VINAYAKA MISSIONS UNIVERSITY: SALEM

VINAYAKA MISSIONS KIRUPANANDA VARIYAR ENGINEERING COLLEGE,

SALEM & AARUPADAI VEEDU INSTITUTE OF TECHNOLOGY, CHENNAI

REGULATIONS - 2015

CURRICULUM AND SYLLABUS – FULL TIME

M.E. COMPUTER AIDED DESIGN

SEMESTER I

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
THEORY							
1		ADVANCED ENGINEERING MATHEMATICS	MATHS	3	1	0	4
2		COMPUTER AIDED DESIGN AND MANUFACTURING	MECH	3	0	0	3
3		FINITE ELEMENT METHODS	MECH	3	1	0	4
4		MECHANICAL BEHAVIOR OF ENGINEERING MATERIALS	MECH	3	0	0	3
5		INTEGRATED MECHANICAL DESIGN	MECH	3	1	0	4
6		ELECTIVE – I	MECH	3	0	0	3
PRACTICAL							
7		MECHANICAL COMPONENTS MODELING LAB	MECH	0	0	3	**2**
TOTAL				**18**	**3**	**3**	**23**

SEMESTER II

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
THEORY							
1		OPTIMIZATION TECHNIQUES	MATHS	3	1	0	4
2		PRODUCT DESIGN	MECH	3	0	0	3
3		MECHANICAL VIBRATIONS	MECH	3	1	0	4
4		ADVANCED STRENGTH OF MATERIALS	MECH	3	1	0	4
5		ELECTIVE - II	MECH	3	0	0	3
6		ELECTIVE - III	MECH	3	0	0	3
PRACTICAL							
7		ANALYSIS & SIMULATION LAB	MECH	0	0	3	**2**
TOTAL				**18**	**3**	**3**	**23**

SEMESTER III

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
THEORY							
1		ELECTIVE- IV	MECH	3	0	0	3
2		ELECTIVE -V	MECH	3	0	0	3
3		ELECTIVE- VI	MECH	3	0	0	3
PRACTICAL							
		PROJECT PHASE- I	MECH	0	0	12	6
TOTAL				9	0	12	**15**

SEMESTER IV

SL.NO	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
PRACTICAL							
1		PROJECT PHASE- II	MECH	0	0	24	12
TOTAL				**0**	**0**	**24**	**12**

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 73

LIST OF ELECTIVES

SL. No	COURSE CODE	COURSE TITLE	DEPT	L	T	P	C
1		INTEGRATED MANUFACTURING SYSTEMS	MECH	3	0	0	3
2		RAPID PROTOTYPING AND TOOLING	MECH	3	0	0	3
3		INDUSTRIAL ROBOTICS AND PROGRAMMING	MECH	3	0	0	3
4		MANUFACTURING INFORMATION SYSTEMS	MECH	3	0	0	3
5		COMPUTATIONAL FLUID DYNAMICS	MECH	3	0	0	3
6		ADVANCED MACHINE TOOL DESIGN	MECH	3	0	0	3
7		CONCURRENT ENGINEERING	MECH	3	0	0	3
8		COMPOSITE MATERIALS AND MECHANICS	MECH	3	0	0	3
9		TRIBOLOGY IN DESIGN	MECH	3	0	0	3
10		REVERSE ENGINEERING	MECH	3	0	0	3
11		DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS	MECH	3	0	0	3
12		DESIGN OF MATERIAL HANDLING EQUIPMENT	MECH	3	0	0	3
13		ADVANCED MACHINE TOOL DESIGN	MECH	3	0	0	3

ADVANCED ENGINEERING MATHEMATICS

L	T	P	C
3	1	0	4

UNIT – I CALCULUS OF VARIATIONS **12**

Concept of variation and its properties- Euler's Equation-Functional dependant on first and higher order derivatives - Functional dependant on functions of several independent variables- Isoperimetric problems – Direct methods-Ritz and Kantrovich methods

UNIT – II TRANSFORM METHODS **12**

Laplace transform methods for one dimensional wave equation – Displacements in a long string – Longitudinal vibration of an elastic bar - Fourier Transform methods for one dimensional heat conduction problems in infinite and semi-infinite rod

UNIT – III ELLIPTIC EQUATIONS **12**

Laplace equation – Properties of Harmonic functions – Solutions of Laplace equation by means of Fourier transform in a half plane in an infinite strip and in a semi-infinite strip

UNIT – IV N UMERICAL SOLUTION OF PARTIALDIFFERENTIAL EQUATIONS **12**

Solution of Laplace and Poisson equation on a rectangular region by Lieebmann's method – Diffusion equation by the explicit and Crank Nicolson – Implicit methods – Solution of wave equations by explicit scheme Cubic spline interpolation

UNIT – V CONFORMAL MAPPING AND APPLICATIONS **12**

The Schwarz – Christoffel transformation – Transformation of boundaries in parametric form Physical applications - Application to fluid and heat flow

TOTAL: 60 PERIODS

Dr.K.G.Muthurajan Dr.M.Venkataraman Prof.J.Senthil Prof.G.Nagarajan

Prof.N.Rajan Prof.J.Sathees babu

REFERENCE BOOKS

1. Gupta, A.S. – Calculus of Variations with Applications, Prentice Hall of India(P) Ltd.,New Delhi, 6th print, 2006

2. Sankara Rao, .K. – Introduction to Partial Differential Equations, Prentice Hall of India(P) Ltd., New Delhi, 5th print, 2004

3. Jain.R.K, Iyengar.S.R.K. - Advanced Engineering Mathematics, Narosa publications 2nd Edition, 2006

4. Grewal, B.S – Numerical Methods in Science and Engineering, Kanna Publications, New Delhi.

5. Kandasamy.P , Thilagavathy. K and Gunavathy, K – Numerical Methods, S Chand and Co., Ltd., New Delhi, 5th Edition, 2007

6. Spiegel , M. R – Theory and problems of Complex Variables with an Introduction to Conformal Mapping and Its applications, Schaum's outline series, Mc Graw Hill Book Co., 1987.

