

FIRST SEMESTER

CADM 101 COMPUTER GRAPHICS

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.
Examination (Theory): 3hrs.

Ses. : 30 Exam: 70
Credits: 4

Geometry and line generation: Line segments, Pixels and frame buffers, Bresenham's algorithms: line, circle, ellipse generation.

Graphics primitives: Primitive operations, The display-file interpreter, Display-file structure, Display-file algorithms.

Polygons: Polygons representation, An inside test, Filling polygons, Filling with a pattern.

Transformations: Scaling transformations, Reflection and zooming, Rotation, Homogeneous coordinates and translation, Rotation about an arbitrary point.

Segments: The segment table, Segment creation, Closing a segment, Deleting a segment.

Windowing and clipping: The viewing transformation, Clipping, The clipping of polygons, Generalized clipping.

Three dimensions: 3D geometry, 3D primitives, 3D transformations, Parallel projection, Perspective projection, Isometric projections, Viewing parameters, Special projections.

Hidden surfaces and lines: Back-face removal, Back-face algorithms, The Painter's algorithm, Warnock's algorithm, Franklin algorithm, Hidden-line methods.

Light, color and shading: Point-source illumination, Shading algorithms, Shadows, Color models.

Curves and fractals: Curve generation, Interpolation, B splines, Curved surface patches, Bezier curves, Fractals, Fractal lines, Fractal surfaces.

References:

1. Computer Graphics - A Programming Approach by Steven Harrington, McGraw-Hill International Edition, 1987.
2. Schaum's Outline of Theory and Problems of Computer Graphics by Roy A. Plastock and Gordon Kalley, McGraw-Hill Companies, Inc., 1986.
3. Mathematical Elements for Computer Graphics by David F. Rogers and Adams.

CADM 102 INTEGRATED COMPUTER AIDED DESIGN

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.
Examination (Theory): 3hrs.

Ses. : 30 Exam: 70
Credits: 4

Fundamentals of CAD: Introduction, Design process, Application of computer for design, Creating the manufacturing database, Benefits of CAD, Design work station, CAD hardware.

Geometric modeling: Geometric modeling techniques - Multiple view 2D input, Wire frame geometry, Surface models, Geometric entities - Curves and Surfaces, Solid modelers, Feature recognition.

Computer aided drafting: AutoCAD tools, 3D model building using solid primitives and boolean operations, 3D model building using extrusion, Editing tools, Multiple views: Orthogonal, Isometric.

Visual realism: Shading solids, Coloring, Color models, Using interface for shading and coloring.

Graphic aids: Geometric modifiers, Naming scheme, Layers, Grids, Groups, Dragging and rubber banding.

Computer animation: Conventional animation, Computer animation - Entertainment animation, Engineering animation, Animation types, Animation techniques.

Mechanical assembly: Assembly modeling, Part modeling, Mating conditions, Generation of assembling sequences, Precedence diagram, Liaison-sequence analysis.

Mechanical tolerancing: Tolerance concepts, Geometric tolerancing, Types of geometric tolerances, Location tolerances, Drafting practices in dimensioning and tolerancing, Tolerance analysis.

Mass property calculations: Geometrical property formulation - Curve length, Cross-sectional area, Surface area, Mass property formulation - Mass, Centroid, Moments of inertia, Property mapping. Properties of composite objects.

References:

1. CAD/CAM Theory and Practice by Ibrahim Zeid.
2. CAD/CAM Principles and Applications by P.N. Rao, Tata McGraw Hill Publishing Company Ltd.
3. CAD/CAM Computer Aided Design and Manufacturing by Mikell P. Groover and Emory W. Zimmer, Jr.
4. Computer Integrated Design and Manufacturing by David D. Bedworth, Mark R. Henderson, Philip M. Wolfe.

CADM 103 CNC AND APT PROGRAMMING

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.

Ses. : 30 Exam: 70

Examination (Theory): 3hrs.

Credits: 4

Introduction: NC, DNC, CNC, Programmed Automations, Machine control unit, Part program, NC tooling.

NC machine tools: Nomenclature of NC machine axes, Types of NC machine tools, Machining centres, Automatic tool changes (ATC), Turning centres.

Machine control unit & tooling: Functions of MCU, NC actuation systems, Part program to command signal, MCU organization, Computerised numerical control, Transducers for NC machine tools, Tooling for NC machining centres and NC turning machines, Tool presetting.

Manual part programming: Part program instruction formats, Information codes: Preparatory function, Miscellaneous functions, Tool code and tool length offset, Interpolations, Canned cycles. Manual part programming for milling operations, Turning operations, Parametric subroutines.

Computer aided part programming: NC languages: APT, NELAPT, EXAPT, GNC, VNC, Preprocessor, Post processor.

APT programming: APT language structure, APT geometry: Definition of point, time, vector, circle, plane, patterns and matrices. APT motion commands: setup commands, point-to-point motion commands, continuous path motion commands. Post processor commands, complication control commands. Macro subroutines. Part programming preparation for typical examples.

