrs

Load-Stress and Load-Deflection, Stress-strain relations, Failure and limits on design Theories of Stress and Strain- Definition of stress at a point, Stress notation, Symmetry of the stress array and stress on an arbitrarily oriented plane, Transformation of stress, Principal stresses, Differential equations of a deformable body, Deformation of a Deformable body, Strain Theory, Transformation of strain, Principal strains, Small displacement theory, Strain measurement

UNIT II: TORSION

12 Hrs

Torsion of Prismatic bar of circular cross section, Saint-Venant's semi inverse method, Linear elastic solution, Narrow rectangular cross section, Hollow thin-wall torsion members, Multiply connected cross section, Thin wall torsion members with restrained ends, Numerical solution of torsion problems

UNIT III: BENDING

12 Hrs

Definition of shear center in bending, Symmetrical and non-Symmetrical bending, Bending stresses in beams subjected to non-Symmetrical bending, Deflections of straight beams subjected to non-Symmetrical bending, Effect of Inclined loads

UNIT IV: CURVED BEAMS

12 Hrs

Introduction, Circumferential stresses in a curved beam, Radial stresses in curved beams, Correction of circumferential stresses in curved beams, Deflection of curved beams, statically indeterminate curved beams, closing ring subjected to a concentrated load

UNIT V: CONTACT STRESSES

12 Hrs

Introduction, the problem of determining contact stresses, Geometry of the contact surface, Notation and meaning of terms, Expressions for Principal stresses, Method of computing contact stresses, Deflection of bodies in point contact, Stress for two bodies in line contact, Loads normal to contact area and Tangent to contact area , Problems

Total No. of Hrs : 60

REFERENCES

1. Arthur P.Boresh "Advanced Mechanics of Materials, John wiley & sons.Inc.
2. Egor P. Popov (1997) "Engineering Mechanics of Solids", Prentice Hall of India, New Delhi.
3. Srinath L.N "Advanced Mechanics of Solids, "Tata McGraw Hill Publishing Company Ltd., New Delhi.
4. Junarkar S.B (1995) "Mechanics of Structures", Vol. 1, 21st Edition, Charotar Publishing House, Anand, India.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13C001 COMPUTER INTEGRATED MANUFACTURING SYSTEMS 3 0 0 3

OBJECTIVE: The student will learn

- Computer integrated planning and manufacturing systems

UNIT I: INTRODUCTION **9 Hrs**
Modern Manufacturing – Sequence of functions in Computer Integrated Manufacturing – Elements of CIM system – The CIM Wheel – CIM- DBMS –LAN-WAN– Benefits of CIM

UNIT II: GROUP TECHNOLOGY **9 Hrs**
Introduction – Part families – PFA – Parts Classifications and Coding – Machine Cells – Coding Systems – Economics of GT – Benefits of GT – Applications, Advantages, Disadvantages of GT

UNIT III: COMPUTER AIDED PROCESS PLANNING & PLANNING CONTROL **9 Hrs**
Role of Process Planning – Approaches to Process planning – Process planning systems – Benefits of CAPP. Production control function – Business Planning - MRP

UNIT IV: COMPUTER AIDED QUALITY CONTROL **9 Hrs**
QC – Computer Aided Quality Control – Automated inspection principles and methods – Computer Aided Inspection – Computer Aided Testing- Integration of CAQC with CAD/CAM

UNIT V: FLEXIBLE MANUFACTURING SYSTEMS **9 Hrs**
Introduction – Elements of Flexible Manufacturing Systems – Classification, Operational aspects of FMS – Types of FMS – Work Stations Layout – Material Handling equipment – Analysis, applications of FMS

Total No. of Hrs : 45

REFERENCES

1. Groover. M.P (2006) "*Automation, Production System and CIM*", Prentice-Hall of India.
2. David Bedworth (1998) "*Computer Integrated Design and Manufacturing*", TMH, New Delhi.
3. Yoram Koren (1983) "*Computer Integrated Manufacturing Systems*", McGraw Hill.
4. Ranky, Paul G (1986) "*Computer Integrated Manufacturing*", Prentice Hall International.
5. R.W. Yeomamas, A. Choudry and P.J.W. Ten Hagen (1985) "*Design rules for a CIM system*", North Holland Amsterdam.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13C002

MANUFACTURING INFORMATION SYSTEMS

3 0 0 3

OBJECTIVE: The student will learn

- Management information database used for manufacturing

UNIT I: INTRODUCTION

9 Hrs

The evolution of order policies, from MRP to MRP II. The role of production organization. operations control

UNIT II: DATABASE

9 Hrs

Terminologies-Entities and attributes-Data models, schema and subschema-Data Independence-ER Diagram-Trends in Database

UNIT III: DESIGNING DATA BASE

9 Hrs

Hierarchical model-Network approach-Relational data model-Concepts, Principles, keys, relational operations functional dependence-Normalization, types-Query languages

UNIT IV: MANUFACTURING CONSIDERATION

9 Hrs

The product and its structure, Inventory and process flow-Shop floor control-Data structure and procedure-Various model, the order-scheduling module. Input/output analysis module the stock status database-The complete IOM Database.

UNIT V: INFORMATION SYSTEM FOR MANUFACTURING

9 Hrs

Parts oriented production information system-Concepts and structure-Computerized production Scheduling, online production controlsystems, computer based production management system, computerized manufacturing information system - case study.