Dr.K.G.Muthurajan Dr.M.Venkataraman Prof.J.Senthil Prof.G.Nagarajan

Prof.N.Rajan Prof.J.Sathees babu

COMPUTER AIDED DESIGN AND MANUFACTURING

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION TO CAD/CAM 9

Basic concepts of CAD – principles of computer graphics – graphics programming – mechanical drafting package.Advanced modeling techniques – surface modeling – solid modeling, rendering methods. CAD/CAM data basedevelopment and data base management systems. Computer aided manufacturing, programming and interface hardware– computer aided process monitoring – adaptive control, on-line search strategies.

UNIT II TWO DIMENSIONAL AND THREE DIMENSIONAL TRANSFROMATIONS 9

2D – Representation and Transformation of Points – Transformation of Lines –Rotation, Reflection, Scaling andcombined transformations – 3D-scaling – shearing – Rotation – Reflection – Translation – Projections parametricrepresentation of Ellipse, Parabola, Hyperbola.

UNIT III COMPUTER AIDED DRAFTING 9

Graphic software: coordinate representation- graphic functions, software standards. Graphical Kernal system(GKS)-Initial graphics exchange system (IGES)- Graphic packages. Use of interactive drafting packages like AutoCAD.Geometry generators, size generators, geometry modifiers, construction or Mechanical drawing using graphics tablet,revision or modifier methods, preservation procedures, additional geometry generators, CAD- exclusive tasks-creation of drawings of simple components.

UNIT IV COMPUTER AIDED MANUFACTURING 9

Principles of optimum design – CAD optimization techniques, Application of CAD – computer-aided process planning – post processing – NC code generation – principles of computer aided engineering and concurrent engineering.

UNIT V PRODUCTION PLANNING AND SHOP FLOOR CONTROL 9

Production systems at the operation level – computer generated time standards – machinability data systems - cutting conditions optimization – production planning – capacity planning – shop floor control – computer integratedmanufacturing systems, application.

Total: 45 PERIODS

REFERENCE BOOKS:

1. Groover, M. P., “Automation, Production Systems and Computer Integrated Manufacturing”, Prentice Hall, 2007.

2. Radhakrishnan, P.,Subramanyan, S., Raju,V., “CAD/CAM/CIM”, New Age International Publishers(P) Ltd., 2006.

3. Rao, P.N., “CAD/CAM principles and applications” Tata McGraw Hill, 2002.

4. Hearn, Donald and Pauline Baker, M., “computer Graphics", Prentice Hall 1986

FINITE ELEMENT METHODS

L T P C
3 1 0 4

UNIT I - INTRODUCTION **9**

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

UNIT II - BASIC ELEMENTS **9**

Interpolation and shape functions - element matrices-linear triangular elements (CST)- quadratic triangular elements – bilinear rectangular elements-quadratic rectangular elements-solidelements-higher order elements-nodal loads-stress calculations-example problems.

UNIT III - ISOPARAMETRIC ELEMENTS **9**

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

UNIT IV - FINITE ELEMENTS IN STRUCTURAL DYNAMICS APLICATIONS **9**

Dynamic equations – mass and damping matrices – natural frequencies and modes – damping – reduction of number of degrees-of-freedom-response history – model methods – Ritz vectors – component mode synthesis – harmonic response – direct integration techniques – explicit and implicit methods – analysis by response spectra – example problems.

UNIT V - HEAT TRANSFER AND FLUID MECHANICS APLICATIONS **9**

Heat transfer – element formulation – radiation-nonlinear problems-transient thermal nalysisacousticfrequencies and modes-fluid structure interaction problems-plane incompressible and rotational flows-example problems.

Tutorial: 15, Period: 45, Total: 60 PERIODS

TEXT BOOK:

1. Cook, Robert Davis et al “Concepts and Applications of Finite Element Analysis”, John Wiley & Sons, 1999.

REFERENCES:

1. Reddy J.N. An Introduction to the Finite Element Method, McGraw Hill, International Edition, 1993.

2. Segerlind L.J., "Applied Finite Element Analysis", John Wiley & Sons, 1984

3. Chandrupatla & Belagundu, "Finite Elements in Engineering", Prentice Hall of India Private Ltd., 1997.

4. George R Buchaman , " Schaum's Outline of Finite Element Analysis", McGraw Hill Company 1994.

5. S.S.Rao, Finite Element Analysis, 2002 Edition

MECHANICAL BEHAVIOR OF ENGINEERING MATERIALS

L T P C
3 0 0 3

UNIT I STRUCTURE OF SOLID MATERIAL & MECHANICAL BEHAVIOUR 9

Structure of metals: Point, line and surface imperfection, relationship between structure and properties. Mechanical properties: Strength, hardness, toughness, ductility, stress-strain relationship, strains, true strains, strain hardening.

UNIT II STATIC MECHANICAL BEHAVIOUR FOR MULTIAXIAL STRESSES 9

Stresses, Strains and Strain Energy for Combined Stresses, Theories of Strength, Application to Design

UNIT III FATIGUE BEHAVIOR 9

Introduction to fatigue phenomenon - characteristics of fatigue failure - theories of fatigue failure. Fatigue testingmachines, specimens, test procedures, method of presenting data, statistical analysis of fatigue results, factors affecting fatigue strength. Low cycle fatigue phenomenon, difference between low high cycle fatigues, parameters influencing low cycle fatigue behavior. Cumulative fatigue damage, Effect of mean stress, Combined stress fatigue, Studies incurrent trends in fatigue testing.

