

COMPUTER AIDED DESIGN

ME-501

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INTRODUCTION: Definition and scope of CAD/CAM. Introduction to Design process and role of computers in the design process. Hardware and Software in CAD/CAM applications.

GEOMETRIC MODELLING CURVES AND SURFACES: Representation, Wire Frame models, Intrinsic and parametric representations, analytic and parametric curves and surfaces. Manipulations of curves and surfaces.

GEOMETRIC SOLID MODELING: Solid models, Fundamentals of Solid Modeling, Half -spaces, Boundary Representation(B-rep), Constructive Solid Geometry (CSG), Sweep Representation, Analytic Solid Modeling. Solid Manipulations.

CAD/CAM DATA EXCHANGE FORMATS.

INTRODUCTION TO DESIGN AND ENGINEERING APPLICATIONS: Geometry and mass property formulations; Design projects with CAE focus.

INTRODUCTION TO REVERSE ENGINEERING TOOLS.

Recommended Books:

1. Ibrahim Zeid, CAD/CAM, Tata McGraw Hill, New Delhi.
2. J. Rooney & P.Steadman, Principles of Computer Aided Design, Pitman/ Open University, London.
3. Joe Rooney & Philip Steadman, Computer Aided Design, Pitman/Open University, London.
4. Glen Mallineuse, Computational Concepts and Methods, Kogan Page Ltd. London.
5. Daniel L. Rayan, Computer Aided Graphical Design, Marcel Dekker, New York.
6. P. Radhakrishnan & C.P.Kothandaraman, Computer Graphics & Design(CADD), Dhanpat Rai Pub, New Delhi.
7. C.S. Krishnamoorathy, J.S. Rajeev, Computer Aided Design (Software and Analysis Tools), Narosa Pub House, New Delhi.

TRIBOLOGY

ME-502

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Introduction: friction, wear and lubrication, types of engg., Contacts: conforming and non-conforming, Types of motion; rubbing sliding, oscillating, Roolling, Surface of interactions, elastic and plastic deformations, properties of materials, surface energy and flash temperature theory.

Friction: Laws of sliding friction, concept of adhesion, Tabor's model of friction elastic thermo friction, rolling friction, measurement of friction.

Wear: Laws of wear, types of wear such as adhesive, declamination, abrasive, fatigue, corrsice, fretting, erosice, electrical and oxidative. Measurement of wear and friction in atmosphere and different environments, Prevention and control of wear and friction in machines, wear of cutting tool and dies, study of abrasion in grading, lappling and honing.

Lubrication: Mechinism of lubrication, Boundry, squeeze film hydrodynamic and elasto dydro dynamic and hydro stative lubrications plasto hydrodynamic lubrication, solution of Reynold's equation in two and three dimensional flow, pressure distribution load carrying capacity friction forces in oil film and Co-efficient of friction in journal bearing. Soild lubricants types and applications.

Bearing Design: Design of bearing: clearance in journal bearing, minimum film thickness, sommar-field numer, Oil grooves anf flow of oil in axial and circumferential grooves cavittion and turbulence in oil bearings. Heat generation and cooling or bearing Hydrostatic and dynamic and their applications in machine tools. Design of air bearing and other gas bearing.

Rolling Friction: Reynold's slip, Heathe cote concept selection of roller bearings and their methods of lubrication design aspects and modes of bearing failures and elasto hydrodynamic lubrication.

Solid Lubricants: Their applications in metal forming process.

Recommended Books:

1. Sharma Agarwal, A Test Book, Kataria
2. Main Engg. Hand Book, A M/c Design, McGraw Hill

OPTIMIZATION TECHNIQUES

ME-507

Linear Programming: The theory of simplex solution, alternate optimal solution, unbounded solutions, infeasible solutions, Formulation of LP models for production scheduling, network planning, inventory maintenance and capital budgeting and similar industrial problems. Two phase method, Revised simplex method and dual simplex method. Sensitivity analysis. The dual problem and its role for post optimality analysis.

The transportation and assignment models. Traveling salesman model and their industrial applications.

Dynamic Optimization Models: Formulation of dynamic optimization models for common industrial problems. Optimization of non-linear objective function by dynamic programming.