Total No. of Hrs : 45

REFERENCES

1. Luca G. Sartori (1989) "*Manufacturing Information systems*", Addison-Wesley Publishing Company.
2. Date.C.J (1997) "*An Introduction to Database systems*", Narosa Publishing House.
3. Orlicky.G (1994) "*Material Requirements Planning*", McGraw Hill Publishing Co.
4. Kerr.R (1991) "*Knowledge based Manufacturing Management*", Addison-Wesley.
5. www.ist.psu.edu



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13C003

COMPUTER AIDED DESIGN

3 0 0 3

OBJECTIVE: The student will learn

- Use of computers in design of components and assembly

UNIT I: INTRODUCTION TO COMPUTER AIDED DESIGN

11 Hrs

The design process-Application of computers in design-typical CAD System-CAE-Benefits of CAD-Concept of CAD as drafting and designing facility-drawing features in CAD-Translation, rotation, scaling-Layering-CAD Hardware-Design workstation-Graphic Terminal-Operator input devices-Output devices-CPU

UNIT II: INTERACTIVE COMPUTER GRAPHICS

12 Hrs

Creation of Graphic primitives-Output primitives(Points,Lines,Curves)- Windowing, view ports-Clipping transformation- Data exchange standards-Geometric modelling- Wireframe, Surface, Solid Modelling –Data Structures-Engineering Data Management System-Hierarchical,Network,Relational data structure

UNIT III: VISUAL REALISM

7 Hrs

Fundamentals -rendering techniques-lines and shaded images, dynamics, stereopsis, Improved display, aliasing and ant-aliasing.

UNIT IV: ASSEMBLY OF PARTS

8 Hrs

Assembly of parts, tolerance analysis, mass property calculations, mechanisms simulation.

UNIT V: SOLID MODELING

7 Hrs

Solid modeling- Rapid Prototyping -CSG and B-REP Techniques-Features of Solid Modeling Packages- Case Studies

Total No. of Hrs : 45

REFERENCES

1. William .M. Neumann and Robert .F. Sproul (1989) “*Principle of Computer Graphics*” , McGraw Hill Book Co. Singapore.
2. Donald Hearn and .M. Pauline Baker (1992) “*Computer Graphics*”, Prentice Hall, Inc.
3. Mikell .P. Grooves and Emory .W. Zimmers Jr. (1995) “*CAD/CAM Computer -- Aided Design and Manufacturing*”, Prentice Hall, Inc.
4. Ibrahim Zeid (1998) “*CAD/CAM -- Theory and Practice*”, McGraw Hill, International Edition.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13DL01

DESIGN ANALYSIS LAB

0 0 4 2

OBJECTIVE: The student will learn

- Design , modelling and analysis using computer software and tools

I. MODELLING:

- Introduction to modelling techniques- Type of modelling- wire frame, surface and solid modelling— constructive solid modelling and B-rep modelling- Feature based and parametric modelling etc.
- Generation of surfaces of revolution, surfaces of extrusion, surfaces by skinning operation etc.
- Creation of different views-importing models from other softwares-Data base management.

(Exercises will be given using packages like PROE/CATIA/Unigraphics etc.)

II. ANALYSIS:

- Introduction to FEM-Analysis software – ANSYS / NASTRAN/NISA/COSMOS/I-DEAS etc.
- Structural and fluid analysis.-One dimensional, two dimensional and Three dimensional Elements Based Problems.
- Thermal Analysis-Conduction, Convection and Radiation heat transfer Problems.

III. MATLAB:

- Introduction to MATLAB
- Study of different MATLAB tools
- Arithmetic and logical operators
- Matrix operation using MATLAB
- Mathematical equations solution
- Generation of trigonometrically wave functions
- Introduction to SIMULINK
- Flow control statements and graphs

Total No. of Hrs : 60



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13D003

ADVANCED FINITE ELEMENT ANALYSIS

3 1 0 4

OBJECTIVE: The student will learn

- Formulation and modelling of a problem and analyzing the dynamic, fluidics and heat transfer problems

UNIT I: BENDING OF PLATES AND SHELLS

12 Hrs

Review of Elasticity Equations-Bending of Plates and Shells-Finite Element Formulation of Plate and Shell Elements-Conforming and Non Conforming Elements - Co and C1 Continuity Elements-Application and Examples

UNIT II: NON-LINEAR PROBLEMS

12 Hrs

Introduction-Iterative Techniques-Material non-Linearity-Elasto Plasticity-Plasticity-Visco plasticity-Geometric Non linearity-large displacement Formulation-Application in Metal Forming Process and contact problems

UNIT III: DYNAMIC PROBLEM

12 Hrs

Direct Formulation - Free, Transient and Forced Response - Solution Procedures-Subspace Iterative Technique - Houbolt, Wilson, Newmark - Methods - Examples

UNIT IV: FLUID MECHANICS AND HEAT TRANSFER

12 Hrs

Governing Equations of Fluid Mechanics-Inviscid and Incompressible Flow-Potential Formulations-Slow Non-Newtonian Flow-Metal and Polymer Forming-Navier Stokes Equation-Steady and Transient Solutions.