UNIT IV CREEP 9

Parameters influencing creep, creep in tension in detail, qualitative study of creep in bending, torsion, bucklingand combined stress.

UNIT V FRACTURE 9

Linear elastic fracture mechanics, Griffith theory, Irwin- Orowan theory, different modes of crack extension, conceptof stress intensity factor, analysis of some typical crack problems, non-linear fracture on crack extension, concept ofmodified stress intensity factor, crack opening displacement and J- integrals.

Total: 45 PERIODS

Dr.K.G.Muthurajan Dr.M.Venkataraman Prof.J.Senthil Prof.G.Nagarajan

Prof.N.Rajan Prof.J.Sathees babu

REFERENCE BOOKS:

1. Joseph Marin. “Mechanical behavior of engineering materials”, prentice – Hall of India pvt,Ltd., 1966.

2. Kennedy, A.J., “Process of Creep and Fatigue of Metals”, Industrial Press,1958.

3. Forrest, P.G., “Fatigue of Metals“, Pregaman Pross, 1961.

4. Knott, J.F., “Fundamentals of fracture mechanics “, Worths, 1979.

5. Parton, V.Z., and Morozor, E.M., “Elastic Plastic fracture Mechanics”, MIR Publishers, Moscow, 1978

6. Williams, J. G., “Fracture Mechanics of Polymers”, Ellis Horwood, 1984

7. ATKINS,A.G and MAI,Y.W., “Elastic and Plastic Fracture – Metals, Polymers, Ceramics, Composites, Biological Materials”, Elli s
Horwood, 1985

INTEGRATED MECHANICAL DESIGN

L	T	P	C
3	0	0	3

UNIT I - INTRODUCTION 6

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 8

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 AND GEAR BOXES 12

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

UNIT IV - CLUTC HES 9

Integrated design of automobile clutches and over running clutches.

UNIT V - BRAKES 10

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

Total: 45 PERIODS

REFERENCES:

1. Newcomb, T.P. and Spur, R.T., “Automobile Brakes and Braking Systems”, Chapman and Hall, 2nd Edition, 1975.
2. Juvinall, RL.C., “Fundamentals of Machine Component Design”, John Wiley, 1983.
M.E. Computer Aided Design 17
3. Maitra G.M., “Hand Book of Gear Design”, Tata McGraw Hill, 1985.
4. Shigley, J.E., “Mechanical Engineering Design”, McGraw Hill, 1986.
5. Tech. P.S.G., “Design Data Book”, Kalaikathir Achchagam, Coimbatore, 2003.
6. Lingaiah. K. and Narayana Iyengar, “Machine Design Data Hand Book”, Vol. 1 & 2, Suma Publishers, Bangalore, 1983

WEB REFERENCES:

1. http://agma.org/

MECHANICAL COMPONENTS MODELING LAB 0 0 3 2

Exercises will be given on modeling of mechanical components using packages like, Pro/ENGINEER, Solid Works, CATIA, Inventor etc.

1. 3D Modeling of Mechanical Components

Using packages like AutoCAD, Pro-E Solid Works etc..

2. Assembly Drawings

(a) Flange Coupling, Universal Coupling (b) Gib and Cotter Joint (c) Sleeve and cotter Joint (d) Knuckle joint (e) Plummer Block (f) Screw Jack (g) Machine Vice (h) Bench vice (i) Connecting Rod

OPTIMIZATION TECHNIQUES

L T P C
3 1 0 4

UNIT I INTRODUCTION TO OPTIMIZATION 9

Formulation of an optimization problem- Classification of optimization problem – optimization techniques- Classical optimization technique – Single variable optimization – Multi variable optimization algorithms

UNIT II MINIMIZATION METHODS 9

One dimensional minimization methods: unimodal function – elimination methods: unrestricted search, exhaustive search, Dichotomous search, Fibonacci methods, Golden section methods, Interpolation methods: Quadratic and cubic interpolation methods.

UNIT III CONSTRAINED OPTIMIZATION TECHNIQUES 9

Optimization with equality and inequality constraints - Direct methods – Indirect methods using penalty functions, Lagrange multipliers - separable programming and Geometric programming

UNIT IV UNCONSTRAINED OPTIMIZATION TECHNIQUES 9

Multi variable unconstrained optimization techniques: Direct search methods: Random search method, univariate method, pattern search method, steepest descent method and Conjugate gradient method.

UNIT V APPLICATIONS OF HEURISTICS IN OPTIMIZATION 9

Heuristics-Introduction-Multi objective optimization: Genetic algorithms and Simulated Annealing techniques; Neural network & Fuzzy logic principles in optimization.

Tutorial: 15, Period: 45, Total: 60 PERIODS

REFERENCE BOOKS

1. Rao, Singaresu, S., “Engineering Optimization – Theory & Practice”, New Age International (P) Limited, New Delhi, 2000.

2. Johnson Ray, C., “Optimum design of mechanical elements”, Wiley, John & Sons, 1990.

3. Kalyanamoy Deb, “Optimization for Engineering design algorithms and Examples”, Prentice Hall of India Pvt. 1995.

4. Goldberg, D.E., “Genetic algorithms in search, optimization and machine”, Barnen, Addison-Wesley, New York, 1989.

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PRODUCT DESIGN

L T P C
3 0 0 3

UNIT I DESIGN FUNDAMENTALS 9

Importance of design- The design process-Considerations of Good Design – Morphology of Design – Organizationfor design– Computer Aided Engineering – Designing to codes and standards – Concurrent Engineering – Productand process cycles – Technological Forecasting – Market Identification – Competetive Bench Marking.