Queues Models: Queuing with single and parallel channels with limited and unlimited service. Bulk input, bulk service, priority queue discipline.

Simulation Models: Generation of random number. Use of random numbers for system simulation. Use of computers for system design and assembly line balancing.

Books Recommended

1. Fundamental of Operations Research Ackoff and Saseini: Wiley Eastern
2. Principles of OR with applications to managerial decisions by Wagner: Prentice Hall
3. Introduction to OR by Hillier & Lieberman: Holden day

MANAGEMENT INFORMATION SYSTEMS

ME-511

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Introduction: Concepts of Management, Information and Systems, History of Information Systems. Philosophies Governing the development of Information Systems.

Role of Information Systems In Organisations: Local and Global context. Additional perspectives as benefits from Technical Trends and innovations, special characteristics and enigmas of information.

Information System And Business Processes: Analysing information system from a business perspective using work centred analysis of systems.

Information System Taxonomies: Transaction Processing system, Management Information Systems. Decision support system, Executive Information Systems. Artificial Intelligence, Expert Systems and Office Automation Systems.

System Analysis And Design: Information System Planning, introduction challenges, strategic issues, selecting systems, project management issues. Methodology and implications of system analysis and design, SDLC, Prototyping. End user Development, Off the shelf software, outsourcing and application software.

Tools For Information System Development: Structural tools for analysis and design, tools to represent system data and process. Tools for structured programming, tools to convert programs specification into code.

Database Design And Management: Components of DBMS, Database models, Principles of DBMS.

Strategic Information Systems: Characteristics, and Plan. Business Information Systems; MARIS, Information systems for Manufacturing, Human Resource, Finance and Accounts, and Quality.

Client Server Computing: Developing client server, organisational implications of c/s computing. Information system security and control.

ERP: Introduction, concepts, applications, advantages and disadvantages.

Recommended Books:

1. Uma G Gupta, Management Information Systems - A Managerial Perspective, Galgotia Publishers, New Delhi.
2. Edward Yourdon, Structured Analysis, Prentice Hall of India, New Delhi.
3. James A. O'Brien, Management Information System (Managing Information Technology in the Internetworked Enterprise, Tata McGraw Hills, New Delhi
4. Steve Alter, Management Information System, Benjamin Cummins, New York.
5. Davis & Olson, Management Information Systems, McGraw Hill, New York.
6. Gerald V Post & David L Anderson, Management Information Systems, Solving Business Problem with Information Technology, Tata McGraw Hills, New Delhi.
7. Jawedkar, Management Information Systems, Tata McGraw Hills, New Delhi.
8. Schultheis & Sumner, Management Information Systems (A Management Perspective), Tata McGraw Hills, New Delhi.
9. Landon & Landon, Management Information Systems, Prentice Hall of India, New Delhi.

MECHANISMS: DESIGN, SYNTHESIS AND ANALYSIS

ME-512

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INTRODUCTION TO KINEMATICS AND MECHANISMS: Motion, The four bar Linkage, The science of Relative motion, Kinematic diagrams, six-bar chains, Degrees of freedom, Analysis vs. Synthesis.

MECHANISM DESIGN PHILOSOPHY: Stages of design, the synthesis process, Design categories and mechanism parameters.

MECHANISM ANALYSIS: Displacement and velocity analysis, acceleration analysis.

KINEMATIC SYNTHESIS OF MECHANISMS: Number synthesis-The associated linkage concept. Graphical methods, tools and computer programming for synthesis of mechanisms for two, three and four prescribed positions, path generation, prescribed and un-prescribed timings. Analytical Synthesis Techniques. Function and motion generation. Number of prescribed positions vs. Number of Free Choices. Extension of Three-precision-Point Synthesis to Multi-loop mechanisms.

DYNAMICS OF MECHANISMS: Inertia forces, Kinetostatic Analysis by complex numbers, Superposition method, Matrix Method. Time response, modification of time response of mechanisms. Virtual work. Lagrange Equations of motion. Free vibration of systems with one degree of freedom. Decay of free vibrations. Forced vibrations of systems with one degree of freedom. Rotor balancing. Introduction to Force and Moment balancing of Linkages. Computer program for Force and Moment balancing. Elastic beam element in Plane Motion. Displacement fields for Beam element. Element and system mass and stiffness Matrices.