UNIT V: ERROR ESTIMATES AND ADAPTIVE REFINEMENT

12 Hrs

Error norms and Coverage rates- high refinement with adaptivity-Adaptive refinement

Total No of Hrs : 60

REFERENCES

1. Zeinkiewicz. O.C and Taylor, R.L (1991) "*The Finite element Method*", Fourth Edition, Volumes 1 & 2, McGraw Hill International Edition, Physics service.
2. Cook R.D (1989) "*Concepts and Applications of Finite Element Analysis*", John Wiley and Sons Inc, New York.
3. Bathe K.J (1990) "*Finite Element Procedures in Engineering Analysis*", Prentice Hall.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13D004

DESIGN FOR MANUFACTURING AND ASSEMBLY

3 1 0 4

OBJECTIVE: The student will learn

- requirements of designing to ease manufacturing and assembly

UNIT I: INTRODUCTION

12 Hrs

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

UNIT II: FORM DESIGN - CASTING

12 Hrs

Production methods on form design - Casting considerations - Requirements and rules - Redesign of components for castings and Case studies.

UNIT III: FORM DESIGN - FORGING

12 Hrs

Forging considerations - Requirements and rules - Redesign of components for forging and Case studies.

UNIT IV: FORM DESIGN - MACHINING

12 Hrs

Machining considerations - Requirements and rules -Redesign of components for Machining and Case studies.

UNIT V: DESIGN FOR ASSEMBLY METHODS

12 Hrs

Approaches to design for assembly - Qualitative evaluation procedures, knowledge based approach, Computer aided DFA methods. Assemblability measures. Boothroyd - Dewhurst DFA method - Redesign of a simple product - Case studies.

Total No of Hrs : 60

REFERENCES

1. Harry Peck (1983) "*Design for Manufacture*", Pittman Publication.
2. Alan Redford and Chal (1994) "*Design for Assembly - Principles and Procedures*", McGraw Hill International Europe, London.
3. Robert Matousek (1963) "*Engineering Design - A Systematic Approach*", Blackie & Sons Ltd.
4. James G. Bralla (1986) "*Hand Book of Product Design for Manufacturing*", McGraw Hill Co.
5. Swift. K. G (1987) "*Knowledge Based Design for Manufacture*", Kogan Page Ltd.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13CL01

CAM LABORATORY

0 0 4 2

OBJECTIVE: The student will learn

➤ Practically the method of writing programs for machining operations

1. Practice in part programme and operation of a turning center.
2. Diagnosis and trouble shooting in CNC machine.
3. Practice in part programming and operations of a machine center.
4. Tool planning and selection for machining center/turning center.
5. Programming using CAD based software.
6. Practice in APT based NC programming languages
7. Practice in robot programming and its languages
8. Preparation of various reports and route sheets.
9. Simulation of a manufacturing system.

Total No. of Hrs : 60



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13DE02

OPTIMIZATION IN DESIGN

3 1 0 4

OBJECTIVE: The student will learn

- Optimization techniques and its application in design and manufacturing

UNIT I: CLASSICAL OPTIMIZATION TECHNIQUES

12 Hrs

Single variable optimization with and without constraints, Multi-variable optimization without constraints, multi-variable optimization with constraints– method of Lagrange multipliers, Kuhn-Tucker conditions.

UNIT II: NUMERICAL METHODS FOR OPTIMIZATION

12 Hrs

Nelder Mead's Simplex search method, Gradient of a function, steepest descent method, Newton's method, types of penalty methods for handling constraints.

UNIT III: GENETIC ALGORITHM (GA)

12 Hrs

Differences and similarities between conventional and evolutionary algorithms, working principle, reproduction, crossover, mutation, termination criteria, different reproduction and crossover operators, GA for constrained optimization, draw backs of GA, multi-objective GA, Non-dominated sorted GA, convergence criterion, applications of multi-objective problems.

**UNIT IV: APPLICATIONS OF OPTIMIZATION IN DESIGN
AND MANUFACTURING SYSTEMS**

12 Hrs

Some typical applications like optimization of path synthesis of a four-bar mechanism, minimization of weight of a cantilever beam, optimization of springs and gears, general optimization model of a machining process, optimization of arc welding parameters, and general procedure in optimizing machining operations sequence.

UNIT V: INTRODUCTION TO NEURAL NETWORKS

12 Hrs

Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate and- Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch- Pitts Model, Historical Developments, Potential Applications of ANN.

Total No. of Hrs : 60

REFERENCES

1. Jasbir Arora "*Optimal design*", Mc Graw Hill (International) Publishers.
2. Kalyanmoy Deb "*Optimization for Engineering Design*", PHI Publishers.
3. S.S.Rao "*Engineering Optimization*", New Age Publishers.
4. Johnson Ray, C (1990) "*Optimum Design of mechanical elements*", Wiley, John & Sons.
5. Kalyanmoy Deb. "*Multi objective Genetic algorithms*", PHI Publishers.
6. Hertz, Krogh, Palmer "*Introduction to the theory of Neural Computation*".
7. B. Yegnanarayana (PHI) "*Artificial Neural Networks*".
8. David E. Goldberg, Addison Wesley (1989) "*Genetic Algorithms*" New York.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13CL02

PROJECT PHASE I

0 0 6 3

- Students should select the area of the project work and complete the literature survey.
- Student should identify the problem of study and start the project work.
- Students are expected to do the project work individually.
- A guide will be allotted to each student based on the area of the Project work.
- Project reviews will be conducted once in a fortnight to assess the development of the project work.
- At the end of the semester students should submit a report of the work completed and should appear for a Project Viva-voce examination conducted by the internal examiner.
- Continuous assessment mark (50 marks) will be awarded based on the performance in the reviews.
- End semester mark (50 marks) will be awarded based on project viva voce examination.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13CL03

PROJECT PHASE II

0 0 24 12

- Students are expected to do a Project work either in an Industry or at the University in the area of specialization individually.
- Each student will be allotted a guide based on the area of Project work
- Number of reviews will be conducted during the semester to monitor the development of project. Students have to submit the thesis at the end of the semester and appear for the Project Viva-Voce examination conducted by one internal examiner and one external examiner.