UNIT II CUSTOMER ORIENTED DESIGN & SOCIETAL CONSIDERATIONS 9

Identification of customer needs- customer requirements- Quality Function Deployment- Product DesignSpecifications- Human Factors in Design – Ergonomics and Aesthetics. Societal consideration - Contracts – Productliability – Protecting intellectual property – Legal and ethical domains – Codes of ethics - Ethical conflicts – Environmentresponsible design-future trends in interaction of engineering with society.

UNIT III DESIGN METHODS 9

Creativity and Problem Solving –Creativity methods-Theory of Inventive Problem Solving(TRIZ)– Conceptualdecomposition-Generating design concepts-Axiomatic Design – Evaluation methods-Embodiment Design-ProductArchitecture-Configuration Design- Parametric Design. Role of models in design-Mathematical Modeling – Simulation –Geometric Modeling –Rapid prototyping- Finite Element Analysis– Optimization – Search Methods.

UNIT IV SELECTION of MATERIAL, PROCESSING AND DESIGN 9

Material Selection Process – Economics – Cost Vs Performance – Weighted property Index – Value Analysis– Role of Processing in Design – Classification of Manufacturing Process – Design for Manufacture – Design forAssembly –Designing for castings, Forging, Metal Forming, Machining and Welding – Residual Stresses – Fatigue,Fracture and Failure.

UNIT V PROBABILITY CONCEPTS IN DESIGN FOR RELIABILITY 9

Probability – Distributions – Test of Hypothesis – Design of Experiments – Reliability Theory – Design forReliability – Reliability centered Maintenance-Robust Design-Failure mode Effect Analysis.

Total: 45 PERIODS

TEXT BOOK:

1. Dieter, George E., “Engineering Design – A Materials and Processing Approach”, McGraw Hill International Edition, Singapore, 2000.

REFERENCE BOOKS:

1. Pahl, G, and Beitz, W.,” Engineering Design”, Springer – Verlag, NY. 1984.
2. Ray, M.S., “Elements of Engg. Design”, Prentice Hall Inc. 1985.
3. Suh, N.P., “The principles of Design”, Oxford University Press, NY.1990.
4. Karl T. Ulrich and Steven D. Eppinger “Product Design and Development” McGraw Hill Edition 2000.

MECHANICAL VIBRATIONS

L T P C
3 1 0 4

UNIT I SINGLE DEGREE OF FREEDOM SYSTEM 9

Introduction – Equation of motion: Newton's laws of motion – Frequency and periodic Vibration – Forced vibration– Damping – resonance. Solution of Problems by Digital Computer for one degree of freedom System for Transientand Harmonic Response, Solution by Energy method: Rayleigh's method. Applications: Measurement of Damping,Isolation of vibrations and Transmissibility, Seismic Instruments.

UNIT II TWO DEGREES OF FREEDOM SYSTEM 9

Two degrees of freedom systems: Translational & Torsional Systems, Positive & Semi definite systems: Equationsof motion: Newton's Law, Influence coefficients, Conservation of Energy, Lagrange's Equation Methods & Generalizedcoordinates.Free Vibration:Frequencies, Modes of Vibration, Principal modes, Orthogonal Property of Modes. Solutionfor Initial Conditions. Forced Vibration: Application: Dynamic vibration absorber.

UNIT III SEVERAL DEGREES OF FREEDOM SYSTEM 9

Three and four degrees of freedom systems: Translational & Torsional Systems
Methods of finding natural frequencies:: Exact method & Limitations. Approximate Methods: Matrix iteration,Stodola's, Holzer's, Rayleigh's and Dunkerley's methods. Solution of problem by Digital Computers for multi degreeof freedom systems for free and forced (Harmonic) Response.

UNIT IV CRITICAL SPEEDS OF SHAFTS 9

Fundamental and higher order critical speeds, Solution using different methods and also by digital computers

UNIT V VIBRATION OF CONTINUOS SYSTEMS 9

Longitudinal and Lateral vibration of Bars, with different geometric and force boundary conditions. Free andforced (Harmonic) responses. Frequencies - Amplitudes for given Initial conditions. Mode shapes and Orthogonal property of normal modes. Semi definite conditions & rigid body motions. Vibration of strings and membranes. Qualitative
study of vibration of plates.

Tutorial: 15, Period: 45, Total: 60 PERIODS

Dr.K.G.Muthurajan Dr.M.Venkataraman Prof.J.Senthil Prof.G.Nagarajan

Prof.N.Rajan Prof.J.Sathees babu

REFERENCE BOOKS:

1. Tse, Francis,S., Morse, Ivan, E., Hinkle, Rolland, T., "Mechanical Vibrations", CBS Publishing and Distributors, 1983.

2. William, W.Seto," Mechanical Vibrations", Schaum Publishing Company, 1964.

3. Thompson, W.T., "Theory of Vibrations with applications", Prentice Hall of India, 1972.

4. Den Hartog," Mechanical Vibrations", McGraw Hill.

5. Srinivasan,P., "Mechanical Vibration Analysis", Tata Mc Graw Hill Publishing Company Ltd., 1982.

6. Grover, "Mechanical Vibrations", Nem Chad & Bros, 1996.

ADVANCED STRENGTH OF MATERIALS

L T P C
3 1 0 4

UNIT I ELASTICITY **9**

Stress-Strain relations and general equations of elasticity in Cartesian coordinates Differential equations of equilibrium- Compatibility-boundary conditions- representation of 3-dimensional stress of a tensor- Generalized Hook's law-St.Venant's principle-plane strain – plain stress- Airy's Stress function.

UNIT II SHEAR CENTRE **9**

Location of Shear centre for various sections- Shear flow.Unsymmetrical Bending: Stresses and deflections in beams subjected to unsymmetrical loading- Kern of a section.