References:

1. Numerical Control and Computer Aided Manufacturing by T.K. Kundra, P.N. Rao and N.K. Tewari, Tata McGraw-Hill Company Limited, New Delhi.

2. Numerical Control of Machine Tools by Yoram Koren and Joseph Ben-Uri, Khanna Publishers, Delhi.

CADM 104 ROBOTICS

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.

Ses. : 30 Exam: 70

Examination (Theory): 3hrs.

Credits: 4

Introduction, Transformations and kinematics: Historical development, A sense of mechanisms, Robotic systems, Classification of robots, Position, orientation and location of a rigid body, Mechanics of robot manipulators. Objectives, Homogeneous coordinates, Homogeneous transformations, Coordinate reference frames, Some properties of transformation matrices, Homogeneous transformations and the manipulator: The position of the manipulator in space, Moving the base of the manipulator via transformations, Moving the tool position and orientation.

Position analysis of serial manipulators: Link parameters and link coordinate systems, Denavit-Hartenberg homogeneous transformation matrices, Loop-closure equations, Other coordinate systems, Denavit-Hartenberg method: Position analysis of a planar 3-DOF manipulator: Direct kinematics, Inverse kinematics, Method of successive screw displacements, Wrist centre position.

Position analysis of parallel manipulators: Structure classification of parallel manipulators, Denavit- Hartenberg method versus geometric method, Position analysis of a planar 3RRR parallel manipulator, Geometry, Inverse kinematics and Direct kinematics, Position analysis of a spatial orientation mechanism.

Jacobian analysis of serial manipulators: Differential kinematics of a rigid body, Differential kinematics of serial manipulators, Screw coordinates and screw systems, Manipulator Jacobian matrix.

Trajectory generation: General considerations in path description and generation, Joint space schemes, Cartesian space schemes, Geometric problems with Cartesian paths, Path generation at run time, Description of paths, Planning paths using the dynamic model, Collision-free path planning.

Robot Programming: Robot languages: AL, AML, RAIL, RPL, VAL, Demonstration of points in space: Continuous path (CP), Via points (VP), Programmed points (PP).

Text Book:

1. Robot Analysis - The Mechanics of Serial and Parallel Manipulators by Lung-Wen Tsai, John Wiley & Sons, Inc.

References:

1. Introduction to Robotics - Mechanics and Control by John J. Craig, Addison-Wesley Longman Inc., 1999.
2. Robotic Engineering - An Integrated Approach by Richard D. Klafter, Thomas A. Chmielewski and Michael Negin, Prentice-Hall of India Private Limited, 1994.
3. Robotics and Control by Mittal & Nagrath, Tata McGraw Hill Company Ltd.

CADM 105 ADVANCED OPTIMIZATION TECHNIQUES

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.

Ses. : 30 Exam: 70

Examination (Theory): 3hrs.

Credits: 4

Geometric programming (G.P): Solution of an unconstrained geometric programming, differential calculus method and arithmetic method. Primal dual relationship and sufficiency conditions. Solution of a constrained geometric programming problem (G.P.P), Complementary Geometric Programming (C.G.P)

Dynamic programming(D.P): Multistage decision processes. Concepts of sub optimization and Principle of optimality, computational procedure in dynamic programming calculus method and tabular methods. Linear programming as a case of D.P. and continuous D.P.

Integer programming(I.P): Graphical representation. Gomory's cutting plane method. Bala's algorithm for zero-one programming problem. Branch-and-bound method, Sequential linear discrete Programming, Generalized penalty function method.

Stochastic Programming (S.P.): Basic Concepts of Probability Theory, Stochastic Linear programming.

Non-traditional optimization techniques: Multi-objective optimization - Lexicographic method, Goal programming method, Genetic algorithms, Simulated annealing, Neural Networks based Optimization.

References:

1. Operations Research- Principles and Practice by Ravindran, Phillips and Solberg, John Wiley
2. Introduction to Operations Research by Hillier and Lieberman, Mc Graw Hill
3. Engineering Optimization - Theory and Practice by Rao, S.S., New Age International (P) Ltd. Publishers.
4. Engineering Optimization By Kalyanmanai Deb, Prentice Hall of India, New Delhi.
5. Genetic Algorithms - In Search, Optimization and Machine Learning by David E. Goldberg, Addison-Wesley Longman (Singapore) Pvt. Ltd

CADM 106 ADVANCED DESIGN

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.

Ses. : 30 Exam: 70

Examination (Theory): 3hrs.

Credits: 4

Design philosophy: Design process, Problem formation, Introduction to product design, Various design models-Shigley model, Asimov model and Norton model, Need analysis, Strength considerations -standardization. Creativity, Creative techniques, Material selections, Notches and stress concentration, design for safety and Reliability

Failure theories: Static failure theories, Distortion energy theory, Maximum shear stress theory, Coulomb-Mohr's theory, Modified Mohr's theory, Fracture mechanics theory. Fatigue failure theories, Fatigue mechanisms, Fatigue failure models, Fatigue failure criteria, Methods to reduce fatigue, Design for fatigue, Modified Goodman Diagram, Gerber method, Soderberg line, Surface failure models. Lubrication, friction and wear

Product Design: Product strategies, Product value, Product planning, product specifications, concept generation, concept selection, concept testing.