SPATIAL MECHANISMS: Transformations for spatial mechanisms, Analysis of spatial mechanisms. Link and Joint Modeling with Elementary Matrices. Kinematic analysis of an Industrial Robot, position, velocity and acceleration analysis..

Recommended Books:

1. Sandor and A.G. Erdman, Mechanism Design (Analysis and Synthesis), Vol.-I, Prentice Hall of India, New Delhi.
2. Sandor and A.G. Erdman, Advanced Mechanism Design (Analysis and Synthesis), Vol.-II, Prentice Hall of India, New Delhi.
3. J.E Shigley & J.J Uicker, Theory of Machines and Mechanisms, McGraw Hill, Singapore.
4. Rudolf A.Beyer, Kinematic Synthesis of Mechanisms, McGraw Hill, New York.
5. Alexander Cowie, Kinematics and Design of Mechanisms, International Textbook, Scranton.
6. Allen.S.Hall Jr, Kinematics and Linkage Design, Prentice Hall, New Jersey.
7. R.Hartenberg and J.Denavit, Kinematic Synthesis of Linkages, McGraw Hill, New York.
8. A.H Soni, Mechanism Synthesis and Analysis, Krieger, Melbourne.
9. Lyndon. O. Barton, Mechanism Analysis, Marcel Dekker, New York.

FINITE ELEMENT METHODS

ME-513

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INTRODUCTION: finite element methods, history and range of applications.

FINITE ELEMENTS: Definition and properties, assembly rules and general assembly procedure, features of assembled matrix, boundary conditions.

CONTINUUM PROBLEMS: Classification of differential equations, variational formulation approach, Ritz method, element equations from variations. Galerkin's weighted residual approach, energy balance methods.

ELEMENT SHAPES AND INTERPOLATION FUNCTIONS: Basic element shapes, generalized coordinates, polynomials, natural coordinates in one-, two- and three-dimensions, Lagrange and Hermite polynomials, two-D and three-D elements for C^0 and C^1 problems, Coordinate transformation, iso-parametric elements and numerical integration.

APPLICATIONS & CASE STUDIES: Application of finite element methods to elasticity and structural, heat transfer, fluid-flow, lubrication and general field problems.

Recommended Books:

1. K.H. Huebner, The Finite Element Method for Engineers, John Wiley, New York.
2. Jeffery M. Steche, Applied Finite Element Modeling, Marcel Dekker, New York.
3. O.C. Zienkiewicz, The Finite Element Method, Tata McGraw Hill, New Delhi.
4. Desai & Abel, Introduction to the FEM, (CBS)-affiliated to East West Press, New Delhi.
5. George R. Buchanan, Finite Element Analysis, Schaum MGH, New York.
6. Chandrupatla & Belgundu, Introduction to Finite Elements in Engineering, Prentice Hall of India, New Delhi.
7. J.N. Reddy, An Introduction to the Finite Element Method, McGraw Hill, New York.
8. Cheung Y.K., Lo.S.H., Leung A.Y.T Finite Element Implementation, Blackwell Science Ltd, London.
9. Brebbia. C.A. and Walker. S., Boundary Element Techniques in Engineering, Newness-Butterworths Pub Ltd, London.
10. W.B. Bickford, A First Course in the Finite Element Methods, Tata McGraw Hill, New Delhi.
11. Ronald L. Huston and Chris E. Passerello, Finite Element methods: An Introduction, Marcel Dekker, New York.
12. Elward R.Champion al J. Michael Ensminger, Finite Element Analysis with Personal Computers, Marcel Dekker, New York.

ME-551 CAD/CAM Lab-I

The following experiments are to be conducted using appropriate software:

1. Use of computer in the design process
2. Wire frame modelling of objects.
3. Solid Modelling.
4. Hidden line removal and shading
5. Rendering
6. Geometry & Mass Property Calculations

- Minimum of two problems of optimisation techniques be solved using appropriate softwares
- In addition to above a visit to some facility where any of the above is actually used and to prepare report of that.