It is mandatory that the student should have presented his project work as a technical paper in National/international conference /Journals. A copy of the certificate in proof of paper presentation should be enclosed in the project report.

50% weightage (100 marks) will be given for the continuous assessment and 50% weightage (100 marks) for the Project viva a voce examination.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13DE03

COMPUTATIONAL FLUID DYNAMICS

3 1 0 4

OBJECTIVE: The student will learn

- Formulation and analysis of problems on fluid dynamics

UNIT I: GOVERNING DIFFERENTIAL EQUATIONS AND FDM

12 Hrs

Classification, Initial and Boundary Conditions, Initial and Boundary value problems. Finite Difference Method, Central, Forward, Backward Difference, Uniform and Non-uniform Grids, Numerical Errors, Grid Independence Test.

UNIT II: CONDUCTION HEAT TRANSFER

12 Hrs

Steady one-dimensional conduction, Two and Three dimensional Steady state problems, Transient One dimensional and Two dimensional problems.

UNIT III: INCOMPRESSIBLE FLUID FLOW

12 Hrs

Governing Equations, Stream function – Vorticity Method, Determination of Pressure for Viscous flow, Simple procedure of Patankar and Spalding, Computation of Boundary layer flow, Finite Difference Approach.

UNIT IV: CONVECTION HEAT TRANSFER AND FEM

12 Hrs

Steady One Dimensional and Two Dimensional Convection-Diffusion, Unsteady One Dimensional Convection-Diffusion, Unsteady Two Dimensional Convection – Diffusion – Introduction to Finite Element Method- Solution of Steady Heat Conduction by FEM- Incompressible flow – Simulation by FEM.

UNIT V: TURBULENCE MODELS

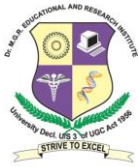
12 Hrs

Algebraic models – One Equation model, K-E Models, Standard, High and Low Reynolds Number models, Prediction of Fluid flow and Heat transfer using Standard Codes.

Total No. of Hrs : 60

REFERENCES

1. Muralidhar K and Sundararajan T (1995) “*Computational Fluid Flow and Heat Transfer*”, Narosa Publishing House, New Delhi,.
2. Ghoshdasdar P. S (1998) “*Computer Simulation of Flow and Heat Transfer*”, Tata McGraw Hill Publishing Company Limited.
3. Subhas, V Patankar (1980) “*Numerical Heat Transfer Fluid Flow*”, Hemisphere Publishing Corporation.
4. Taylor C and Hughes J.B (1981) “*Finite Element Programming of Navier Stoke Equation*”, Pine Ridge Press Ltd, U.K.,.
5. Anderson D.A, Tannehill I.I and Pletcher R.H (1984) “*Computational Fluid Mechanics and Heat transfer*”, Hemisphere Publishing Corporation,.
6. Fletcher C.A.J (1987) “*Computational Techniques for Fluid Dynamics-Fundamental and General Techniques*”, Springer –Verlag.
7. Fletcher C.A.J (1987) “*Computational Techniques for Different Flow Categories*”, Springer –Verlag.
8. Bose T.K (1997) “*Numerical Fluid Dynamics*”, Narosa Publishing House.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13DE04

TRIBOLOGY IN DESIGN

3 1 0 4

OBJECTIVE: The student will learn

- Influence of behaviour of friction, wear and lubrication on mechanical system design

UNIT I: SURFACES, FRICTION AND WEAR

12 Hrs

Topography of the surfaces - Surface features - Surface interaction - Theory of Friction - Sliding and Rolling Friction, Friction properties of metallic and non-metallic materials - friction in extreme conditions - Wear, types of wear - Mechanism of wear - Wear resistance materials - Surface treatment - Surface modifications - Surface coatings.

UNIT II: LUBRICATION THEORY

12 Hrs

Lubricants and their physical properties, lubricants standards - Lubrication regimes- Hydrodynamic lubrication - Reynolds Equation, thermal, inertia and turbulent effects - Elasto hydrodynamic and plasto hydrodynamic and magneto hydrodynamic lubrication - Hydro static lubrication .

UNIT III: DESIGN OF FLUID FILM BEARINGS

12 Hrs

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

UNIT IV: ROLLING ELEMENT BEARINGS

12 Hrs

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

UNIT V: TRIBO MEASUREMENT IN INSTRUMENTATION

12 Hrs

Surface topography measurements - Electron microscope and friction and wear measurements - Laser method - Instrumentation - International standards - Bearings performance measurements - Bearing vibration measurement.