Design for manufacturing: Forging design, Casting design, Design process for non metallic parts, Plastics, Rubber, Ceramic, Wood, Glass parts.

Economic factors influencing design: Economic analysis, Break-even analysis, Human engineering considerations, Ergonomics, Design of controls, Design of displays. Value engineering, Material and process selection in value engineering, Modern approaches in design.

References:

1. Product Design and Manufacturing by A.K. Chitale and R.C. Gupta, Prentice Hall.
2. Mechanical Engineering Design by Joseph Shigley and Mischke. Sixth edition, Tata McGraw Hill
3. Machine Design - An Integrated Approach by R.L. Norton, Prentice Hall.
4. Product design and development by Karl T. Ulrich and Steven D. Eppinger. Third edition, Tata McGraw Hill.

CADM 107 CAD LAB

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 3Pr

Ses. : 50

Credits : 2

2D and 3D modelling and assembly modelling using modelling packages like AutoCAD, Auto Desk Mechanical desktop, ProEngineer, IDEAS.

Linear and non-linear static and dynamic analysis using any FEA package ANSYS / CAEFEM / NASTRAN.

MODEL QUESTION PAPER-Mechanical Engineering
M.E. (CAD/CAM)-I SEMESTER

CADM 101 COMPUTER GRAPHICS
(Four Semester-Credit System-w.e.f. 2007--2008)

Time : 3 Hrs.

Max.

Marks : 70

Answer any FIVE questions.

All questions carry equal marks.

1. a) Explain the Bresenham's algorithm for generating a circle and discuss about its advantages.
b) Explain about the graphic primitives for display-file structure.
2. a) Explain an algorithm for filling a polygon with a pattern.
b) Develop a combined transformation matrix to reflect the given object about a line passing through the point (x_p, y_p) and having a slope l_m .
3. a) Explain the procedure for creating and closing a segment.
b) Explain about the generalized clipping.
4. a) Derive the combined transformation matrix to rotate the given 3-D object about an axis passing through the points (x_a, y_a, z_a) and (x_b, y_b, z_b) .
b) Explain transformation for perspective projection.
5. a) Explain the Painter's algorithm with a suitable example.
b) Explain about any one shading algorithm.
6. a) Given the algorithm to generate the Bezier curve for the four given points.
b) What is fractal? How they are useful in generating lines and surfaces?
7. a) Write short note on 3-D homogeneous transformations.
b) Explain the procedure to represent a surface patch in a CAD model.
8. Write short notes on:
 - a) Pixels and frame buffers.
 - b) Inside test.
 - c) Scaling transformation.
 - d) Curve fitting and curve fairing technique.

MODEL QUESTION PAPER-Mechanical Engineering
M.E. (CAD/CAM)-I SEMESTER
CADM 102 INTEGRATED COMPUTER AIDED DESIGN
(Four Semester-Credit System-w.e.f. 2007--2008)

Time : 3 Hrs.

Max.

Marks : 70

Answer any FIVE questions.

All questions carry equal marks.

1. a) What is CAD and what are its applications and benefits?
b) What are the hardware requirements of a Design workstation? Explain.
2. a) What is geometric modeling? Compare and contrast the various modeling techniques.
b) How are solid modelers categorized? Explain the generic architecture of any solid modeler. Name some popular solid modelers.
c) Create the CSG model of the solid shown in the figure 1.

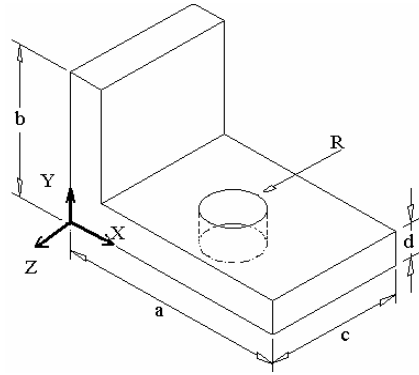


Fig.1.

3. a) What is shading? How is the shading of CSG model achieved? Explain any one shading algorithm for solids.
- b) What do you understand by the term geometric modifier? Explain. Give some examples where layering concepts are useful.
4. a) What is animation? Compare and contrast the conventional animation and computer animation. Write a brief note on animation techniques.
- b) Explain the procedure involved in animating a four bar linkage.
5. a) Generate the assembly tree and the precedence diagram for the assembly shown in the figure 2. Count the number of all possible assembly sequences to create the assembly.

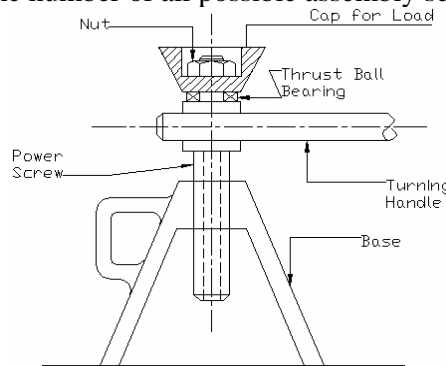


Fig. 2.