UNIT III CURVED FLEXURAL MEMBERS **9**

Circumferential and radial stresses-deflections of curved beam with restrained ends- closed ring subjected to concentrated load and uniform load – chain links and crane hooks.

UNIT IV STRESSES IN FLAT PLATES **9**

Stresses in circular and rectangular plated due to various types of loading and end conditions. Torsion Of Non-Circular Section - Torsion of rectangular cross sections- St.Venant's theory – Elastic membrane Analogy – Prandtl's stress function – Torsional stresses in hollow thin walled tubes.

UNIT V STRESSES DUE TO ROTATION **9**

Radial and tangential stresses in solid disc and ring of uniform thickness and varying thickness- allowable speeds. Theory of contact stresses Methods of computing contact stresses - Deflection of bodies in point and line contact-Applications.

Tutorial: 15, Period: 45, Total: 60 PERIODS

REFERENCE BOOKS:

1. Secly and Smith, "Advanced Mechanics of materials", John Wiley International Edn, 1952.
2. Rimoahwnko, "Strength of Materials", Van Nostrand.
3. Den Hartong, "Advanced Strength of Materials", McGraw Hill Book Co., New York, 1952.
4. Timoshenko and Goodier, "Theory of Elasticity", McGraw Hill.
5. Wang, "Applied Elasticity", McGraw Hill.
6. Case, "Strength of Materials", Edward Arnold, London, 1957.
7. Robert D. Cook, Warren C. Young, "Advanced Mechanics of Materials", Macmillian Pub. Co., 1952.

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ANALYSIS & SIMULATION LAB **0 0 3 2**

Modeling & Analyzing Mechanical Components using software Packages(Ansys).

1. Study of Ansys.
2. Application of Joints and springs in Ansys.
3. Simple Conduction example.
4. Thermal mixed boundary example (condution / convection)
5. Analysis of a Bicycle
6. Linear Buckling Analysis
7. Non-linear Buckling Analysis
8. Sub structuring.

PROJECT WORK PHASE – I

L	T	P	C
0	0	12	6

Aim is to train the students in research work, writing report and presentation Phase – I : Shall consist of identification of the project after literature survey. Students should present a review paper & submit it to the internal examiners. Report should summarise the methodology to be adopted and work plan for the project work

PROJECT WORK PHASE – II

L	T	P	C
0	0	24	12

Requirement: Actual project work with presentation & submission of project report of thesis form to the examiners. The students should publish at least one paper in National / International conference or Journal before submission of the thesis. Proof of acceptance must be enclosed in the thesis

LIST OF ELECTIVE SUBJECTS

Dr.K.G.Muthurajan Dr.M.Venkataraman Prof.J.Senthil Prof.G.Nagarajan

Prof.N.Rajan Prof.J.Sathees babu

INTEGRATED MANUFACTURING SYSTEMS

L	T	P	C
3	0	0	3

UNIT I INTRODUCTION **9**

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

UNIT II GROUP TECHNOLOGY AND COMPUTER AIDED PROCESS PLANNING **9**

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

UNIT III COMPUTER AIDED PLANNING AND CONTROL **9**

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

UNIT IV COMPUTER MONITORING **9**

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

UNIT V INTEGRATED MANUFACTURING SYSTEM **9**

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

Total: 45 PERIODS

TEXT BOOKS:

1. Groover, M.P., “Automation, Production System and CIM”, Prentice-Hall of India, 1998.

REFERENCE BOOKS:

1. David Bedworth, “Computer Integrated Design and Manufacturing”, TMH, New Delhi, 1998.

2. Yorem Koren, “Computer Integrated Manufacturing Systems”, McGraw Hill, 1983.

3. Ranky, Paul G., “Computer Integrated Manufacturing”, Prentice Hall International 1986.

4. R.W. Yeomamas, A. Choudry and P.J.W. Ten Hagen, “Design rules for a CIM system”, North Holland Amsterdam, 1985.

RAPID PROTOTYPING & TOOLING

L	T	P	C
3	0	0	3

UNIT - I **7**

Introduction : Need for time compression in product development, Product development – conceptual design – development – detail design – prototype – tooling.

UNIT – II **9**

Classification of RP systems, Stereo lithography systems – Principle – process parameters – process details – machine details, Applications. Direct Metal Laser Sintering (DMLS) system – Principle – process parameters – process details – machine details, Applications

UNIT -III **9**

Fusion Deposition Modeling – Principle – process parameters – process details – machine details, Applications. Laminated Object Manufacturing – Principle – process parameters – process details – machine details, Applications.

UNIT - IV **10**

Solid Ground Curing – Principle – process parameters – process details – machine details, Applications, 3-Dimensional printers – Principle – process parameters – process details – machine details, Applications, and other concept modelers like thermo jet printers, Sander's model maker, JP system 5, Object Quadra system.

UNIT – V **10**

Laser Engineering Net Shaping (LENS), Ballistic Particle Manufacturing (BPM) – Principle, Introduction to rapid tooling – direct and indirect method, software for RP – STL files, Magics, Mimics. Application of Rapid prototyping in Medical field

Total: 45 PERIODS

TEXT BOOK:

1. Pham,D.T. & Dimov.S.S., Rapid manufacturing, Springer-Verlag, London, 2001.

REFERENCE:

1. Terry wohlers, Wohlers Report 2000, Wohlers Associates, USA, 2000.

2. Rapid Prototyping and manufacturing – Fundamentals of Streolithography, Paul F Jacobs, Society of Manufacturing Engineering Dearborn, USA 1992.