Total No. of Hrs : 60

REFERENCES

1. Cameron. A (1981) "*Basic Lubrication Theory*", Ellis Herward Ltd. , UK.
2. Hulling , J. (Editor) (1984) --"*Principles of Tribology*", MacMillan .
3. Williams J.A (1994) "*Engineering Tribology*" ,Oxford Univ. Press .
4. Neale M.J (1995) "*Tribology Hand Book* ", Butterworth Heinemann.
5. <http://www.csetr.org/link.htm>
6. <http://www.me.psu.edu/research/tribology.htm>



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13D007

ADVANCED MECHANISM DESIGN

3 1 0 4

OBJECTIVE: At the end of this course the student will learn

- Different types of advanced mechanisms analyze and synthesize mechanisms.

UNIT I: INTRODUCTION TO KINEMATICS

12 Hrs

Review of fundamentals of kinematics--Mobility ,kinematic inversion,Graphical position analysis,algebraic position analysis,position analysis techniques,displacement difference between two points,rotation and translation,apparent displacement and absolute displacement.

UNIT II: VELOCITY AND ACCELERATION

12 Hrs

Velocity and acceleration of simple and complex mechanisms using graphical method.

UNIT III: SYNTHESIS

12 Hrs

Type , Number and. Dimensional synthesis - Function generation , path generation, body guidance.Two position synthesis of crank and rocker mechanism.Crank and rocker mechanism with optimum transmission angle.Three position synthesis,Four position synthesis,point precision reduction,precision position,structural error,chebychev spacing.

UNIT IV: SYNTHESIS OF LINKAGES

12 Hrs

Coupler curve synthesis, cognate linkages, Robert-Chebychev theorem, Blocks method of synthesis, Freudenstein's equation, Analytical synthesis using complex algebra, Synthesis of dwell mechanisms.

UNIT V: SPATIAL MECHANISM

12 Hrs

Introduction, exception in the mobility of mechanisms, the position analysis problem, Velocity and acceleration analysis.

Total No. of Hrs : 60

REFERENCES

1. Sandor G.N and Erdman A.G (1984)"*Advanced Mechanism Design Analysis and Synthesis*", Prentice Hall.
2. Shigley, J.E and Uicker, J.J (1995) "*Theory of Machines and Mechanisms*", McGraw Hill.
3. Amitabha Ghosh and Ashok Kumar Mallik (1999) "*Theory of Mechanism and Machines*", EWLP, Delhi.
4. Norton R.L (1999) "*Design of Machinery*", McGraw Hill.
5. Kenneth J. Waldron, Gary L. Kinzel (1999)"*Kinematics, Dynamics and Design of Machinery*", John Wiley- sons.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13D008

MECHANICAL VIBRATIONS

3 1 0 4

OBJECTIVE: At the end of this course the student will learn

- Various types of vibration and their analysis

UNIT I: FUNDAMENALS OF VIBRATION

12 Hrs

Review of Single degree freedom systems - Response to arbitrary periodic excursions - Duhamel's integral - Impulse response function - Virtual work - Lagrange's equations - Single degree freedom forced vibration with elastically coupled viscous dampers - System identification from frequency response - Transient vibration - Laplace transformation formulation.

UNIT II: TWO DEGREE FREEDOM SYSTEM

12 Hrs

Free vibration of spring-coupled system - Mass coupled system - Bending vibration of two degree freedom system - Forced vibration - Vibration Absorber - Vibration isolation.

UNIT III: MULTI DEGREE FREEDOM SYSTEM

12 Hrs

Normal mode of vibration - Flexibility matrix and stiffness matrix - Eigen value and Eigen vector – Orthogonal properties - Modal matrix - Modal analysis - Forced vibration by matrix inversion - Modal damping in forced vibration - Numerical methods of fundamental frequencies.

UNIT IV: VIBRATION OF CONTINUOUS SYSTEMS

12 Hrs

Systems governed by wave equations - Vibration of strings - Vibration of rods - Euler 's equation for beams - Effect of Rotary inertia and shear deformation - Vibration of plates.

UNIT V: EXPERIMENTAL METHODS IN VIBRATION ANALYSIS

12 Hrs

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

Total No. of Hrs : 60

REFERENCES

1. Rao, J. S., & Gupta K (1984)"*Ind. Course on Theory and Practice Mechanical Vibration*", NewAge International (P) Ltd.
2. Thomson, W.T (1990)"*Theory of Vibration with Applications*" CBS Publishers and Distributers, NewDelhi,
3. Den Hartog. J.P (1990) "*Mechanical Vibrations*",Dover Publications.
4. Rao, S.S (1995)"*Mechanical Vibrations*", Addison Wesley Longman.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13D012 DESIGN OF MATERIAL HANDLING EQUIPMENTS 3 1 0 4

OBJECTIVE: At the end of this course the student will learn

- Design of different types of material handling systems used for engineering and process industries

UNIT I: INTRODUCTION TO MATERIALS HANDLING EQUIPMENT 12 Hrs

Overview-consideration in material handling system design, ten principles of material handling. Types of material handling equipments-trolleys, industrial trucks, AGV, monorails and other rail guided vehicles, conveyors, cranes, hoists and elevators.

UNIT II: DESIGN OF HOISTS 12 Hrs

Design of hoisting elements: Welded and roller chains - Hemp and wire ropes - Design of ropes, pulleys, pulley systems, sprockets and drums, Load handling attachments. Design of forged hooks and eye hooks – crane grabs - lifting magnets - Grabbing attachments - Design of arresting gear - Brakes: shoe, band and cone types.