- b) What are the various techniques to generate all assembly sequences for a mechanical component? Explain Liaison sequence analysis.
6. a) What is geometric tolerancing? What are the types of geometric tolerances? How is it different from conventional tolerancing? Give a list of ANSI symbols for geometric tolerances?
- b) Fig.3 shows a part design with assigned tolerances. Use the arithmetic method to calculate the tolerance information for the axial dimension F of the outside surface shown.

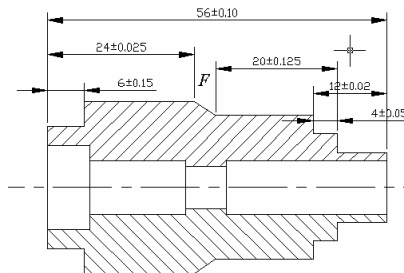


Fig. 3

7. a) Derive the principal moments of inertia of an object given its moments about a coordinate system.
 b) The geometry of an object is given in the following figure. Calculate the mass properties of the object assuming a density of 801.2 N/m^3 .

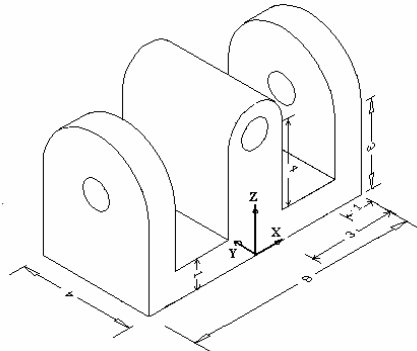


Fig. 4

8. Write short notes on any FOUR of the following:
 a) Rubber banding and dragging
 b) Rendering a 3-D solid model
 c) Boolean operations, extrusion with AutoCAD
 d) Tolerance analysis
 e) Properties of composite objects

MODEL QUESTION PAPER-Mechanical Engineering
 M.E. (CAD/CAM)-I SEMESTER

CADM 103 CNC AND APT PROGRAMMING
(Four Semester-Credit System-w.e.f. 2007--2008)

Time : 3 Hrs.
 Marks : 70

Max.

Answer any FIVE questions.
 All questions carry equal marks.

1. a) What is NC? What are the major advantages of CNC machine tool compared to its conventional counter part?
 b) How do you designate the coordinate axes for a CNC lathe? Show them diagrammatically on a rough sketch of a lathe.
2. a) How BCD system differs from Binary system? Explain how the eight track tape coding is specified in ISO and EIA.
 b) Explain important features of a CNC machining centre.
3. a) What is the function of a Transducer in CNC? Explain any one type of a Transducer.
 b) Explain the function of MCU and explain its organization to perform its functions.
4. Prepare manual part program for machining the component with 4 holes of 10 mm diameter on 60 mm p.c.d. as shown in Fig.1 using ISO code. Do not use G41 or G42.

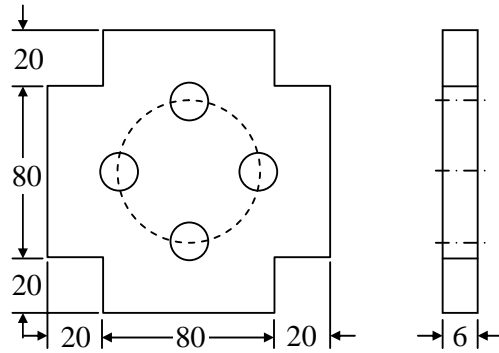


Fig.1

5. Prepare manual part programming for turning the component shown in Fig.2 on CNC lathe using ISO code. Assume the tool tip radius is 2 mm.

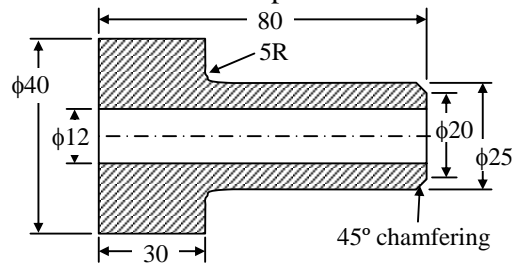


Fig. 2

6. a) Give any six circle definitions in APT geometry.
b) Write APT geometry to define lines and circles shown in Fig.3.

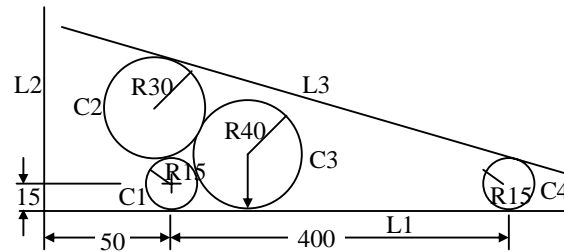


Fig. 3

7. Prepare NC program in APT for machining the contour shown in Fig.4 with two passes one with rough-cut and other with finish cut.