3. Rapid Prototyping and Tooling, Industrial Design Centre, IIT, Mumbai, 1998.

INDUSTRIAL ROBOTICS & EXPERT SYSTEMS

L T P C

3 0 0 3

UNIT I INTRODUCTION 9

Definition of a robot, basic components of robotic system, sensing, programming and intelligence.Robot Components And Operation: Mechanical Arm structure and type of joints, classification of Robots by types of joints .Cartesian, Polar, Cylindrical, Jointed arms. Wrists- typical design and End effectors. Structural characteristics of robot- rigidity, effect of structure on control, work envelope and work volume. Comparison of robot work volumes

End effectors- grippers and tools. Robot drive systems- control systems and dynamic performance. Precision of movement- sensors-robot programming and work cell control

UNIT II ROBOT DRIVE AND CONTROL 9

Basic control system- controllers - Control system analysis. Robot activation and feedback components. Position and velocity sensors. Actuators- power transmission systems. Robot joint control. Robot manipulator kinematics- direct kinematics problem, inverse kinematics problem, inverse kinematics solution- manipulator path control. Robot dynamics. Configuration of a robot controller

UNIT III SENSORS AND MACHINE VISION 9

Transducers and sensors- tactile sensors, proximity and range, sensors, miscellaneous sensor devices- use of sensors in robotics. Machine vision –sensing and digitizing function in machine vision – image processing analysistraining and vision system

UNIT IV ROBOT PROGRAMMING 9

Robot programming: lead through methods, textual robot languages, position specification, motion interpolation, Basic programming languages- Artificial intelligence and Robotics.

UNIT V ROBOT APPLICATIONS IN MANUFACTURING 9

Material transfer and machine loading and unloading- processing operations, welding, spray coating Getc. Assembly and inspection. Robot work design and control. Economic analysis. Special issues and future of Robotics.

Total: 45 PERIODS

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Prof.N.Rajan Prof.J.Sathees babu

REFERENCE BOOKS

1. Groover, M.P., Mitchell Weiss, Nagel,R.N., ”Industrial Robotics Technology, Programming and Applications”, McGraw Hill, 1986.

2. Koren, Y., “Robotics for Engineers”, McGraw Hill, 1987.

3. Paul,Richard, P., ”Robot Manipulators: Mathematical Programming and Control”, the MIT Press, London, 1982.

4. Vukabrativic, M & Stokic,D., ”Control of Manipulation of Robots”,Springer-Verlag, Berline1982.

MANUFACTURING INFORMATION SYSTEMS

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UNIT I INTRODUCTION **9**

The evolution of order policies, from MRP to MRP II, the role of Production organization, Operations control.

UNIT II DATABASE **9**

Terminologies – Entities and attributes – Data models, schema and subschema – Data Independence – ER Diagram – Trends in database.

UNIT III DESIGNING DATABASE **9**

Hierarchical model – Network approach – Relational Data model -concepts, principles, keys, relational operations– functional dependence -Normalisation, types – Query languages.

UNIT IV MANUFACTURING CONSIDERATION **9**

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**

Parts oriented production information system – concepts and structure -computerized production scheduling, online production control systems, Computer based production management system, computerized manufacturing information system – case study.

Total: 45 PERIODS

REFERENCE BOOKS:

1. Luca G. Sartori, “Manufacturing Information Systems”, Addison-Wesley PublishingCompany, 1988.
2. Date. C.J., “An Introduction to Database systems”, Narosa Publishing House, 1997.
3. Orlicky. G., “Material Requirements Planning”, McGraw-Hill Publishing Co., 1975.
4. Kerr. R, “Knowledge based Manufacturing Management”, Addison-wesley, 1991.

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COMPUTATIONAL FLUID DYNAMICS

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UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 9

Basics of CFD, Governing equations of Fluid Dynamics – Continuity momentum and Energy equations, Physical Boundary conditions, Mathematical behaviour of PDEs on CFD – Elliptic, Parabolic and Hyperbolic equations

UNIT II DISCRETISATION TECHNIQUES AND SOLUTION METHODOLOGIES 12

Methods of deriving discretisation equations – Finite difference & Finite volume methods, Finite difference discretisation of wave equation, Laplace equation, Burger's equation, numerical error and stability analysis. Time dependent methods – Explicit, Implicit – Crank – Nicolson methods, time split methods. Solution methodologies – Direct & iteractive methods – Thomas algorithm – Relaxation method – Alternate Direction Implicit method

UNIT III CALCULATION OF FLOW – FIELD FOR N – S EQUATIONS 10

Finite volume formulation of steady one-dimensional convection and Diffusion problems, Central, upwind, hybrid and power-law schemes – Discretization equations for two dimensional convection and diffusion. Representation of the pressure – Gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and velocity corrections – Pressure – Correction equation, SIMPLE algorithm and its variants.

UNIT IV TUR BULENCE MODELING 8

Time – averaged equation for turbulent flow, Turbulence Models – Zero equation model, one equation model, two equation k- models, Advanced models.

UNIT V GRID GENERATION 6

Algebraic Methods – Differential Equation methods – Adaptive grids

Total: 45 PERIODS

TEXT BOOKS

1. Versteeg, H.K, and Malalasekera, Wan Introduction to Computational Fluid Dynamics: The Finite Volume Method", Longman, 1998

2. D. A, Anderson, John C. Tannehill, Richard H. Pletcher – Computational Fluid Mechanics and Head Transfer, Hemisphere publishing corporation, McGraw – Hill book company, USA, 1984.

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1. Muralidhar, K., and Sundararajan, T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 1995.

2. Ghoshdasdidar, P.S., “Computer Simulation of flow and heat transfer” Tata McGraw-Hill Publishing Company Ltd., 1998.

3. Subas, V.Patankar “Numerical heat transfer fluid flow”, Hemisphere Publishing Corporation, 1980.

4. Taylor, C and Hughes, J.B. “Finite Element Programming of the Navier Stokes Equation”, Pineridge Press Limited, U.K., 1981.