UNIT III: DRIVES OF HOISTING GEAR 12 Hrs

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

UNIT IV: CONVEYORS 12 Hrs

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

UNIT V: ELEVATORS 12 Hrs

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

Total No. of Hrs : 60

***NOTE:** Use of Approved Data Book is permitted

REFERENCES

1. Rudenko.N (1970) “*Materials handling equipment*”, ELNvee Publishers.
2. Mikell.P.Groover (2006) “*Automation, Production system and computer integrated manufacturing ,second edition*”,Prentice Hall of India Pvt Ltd.
3. Alexandrov.M (1981) “*Materials Handling Equipments*”, MIR Publishers.
4. Boltzharol. A (1958) “*Materials Handling Handbook*”, The Ronald Press Company.
5. P.S.G. Tech (2003)“*Design Data Book*”, Kalaikathir Achchagam, Coimbatore.
6. Lingaiah. K and Narayana Iyengar (1983)“*Machine Design Data Hand Book*”, Vol.1 & 2, Suma Publishers, Bangalore.
7. Spivakovsy, A.O and Dyachkov, V.K (1985) “ *Conveying Machines*”, Volumes I and II, MIR Publishers.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13CE01

DESIGN OF MECHANICAL DRIVES

3 1 0 4

OBJECTIVE: At the end of this course the student will learn

- Concepts and analysis using computers for various mechanical elements design

UNIT I: INTRODUCTION

12 Hrs

Phases of design - Standardization and interchangeability of machine elements - Tolerances from process and function - Individual and group tolerances - Selection of fits for different design situations - Design for assembly and modular constructions - Concepts of integration.

UNIT II: SHAFTING

12 Hrs

Analysis and design of shafts for different applications - detailed design - preparation of production drawings - Integrated design of shaft, bearing and casing - Design for rigidity.

UNIT III: GEARS

12 Hrs

Principles of gear tooth action - Gear correction - Gear tooth failure modes - Stresses and loads – Component design of spur, helical, bevel and worm gears - Design for sub assembly .

UNIT IV: GEAR BOX

12 Hrs

Integrated design of speed reducers and multispeed gear boxes - application of software packages.

UNIT V: CLUTCHES & BRAKES

12 Hrs

Integrated design of automobile clutches and over running clutches. Dynamic and thermal aspects of vehicle braking - Integrated design of brakes for machine tools, automobiles and mechanical handling equipments.

Total No. of Hrs : 60

REFERENCES

1. Newcomb.T.P. and Spur.R.T (1975)"*Automobile brakes ad braking systems*", Chapman and Hall 2nd Edition.
2. Juvinall. R.L.C (1983)"*Fundamentals of Machine Component Design*", John Wiley.
3. Maitra. G.M (1985) "*Hand Book for Gear Design*", Tata McGraw Hill .
4. Shigley . J.E (1986)"*Mechanical Engineering Design* ", Tata McGraw Hill.
5. <http://www.agma.org/>



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13CE02

DATA COMMUNICATION IN CAD/CAM

3 0 0 3

OBJECTIVE: At the end of this course the student will learn

- Usage of computers for communication of data related to CAD/CAM

UNIT I: DIGITAL COMPUTERS & MICRO PROCESSORS

8 Hrs

Block diagram - register transfer language - arithmetic, logic and shift micro operations - instruction code - training and control instruction cycle - I/O and interrupt design of basic computer., Machine language - assembly language - assembler. Registers ALU and Bus Systems - timing and control signals - machine cycle and timing diagram - functional block diagrams of 80 x 86 and modes of operation. Features of Pentium Processors.

UNIT II: OPERATING SYSTEM & ENVIRONMENTS

9 Hrs

Types - functions - UNIX & WINDOWS NT - Architecture - Graphical User Interfaces.
Compilers - Analysis of the Source program - the phases of a compiler - cousins of the compiler, the grouping of phases - compiler construction tools.

UNIT III: COMMUNICATION MODEL

10 Hrs

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.

UNIT IV: COMPUTER NETWORKS

10 Hrs

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

UNIT V: INTERNET

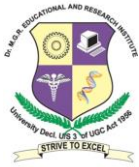
8 Hrs

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

Total No. of Hrs : 45

REFERENCES

1. Morris Mano. M (1996) "*Computer System Architecture*", Prentice Hall of India.
2. Gaonkar R.S (1997) "*Microprocessor Architecture, Programming and Applications of 8085*", Penram International.
2. Peterson J.L, Galvin P. and Silberschaz. A (1997) "*Operating Systems Concepts*", Addison Wesley.
3. Alfred V. Aho, Ravi Setjhi, Jeffrey D Ullman (1986)"*Compilers Principles Techniques and Tools*", Addison Wesley.
4. William Stallings (1997)"*Data of Computer Communications*" Prentice Hall of India.
5. Andrew S. Tanenbaum (1996) "*Computer Networks*", Prentice Hall of India 3rd Edition.
6. Christian Crumlish (1996) "The ABC's of the Internet", BPB Publication.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13CE03 MANUFACTURING SYSTEM AND SIMULATION 3 0 0 3

OBJECTIVE: The student will learn

- To model and simulate the manufacturing systems

UNIT I: COMPUTER MODELING AND SIMULATION SYSTEMS 8 Hrs

Monte Carlo simulation, Nature of computer modeling and simulation. Limitation of simulation, areas of application. Components of a system - discrete and continuous systems. Models of a system - a variety of modeling approaches

UNIT II: RANDOM NUMBER GENERATION 10 Hrs

Techniques for generating random numbers - midsquare method - the mid product method – constant multiplier technique - additive congruential method - linear congruential method - tests for random numbers - the Kolmogorov - Smirnov test - the Chi-Square test.