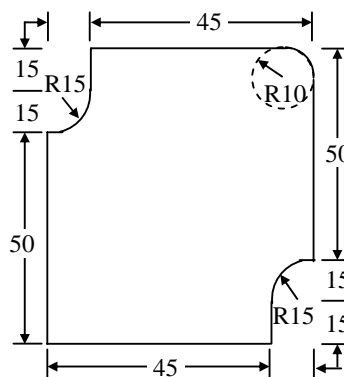


Fig. 4

8. Write short notes on any FOUR of the following:
- i) Servo system
 - ii) Presenting tools
 - iii) Tab sequential format
 - iv) MATRIX definition in APT
 - v) INTOL and OUTTOL commands
 - vi) Post processor

MODEL QUESTION PAPER-Mechanical Engineering
M.E. (CAD/CAM)-I SEMESTER
CADM-104 ROBOTICS
(Four Semester-Credit System-w.e.f. 2007--2008)

Time : 3 Hrs.

Max. Marks : 70

Answer any FIVE questions.

All questions carry equal marks.

1. a) Write about the historical development of Robot manipulators.
b) Write about the classification of Robots.
2. a) Explain the different ways by which the orientation of a rigid body can be described with respect to the fixed frame.
b) What is the resultant rotation matrix for a rotation of 60° about the fixed X-axis, followed by a rotation of 45° about the Y-axis, followed by rotation of 30° about the Z-axis. For the above rotations find the direction of the screw axis and angle of rotation.
3. Figure-1 shows the schematic diagram of the Scorbot robot. In the diagram, the second, third and fourth joint axes are parallel to one another and point into the paper at points A, B, and P respectively. The first joint axis points up vertically, and the fifth joint axis intersects the fourth perpendicularly. The D-H parameters are as given under. Find the overall transformation matrix for the robot.

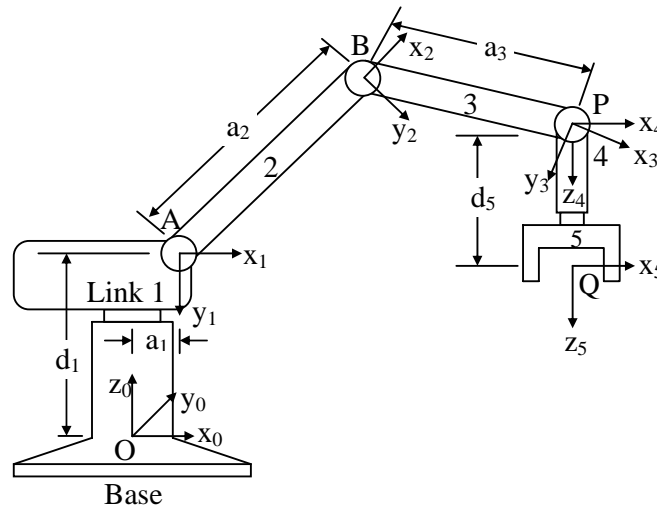


Fig. 1

D-H parameters of a Scorbot robot

Joint i	α_i	a_i	d	θ_i
1	$-\pi/2$	$a_1 = 10$	$d_1 = 5$	$\theta_1 = 30$
2	0	$a_2 = 15$	$d_2 = 0$	$\theta_2 = 45$
3	0	$a_3 = 20$	$d_3 = 0$	$\theta_3 = 60$
4	$-\pi/2$	$a_4 = 0$	$d_4 = 0$	$\theta_4 = 50$
5	0	$a_5 = 0$	$d_5 = 5$	$\theta_5 = 70$

4. a) How do you classify parallel manipulators?
 b) Figure-2 shows the schematic diagram of planar 2-d.o.f. five-bar manipulator that is constructed with one prismatic and four revolute joints. Find the end effector position q as function of the two input joint variables, d_1 and θ_2 .

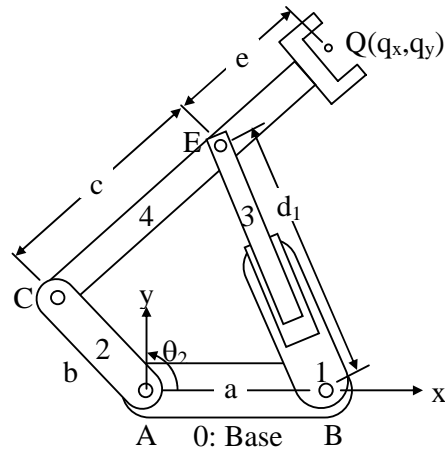


Fig. 2

5. a) What is a Jacobian?
 b) Derive the conventional Jacobian of a planar 2-d.o.f. manipulator shown in Figure-3.