5. Fletcher, C.A.J. “Computational Techniques for Fluid Dynamics Vol 1” Fundamental and General Techniques, Springer – Verlag, 1987.

6. Fletcher, C.A.J. “Computational Techniques for Fluid Dynamics Vol 2” Specific Techniques for Different Flow Categories, Springer – Verlag, 1987.

7. Bose, T., “Numerical Fluid Dynamics” Narosa Publishing House, 1997.

ADVANCED MACHINE TOOL DESIGN

L T P C
3 0 0 3

UNIT I INTRODUCTION 9

Introduction to Metal Cutting Machine tools, Kinematics, Basic Principles of Machine tool design, estimation of drive power.

UNIT II DESIGN OF MACHINE TOOLS, SPINDLES, FRAMES, SLIDEWAYS 9

Design of Machine tool spindle and bearings, Design of power Screws – Static deformation of various machine tool structures – thin walled box structures with open and compliant cross sections – correction coefficients – design of beds, columns, tables and supports.

Dynamics of cutting forces – tool chatter – design of slideways. Concepts of aesthetics and ergonomics applied to machine tools, latest Trends in Machine Tool Design, Introduction to CAD techniques

UNIT III DESIGN OF DRIVES MECHANISMS 9

Design considerations of electrical, mechanical and Hydraulic drives in machine tool, stepped and stepless arrangements and systems.

UNIT IV DESIGN OF CONTROL MECHANISMS 9

Design of control mechanisms – selection of standard components – Dynamic measurement of forces and vibrations in machine tools – Stability against chatter – use of vibration dampers.

UNIT V TESTING AND STANDARDISATION 9

Acceptance tests and standardization of machine tools – machine tools reconditioning.

Total: 45 PERIODS

REFERENCE BOOKS:

1. Mehta, N.K., “Machine Tool design”, Tata McGraw Hill, 1989
2. Koenisberger, F., “Design Principles of Metal cutting Machine Tools”, Pergamon Press, 1964.
3. Acherkan, N., “Machine Tool Design”, Vol. 3 & 4, MIR Publishers, Moscow, 1968
4. Sen.G. and Bhattacharya, A., “Principles of Machine Tools”, Vol.2, NCB.Calcutta, 1973

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CONCURRENT ENGINEERING

L T P C
3 0 0 3

UNIT I INTRODUCTION 9

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

UNIT II USE OF INFORMATION TECHNOLOGY 9

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

UNIT III DESIGN STAGE 9

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 9

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 9

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.

Total: 45 PERIODS

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REFERENCE BOOKS:

1. Anderson MM and Hein, L. Berlin, “Integrated Product Development”, Springer Verlog, 1987.

2. Cleetus, J, “Design for Concurrent Engineering”, Concurrent Engg. Research Centre, Morgantown, WV, 1992.

3. Andrew Kusaik, “Concurrent Engineering: Automation Tools and Technology”, Wiley, JOhn and Sons Inc., 1992.

4. Prasad, “Concurrent Engineering Fundamentals: Integrated Product Development”, Prentice Hall, 1996.

5. Sammy G Sinha, “Successful Implementation of Concurrent Product and Process”, Wiley, John and Sons Inc., 1998.

COMPOSITE MATERIALS AND MECHANICS

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UNIT I LAMINA CONSTITUTIVE RELATIONS 9

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Qij), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding – Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes.

UNIT II FLAT PLATE LAMINATE CONSTITUTIVE RELATIONS 9

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT III LAMINA STRENGTH ANALYSIS 9

Introduction Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

UNIT IV ANALYSIS OF LAMINATED FLAT PLATES 9

Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies

UNIT V EFFECT OF THERMAL PROPERTIES 9

Modification of Hooke's Law due to thermal properties – Modification of Laminate Constitutive Equations. Orthotropic Lamina – special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates – Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

Total: 45 PERIODS

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REFERENCE BOOKS:

1. Gibson, R.F., Principles of Composite Material Mechanics, McGraw-Hill, 1994, Second Edition - CRC press in progress.

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

3. Issac M. Daniel and Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press-2006, First Indian Edition -
2007

4. Mallick, P.K., Fiber –"Reinforced Composites: Materials, Manufacturing and Design", Maneel Dekker Inc, 1993.

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

6. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites", John Wiley and Sons, New York, 1990.

7. Madhujit Mukhopadhyay, "Mechanics of Composite Materials and Structures", University Press (India) Pvt. Ltd., Hyderabad, 2004

TRIBOLOGY IN DESIGN

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UNIT I SURFACE INTERACTION AND FRICTION 9

Topography of Surfaces – Surface features-Properties and measurement – Surface interaction – Adhesive Theory of Sliding Friction –Rolling Friction-Friction properties of metallic and non-metallic materials – friction in extreme conditions –Thermal considerations in sliding contact

UNIT II WEAR AND SURFACE TREATMENT 9

Types of wear – Mechanism of various types of wear – Laws of wear –Theoretical wear models-Wear of Metals and Non metals – Surface treatments – Surface modifications – surface coatings methods- Surface Topography measurements –Laser methods – instrumentation – International standards in friction and wear measurements

UNIT III LUBRICANTS AND LUBRICATION REGIMES 9

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

UNIT IV THEORY OF HYDRODYNAMIC AND HYDROSTATIC LUBRICATION 9

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

UNIT V HIGH PRESSURE CONTACTS AND ELASTO HYDRODYNAMIC LUBRICATION 9

Rolling contacts of Elastic solids- contact stresses – Hertzian stress equation- Spherical and cylindrical contacts-Contact Fatigue life- Oil film effects- Elasto Hydrodynamic lubrication Theory-Soft and hard EHL-Reynolds equation for elasto hydrodynamic lubrication- – Film shape within and outside contact zones-Film thickness and friction calculation- Rolling bearings- Stresses and deflections-Traction drives.