UNIT III: RANDOM VARIABLE GENERATION 8 Hrs

Inverse transform technique - exponential distribution - uniform distribution - Weibull distribution. Empirical continuous distribution - generating approximate normal variates - Erlang distribution.

UNIT IV: DISTRIBUTION AND EVALUATION OF EXPERIMENTS 10 Hrs

1Discrete uniform distribution - Poisson distribution - geometric distribution - acceptance rejection technique for Poisson distribution gamma distribution. Simulation Experiments - Variance reduction techniques - antithetic variables - verification and validation of simulation models. Variance reduction techniques - antithetic variables - verification and validation of simulation models.

UNIT V: DISCRETE EVENT SIMULATION 9 Hrs

Concepts in discrete-event simulation, manual simulation using event scheduling, single channel queue, two server queue, simulation of inventory problem. Programming for discrete event systems in GPSS - Case studies.

Total No. of Hrs : 45

REFERENCES

1. Jerry Banks and John S. Carson, II (1984) "*Discrete Event System Simulation*", Prentice Hall Inc.
2. Gordon .G (1991) "*Systems Simulation*", Pentice Hall of India Ltd.
3. Narsing Deo (1979) "*System Simulation with Digital Computer*", Prentice Hall of India.
4. Francis Neelamkovil (1987) "*Computer Simulation and Modelling*", John Wiley & Sons.
5. Ruth .M. Davis and Robert M.O' Keefe (1989) "*Simulation Modelling with Pascal*", Prentice Hall, Inc.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13CE04 **PERFORMANCE MODELLING AND ANALYSIS OF** **3 0 0 3**
MANUFACTURING SYSTEM

OBJECTIVE: The student will learn

- Modeling and analyzing the manufacturing systems for its performance

UNIT I: MANUFACTURING SYSTEMS & CONTROL **10 Hrs**

Automated Manufacturing Systems - Modelling - Role of performance modelling - simulation models- Analytical models. Product cycle - Manufacturing automation - Economics of scale and scope - input/output model – plant configurations. Performance measures - Manufacturing lead time - Work in process -Machine utilization - Throughput - Capacity - Flexibility - performability - Quality. Control Systems - Control system architecture - Factory communications - Local area networks - Factory networks - Open systems interconnection model - Net work to network interconnections – Manufacturing automation protocol - Database management system.

UNIT II: MANUFACTURING PROCESSES **10 Hrs**

Examples of stochastic processes - Poisson process Discrete time Markov chain models - Definition and notation - Sojourn times in states - Examples of DTMCs in manufacturing - Chapman - Kolmogorov equation - Steady-state analysis. Continuous Time Markov Chain Models - Definitions and notation - Sojourn times in states - examples of CTMCs in manufacturing - Equations for CTMC evolution - Markov model of a transfer line. Birth and Death Processes in Manufacturing - Steady state analysis of BD Processes - Typical BD processes in manufacturing.

UNIT III: QUEUING MODELS **8 Hrs**

Notation for queues - Examples of queues in manufacturing systems - Performance measures - Little's result - Steady state analysis of M/M/m queue, queues with general distributions and queues with breakdowns - Analysis of a flexible machine center.

UNIT IV: QUEUING NETWORKS **8 Hrs**

Examples of QN models in manufacturing - Little's law in queuing networks - Tandem queue - An open queuing network with feedback - An open central server model for FMS - Closed transfer line - Closed server model - Garden Newell networks.

UNIT V: PETRI NETS **9 Hrs**

Classical Petri Nets - Definitions - Transition firing and reachability - Representational power - properties - Manufacturing models. Stochastic Petri Nets - Exponential timed Petri Nets - Generalized Stochastic Petri Nets - modelling of KANBAN systems - Manufacturing models.

Total No. of Hrs : 45

REFERENCES

1. Viswanadham. N and Narahari. Y (1994) "*Performance Modelling of Automated Manufacturing Systems*", Prentice Hall of India, New Delhi.
2. Trivedi, K.S (1982) "*Probability and Statistics with Reliability, Queuing and Computer Science Applications*", Prentice Hall, New Jersey.
3. Gupta S.C & Kapoor V.K (1988) "*Fundamentals of Mathematical Statistics*", 3rd Edition, Sultan Chand and Sons, New Delhi.



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13CE05

APPLIED MATERIALS ENGINEERING

3 0 0 3

OBJECTIVE: The student will learn

- Different types of materials and their behaviours under various types of loads

UNIT I: ELASTIC AND PLASTIC BEHAVIOUR

10 Hrs

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

UNIT II: FRACTURE BEHAVIOUR

10 Hrs

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

UNIT III: SELECTION OF MATERIALS

10 Hrs

Motivation for selection, cost basis and service requirements - Selection for mechanical properties, strength, toughness, fatigue and creep - Selection for surface durability corrosion and wear resistance - Relationship between materials selection and processing - Case studies in materials selection with relevance to aero, auto, marine, machinery and nuclear applications.