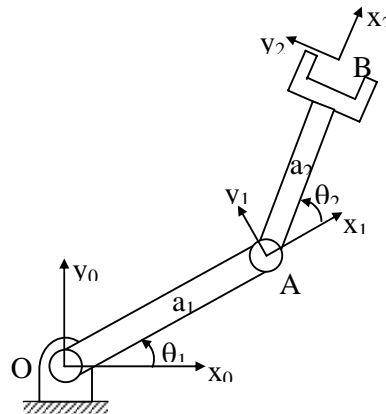


Fig. 3

6. a) A single-link robot with a rotary joint is motionless at $\theta = 15^\circ$. It is desired to move the joint in a smooth manner to $\theta = 75^\circ$ in 3 seconds. Find the coefficients of a cubic which accomplishes this motion and brings the manipulator to rest at the goal. Plot the position, velocity, and acceleration of the joint as a function of time.
 b) What is collision-free path planning?
7. Write about any Robot Language providing a sampling of the important features and statements.
8. Write short notes on any THREE of the following:
 a) Homogeneous Transformation Matrix.
 b) Method of successive crew displacements.
 c) Planning paths using the dynamic model.
 d) Demonstration of points in space.

MODEL QUESTION PAPER-Mechanical Engineering
M.E. (CAD/CAM)-I SEMESTER
MD 105 ADVANCED OPTIMIZATION TECHNIQUES (Model paper)
(Four Semester-Credit System-w.e.f. 2007--2008)

Time : 3 Hrs.

Max. Marks : 70

Answer any FIVE questions.

All questions carry equal marks.

1. a) What is arithmetic – geometric inequality?
b) Minimize the following function:

$$f(X) = \frac{1}{2}x_1^2 + x_2 + \frac{2}{3}x_1^{-1}x_2^{-1}$$

2. a) Explain the problem of Dimensionality in Dynamic programming.
b) Maximize $f(x_1, x_2) = 50x_1 + 100x_2$

Subjected to

$$10x_1 + 5x_2 \leq 2500$$

$$4x_1 + 10x_2 \leq 2000$$

$$x_1 + 1.5x_2 \leq 450$$

$$x_1 \geq 0, \quad x_2 \geq 0$$

3. Solve the following problem using Bala's method.

Minimize $f = 3x_1 + 2x_2 + x_3 + x_4$

Subjected to

$$x_2x_3 + x_4 \leq 1$$

$$2x_1 + x_2x_3 + x_4 \geq 3$$

$$x_i = 0 \text{ or } 1, \quad i = 1, 2, 3, 4.$$

4. A contractor plans to use four tractors to work on a project in a remote area. The probability of a tractor functioning for a year without a breakdown is known to be 82%. If X denotes the number of tractors operating at the end of a year, determine the probability mass and distribution function of X and also find the expected value and the standard deviation of the number of tractors operating at the end of one year.

5. Find the minimum of

$$f_1 = x_1^2 + x_2^2$$

$$f_2 = (x_1 - 2)^2 + x_2^2$$

Subject to

$$x_1 - x_2 - 1 \leq 0$$

6. a) Construct the objective function to be used in GAs for a minimization problem with mixed equality and inequality constraints.

b) Consider the following two strings denoting the vector X_1 and X_2

$$\mathbf{X}_1: \{1\ 0\ 0\ 0\ 1\ 0\ 1\ 1\ 0\ 1\}$$

$$\mathbf{X}_2: \{0\ 1\ 1\ 1\ 1\ 1\ 1\ 0\ 1\ 1\ 0\}$$

Find the result of crossover at location 2. Also, determine the decimal value of the variable before and after crossover if each string denotes a vector of two variables.

7. a) What is a sigmoid function? How it is affected by weighted sum of inputs, explain.
b) How is a neuron modeled in neural network-based model, explain with one example.

8. Explain any four of the following.
- Goal programming method
 - Simulated Annealing Algorithm
 - Continuous Dynamic programming
 - Branch & Bound method
 - Complementary Geometric programming

MODEL QUESTION PAPER-Mechanical Engineering
M.E. (CAD/CAM)-I SEMESTER

CADM 106 ADVANCED DESIGN
(Four Semester-Credit System-w.e.f. 2007--2008)

Time : 3 Hrs.

Max. Marks : 70

Answer any FIVE questions.

All questions carry marks.

Assume any missing data with justification.

- What is need analysis?
 - Explain different design specifications with suitable examples.
- Explain different stages of product life cycle. Illustrate with a suitable example.
 - Briefly enumerate the advantages of standardization.
- Explain Von Mises stress.
 - For the bicycle pedal arm assembly as shown in Fig.1 with rider applied force of 1500 N at the pedal, determine the Von Mises stress in the 15 mm dia pedal arm. The pedal attaches to the arm with a 12 mm thread. Find the Von Mises stress in the screw. Find the safety factor against static failure if the material has $S_y = 350$ MPa.



Fig. 1

- Explain the mechanism of fatigue failure.
 - Explain various factors affecting fatigue life of a component.
- Explain the design considerations for casting process with examples.
 - Briefly explain design process for non-metallic parts.
- Explain the conventional breakeven chart.
 - What is manufacturability? Describe its significance in design for manufacturing.
- What is creativity?
 - Explain the various creative techniques.
- Write any FOUR of the following:

 - Shigley model of design.
 - Fracture mechanics theory of failures.
 - Stress concentration factors.
 - Design for reliability.
 - Material selection concepts.