Total: 45 PERIODS

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REFERENCE BOOKS:

1. Rabinowicz. E, “Friction and Wear of materials”, John Willey & Sons, UK,1995

2. Cameron, A. “Basic Lubrication Theory”, Ellis Herward Ltd., UK, 1981

3. Halling, J. (Editor) – “Principles of Tribology “, Macmillian – 1984.

4. Williams J.A. “ Engineering Tribology”, Oxford Univ. Press, 1994.

5. S.K.Basu, S.N.Sengupta & B.B.Ahuja, ”Fundamentals of Tribology”, Prentice – Hall of India Pvt Ltd, New Delhi, 2005

6. G.W.Stachowiak & A.W.Batchelor, Engineering Tribology, Butterworth-Heinemann, UK, 2005

REVERSE ENGINEERING

L T P C
3 0 0 3

UNIT I INTRODUCTION **9**

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

UNIT II TOOLS FOR RE **9**

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

UNIT III CONCEPTS **9**

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

UNIT IV DATA MANAGEMENT **9**

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

UNIT V INTEGRATION **9**

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

Total: 45 PERIODS

REFERENCE BOOKS:

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

DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS

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UNIT I OIL HYDRAULIC SYSTEMS AND HYDRAULIC ACTUATORS 5

Hydraulic Power Generators – Selection and specification of pumps, Pump characteristics. Linear and Rotary Actuators – Selection, specification and characteristics.

UNIT II CONTROL AND REGULATION ELEMENTS **12**

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

UNIT III HYDRAULIC CIRCUITS **5**

Reciprocation, quick return, sequencing, synchronizing circuits - Accumulator circuits - industrial circuits - press circuits - Hydraulic milling machine - grinding, planning, copying, -forklift, earth mover circuits- Design and selection of components - safety and emergency mandrels.

UNIT IV PNEU MATIC SYSTEMS AND CIRCUITS **16**

Pneumatic fundamentals - control elements, position and pressure sensing - Logic circuits - switching circuits - fringe conditions modules and these integration - Sequential circuits - cascade methods - step counter method - Compound circuit design - Combination circuit design.

UNIT V INSTALLATION , MAINTENANCE AND SPECIAL CIRCUITS **7**

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

Total: 45 PERIODS

REFERENCES:

1. Antony Espossito, “Fluid Power with Applications”, Prentice Hall, 1980.
2. Dudleyt, A. Pease and John J. Pippenger, “Basic fluid power”, Prentice Hall, 1987.
3. Andrew Parr, “Hydraulic and Pneumatics” (HB), Jaico Publishing House, 1999.
4. Bolton. W., “Pneumatic and Hydraulic Systems “, Butterworth –Heinemann, 1997.

WEB REFERENCES:

1. www.pneumatics .com
2. www.fluidpower.com.tw

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DESIGN OF MATERIAL HANDLING EQUIPMENT

LTP C

3 0 0 3

UNIT I INTRODUCTION **9**

Types of material equipment's – Characteristics applications selection of the system

UNIT II: DESIGN OF HOISTS **9**

Design of hosting elements – ropes, chains, pulleys, sheaves, hoists of different types.

UNIT III DESIGN OF ELEVATORS **9**

Types – Design of chair and bucket elevators – belt and bucket elevators - discharges.

UNIT IV DESIGN OF CONVEYORS **9**

Types of conveyors – design of belt, pneumatic, hydraulic, screw and vibratory conveyors – Selection of the conveyors.

DESIGN OF CRANE STRUCTURES

Types – Superstructure of rotary cranes with fixed radius – cantilevers and overhead cranes Stability Analysis

UNIT V SELECTION OF DRIVES **9**

Types of drives – rails traveling mechanism – slewing with rotary pillar, fixed pillar and turn tablets– traveling gear. Selection of Grabbing Attachments: Cranes grabs – grabbing attachments for loose pieces – lifting magnets grab buckets and liquid handling buckets. Design of Arresting Mechanism: Brakes – Shoes, Band, cone disc and Centrifugal types.

Total: 45 PERIODS

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REFERENCE BOOKS:

1. Spivakovsky, A. & Dychnov, V.K., “Conveying Machines Volumes 1 & 11”, MIR Publishers Moscow, 1985.

2. Hudson Wilbur, G., “Conveyors and Related Eqipments “, Join Wiley and Sons, 1949.

3. Boltz, Hord, A., “Material Handling Handbook “, The Ronald Press CO, 1985.

4. Rudenko, N., ”Material Handling Equipments”, MIR Publishers, Moscow, 1969.

5. Spivakovsky, F. and Dyachkov, V.,”Conveyours and Related Equipments”. MIR Pulishers, Moscow, 1954.

6. Duglas, R WOODLEY, “Encyclopaedia of Materials Handling – Vol 1 Pregmen, 1964.

ADVANCED MACHINE TOOL DESIGN

LTP C

3 0 0 3

UNIT I INTRODUCTION 9

Introduction to Metal Cutting Machine tools, Kinematics, Basic Principles of Machine tool design, estimation of drive power.

UNIT II DESIGN OF MACHINE TOOLS, SPINDLES, FRAMES, SLIDEWAYS 9

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UNIT V TESTING AND STANDARDISATION 9

Acceptance tests and standardization of machine tools – machine tools reconditioning

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3. Acherkan, N., “Machine Tool Design”, Vol. 3 & 4, MIR Publishers, Moscow, 1968
4. Sen.G. and Bhattacharya, A., “Principles of Machine Tools”, Vol.2, NCB.Calcutta, 1973

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