UNIT IV: MODERN METALLIC MATERIALS

8 Hrs

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.

UNIT V: NON METALLIC MATERIALS

7 Hrs

Polymeric materials - Formation of polymer structure - Production techniques of fibers, foams, adhesives and coatings - Structure, properties and applications of engineering polymers - Advanced Structural ceramics, WC, TiC, TaC, Al₂O₃, SiC, Si₃N₄, CBN and diamond - properties, processing and applications.

Total No. of Hrs : 45

REFERENCES

1. Thomas H.Courtney (2000) "*Mechanical Behaviour of Materials*", (2nd Edition), McGraw Hill.
2. Charles J.A., Crane, F.A.A and Furness. J.A.G (1977) "*Selection and use of Engineering Materials*", (3rd Edition), Butterworth-Heinemann.
3. Flinn, R.A. and Trojan. P.K (1999) "*Engineering Materials and their Applications*", (4th Edition), Jaico.
4. George E.Dieter (1988) "*Mechanical Metallurgy*", McGraw Hill.
5. Metals Hand Book (1994) "*Failure Analysis and Prevention*", Vol 10, (10th Edition) .



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13CE06 FLEXIBLE COMPETITIVE MANUFACTURING SYSTEM 3 0 0 3

OBJECTIVE: The student will learn

- Techniques and methods of competitive manufacturing systems

UNIT I: MANUFACTURING IN A COMPETITIVE ENVIRONMENT 9 Hrs

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

UNIT II: GROUP TECHNOLOGY 9 Hrs

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

UNIT III: FLEXIBLE MANUFACTURING SYSTEMS 9 Hrs

Introduction - Components of FMS - application work stations - Computer control and functions - Planning, scheduling and control of FMS - Scheduling - knowledge based scheduling - Hierarchy of computer control - Supervisory Computer.

UNIT IV: COMPUTER SOFTWARE, SIMULATION AND DATABASE OF FMS 9 Hrs

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

UNIT V: COMPETITIVE MANUFACTURING 9 Hrs

Characteristics of JIT - Pull method - quality -small lot sizes - work station loads - close supplier ties – flexible work force - line flow strategy - TPM - Kanban system - strategic implications - implementation issues - MRD JIT – Six sigma ,Lean and agile Manufacturing.

Total No. of Hrs : 45

REFERENCES

1. Groover M.P (1996) "*Automation, Production systems and Computer Integrated Manufacturing*", Prentice-Hall of India Pvt.Ltd., New Delhi .
2. Jha . N.K (1991) "*Handbook of Flexible Manufacturing Systems*", Academic Press Inc.
3. Kalpakjian (1995) "*Manufacturing Engineering and Technology*", Addison-Wesley Publishing Co.
4. Taiichi Ohno, Toyota (1992) "*Production System Beyond Large-Scale Production*", Productivity Press India Pvt.Ltd.
5. <http://www.engineeringtalk.com/news/lvd103.htm>



Dr.M.G.R.
EDUCATIONAL AND RESEARCH INSTITUTE
UNIVERSITY
(Decl. U/S 3 of UGC Act 1956)
DEPARTMENT OF MECHANICAL ENGINEERING

MME13CE08

CONCURRENT ENGINEERING

3 0 0 3

OBJECTIVE: The student will learn

- Concepts and analysis of latest method of manufacturing systems

UNIT I: INTRODUCTION

5 Hrs

Extensive definition of CE - CE design methodologies - Organizing for CE - CE tool box collaborative product development

UNIT II: USE OF INFORMATION TECHNOLOGY

10 Hrs

IT support - Solid modeling - Product data management - Collaborative product commerce – Artificial Intelligence - Expert systems - Software hardware co-design.

UNIT III: DESIGN STAGE

10 Hrs

Life-cycle design of products - opportunity for manufacturing enterprises - modality of Concurrent Engineering Design - Automated analysis idealization control - Concurrent engineering in optimal structural design - Real time constraints.

UNIT IV: MANUFACTURING CONCEPTS AND ANALYSIS

10 Hrs

Manufacturing competitiveness - Checking the design process - conceptual design mechanism – Qualitative physical approach - An intelligent design for manufacturing system - JIT system - low inventory - modular - Modeling and reasoning for computer based assembly planning - Design of Automated manufacturing.

UNIT V: PROJECT MANAGEMENT

10 Hrs

Life Cycle semi realization - design for economics - evaluation of design for manufacturing cost – concurrent mechanical design - decomposition in concurrent design - negotiation in concurrent engineering design studies - product realization taxonomy - plan for Project Management on new product development – bottleneck technology development- Case Studies

Total No. of Hrs : 45

REFERENCES

1. Anderson MM and Hein. L. Berlin (1987) "*Integrated Product Development*", Springer Verlag.
2. Cleetus. J (1992) "*Design for Concurrent Engineering*", Concurrent Engg. Research Centre, Morgantown, WV.
3. Andrew Kusaik (1992) "*Concurrent Engineering: Automation Tools and Technology*", Wiley, John and Sons Inc.
4. Prasad (1996)"*Concurrent Engineering Fundamentals: Integrated Product Development*", Prentice Hall.
5. Sammy G Sinha (1998) "Successful Implementation of Concurrent Product and Process", Wiley, John and Sons Inc.
6. www.tm.tue.nl/race/ce/ce95.html