SECOND SEMESTER

CADM 201 COMPUTER INTEGRATED MANUFACTURING

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.

Ses. : 30 Exam: 70

Examination (Theory): 3hrs.

Credits: 4

Introduction: Scope of computer integrated manufacturing, Product cycle, Production automation.

Group technology: Role of group technology in CAD/CAM integration, Methods for developing part families, Classification and coding, Examples of coding systems, Facility design using group technology, Economics of group technology.

Computer aided process planning: Approaches to process planning - Manual, Variant, Generative approach, Process planning systems - CAPP, DCLASS, CMPP, Criteria for selecting a CAPP system, Part feature recognition, Artificial intelligence in process planning.

Integrative manufacturing planning and control: Role of integrative manufacturing in CAD/CAM integration, Over view of production control - Forecasting, Master production schedule, Capacity planning, M.R.P., Order release, Shop-floor control, Quality assurance, Planning and control systems, Cellular manufacturing, JIT manufacturing philosophy.

Computer aided quality control: Terminology in quality control, Contact inspection methods,

Noncontact inspection methods, Computer aided testing, Integration of CAQC with CAD/CAM.

Computer integrated manufacturing systems: Types of manufacturing systems, Machine tools and related equipment, Material handling systems, Computer control systems, FMS.

References:

1. CAD/CAM Principles and Applications by P.N. Rao, Tata McGraw Hill Publishing Company Ltd.
2. CAD/CAM Computer Aided Design and Manufacturing by Mikell P. Groover and Emory W. Zimmer, Jr.
3. Computer Integrated Design and Manufacturing by David D. Bedworth, Mark R. Henderson, Philip M. Wolfe.
4. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P. Groover, Prentice Hall of India Pvt. Ltd.
5. Principles of Computer Integrated Manufacturing by Vajapayee, Prentice Hall of India Pvt. Ltd.

CADM 202 VISION SYSTEMS AND IMAGE PROCESSING

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.

Ses. : 30 Exam: 70

Examination (Theory): 3hrs.

Credits: 4

Machine vision - Vision sensors - Comparison with other types of sensors - Image acquisition and recognition - Recognition of 3D objects - Lighting techniques - Machine vision applications.

Image representation - Application of image processing - Image sampling, Digitization and quantization - Image transforms.

Spatial domain techniques - Convolution, Correlation. Frequency domain operations - Fast Fourier transforms, FFT, DFT, Investigation of spectra. Hough transform

Image enhancement, Filtering, Restoration, Histogram equalisation, Segmentation, Region growing.

Image compression - Edge detection - Thresholding - Spatial smoothing - Boundary and Region representation - Shape features - Scene matching and detection - Image classification.

References:

1. Digital Image Processing by Gonzalez, R.C. and Woods, R.E., Addison Wesley Publications.
2. Robot Vision by Prof. Alan Pugh (Editor), IFS Ltd., U.K. 3. Digital Image Processing by A. Rosenfeld and A. Kak, Academic Press.
4. The Psychology of Computer Vision by P. Winstan, McGraw-Hill.
5. Algorithms for Graphics and Image Processing by T. Pavidis, Springer Verlag.

CADM 203 NEURAL NETWORKS AND FUZZY TECHNIQUES

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.

Ses. : 30 Exam: 70

Examination (Theory): 3hrs.

Credits: 4

Neural networks and fuzzy systems: Neural and fuzzy machine intelligence, Fuzzy as multivalence, The dynamical - Systems approach to machine intelligence, Intelligent behaviour as adaptive model - Free estimation.

Neural dynamics-I: Activations and signals, Neurons as functions, Signal monotonicity, Biological activations and signals, Neuron fields, Neuronal dynamical systems, Common signal functions, Pulse-coded signal functions.

Neuronal dynamics-II: Activation models, Neuronal dynamical systems, Additive neuronal dynamics, Additive neuronal feedback, Additive bivalent models, BAM connection matrices, Additive dynamic and the noise - Saturation dilemma, General neuronal Activations: Cohen-Grossberg and multiplicative models. Synaptic Dynamics I: Unsupervised learning, Learning as encoding, change, and quantization, Four unsupervised learning laws, Probability spaces and random processes, Stochastic unsupervised learning and stochastic equilibrium, Signal Hebbian learning, Competitive learning, Differential Hebbian learning, Differential competitive learning.

Synaptic Dynamics II: Supervised learning, Supervised function estimation, Supervised learning as operant conditioning, Supervised learning as stochastic pattern learning with known class memberships, Supervised learning as stochastic approximation, The back propagation algorithm.

Fuzziness Versus: Probability fuzzy sets and systems, Fuzziness in a probabilistic world, Randomness vs. ambiguity: Whether vs. how much, The universe as a fuzzy set, The geometry of fuzzy set, The geometry of fuzzy sets: Sets as points. The fuzzy entropy theorem, The subethood theorem. The entropy-subethood theorem.

Fuzzy associative memories: Fuzzy systems as between-cube mappings, Fuzzy and neural function estimators, Fuzzy Hebb FAMs, Adaptive FAMs: Product-space clustering in FAM cells. Applications in design and structural analysis.

References:

1. Neural Networks & Fuzzy Systems by Bark Kosko, PHI Published in 1994
2. Neural Network Fundamentals with Graphs, Algorithms and Applications by B.K. Bose, Tata- McGraw Hill.
3. Neural network Design by Hagan, Demuth and Beale, Vikas Publishing House.

4. Fundamentals of Artificial Neural Networks by Mohamad H Hassoum. PHI.
5. Fuzzy Set Theory & its Application by .J. Zimmerman Allied Published Ltd.
6. Algorithms and Applications of Neural Networks in Mechanical Engineering by M. Ananda Rao and J. Srinivas, Narosa Publishing House.

CADM 204 ADVANCED FINITE ELEMENT ANALYSIS
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.
Examination (Theory): 3hrs.

Ses. : 30 Exam: 70
Credits: 4

Introduction, Finite elements of an elastic continuum - displacement approach, generalization of the finite element concept - weighted residuals and variational approaches. Plane stress and plane strain, Axisymmetric stress analysis, 3-D stress analysis.

Element shape functions - Some general families of C continuity, curved, isoparametric elements and numerical integration. Some applications of isoparametric elements in two-and-three dimensional stress analysis.

Bending of thin plates - A C continuity problem. Non-conforming elements, substitute shape functions, reduced integration and similar useful tricks. Lagrangian constraints in energy principles of elasticity, complete field and interface variables (Hybrid method).

Shells as an assembly of elements, axisymmetric shells, semi-analytical finite element processes - Use of orthogonal functions, shells as a special case of 3-D analysis. Steady-state field problems - Heat conduction, electric and magnetic potentials, field flow, etc.

The time domain, semi-discretization of field and dynamic problems and analytical solution procedures. Finite element approximation to initial value - Transient problems.

References:

1. The Finite Element Method by O.C. Zienkiewicz, Tata McGraw Hill Company Ltd.
2. The Finite Element Methods in Engineering by Rao, S.S.
3. Concepts and Applications of Finite Element Analysis by Cook, R.D.
4. Applied Finite Element Analysis by Segerland, L.J.

Elective – I-(A)CADM 205 MECHATRONICS
(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.
Examination (Theory): 3hrs.

Ses. : 30 Exam: 70
Credits: 4

Mechatronics system design: Introduction to Mechatronics: What is mechatronics, Integrated design issues in mechatronics, Mechatronics key elements, The mechatronics design process, Advanced approaches in mechatronics.

Modelling and simulation of physical systems: Simulation and block diagrams, Analogies and impedance diagrams, Electrical systems, Mechanical translational systems, Mechanical rotational systems, Electromechanical coupling, Fluid systems.

Sensors and transducers: An introduction to sensors and transducers, Sensors for motion and position measurement, Force, torque and tactile sensors, Flow sensors, Temperature-sensing devices. Actuating devices: Direct current motor, Permanent magnet stepper motor, Fluid power actuation.

Signals, systems and controls: Introduction to signals, systems and controls, System representation, Linearization of nonlinear systems, Time delays.

Real time interfacing: Introduction, Elements of a data acquisition and control system, Overview of the I/O process, Installation of the I/O card and software.

Advanced applications in mechatronics: Sensors for condition monitoring, Mechatronic control in automated manufacturing, Artificial intelligence in mechatronics, Microsensors in mechatronics.

Text Books:

1. Mechatronics System Design by Devdas Shetty and Richard A. Kolk, P.W.S. Publishing Company, 2001

References:

1. Mechatronics by W. Bolton, Pearson Education, Asia, II-Edition, 2001
2. Introduction to Mechatronics and Measurement Systems by Michael B. Hstand and David G. Alciatore, Tata McGraw Hill Company Ltd.

Elective – I- (B) CADM 205 CONCURRENT ENGINEERING

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.

Ses. : 30 Exam: 70

Examination (Theory): 3hrs.

Credits: 4

Introduction: Concurrent design of products and systems - Product design - Fabrication and assembly system design - designing production systems for robustness and structure.

Strategic approach and technical aspects of product design: Steps in the strategic approach to product design - Comparison to other product design methods - Assembly sequence generation - Choosing a good assembly sequence - Tolerances and their relation to assembly - Design for material handling and part mating - Creation and evaluation of testing strategies.

Basic issues in manufacturing system design: System design procedure - Design factors - Intangibles - Assembly resource alternatives - Task assignment - Tools and tool changing - Part feeding alternatives - Material handling alternatives - Floor layout and system architecture alternatives.

Assembly workstation design: Strategic issues - Technical issues analysis.

Design of automated fabrication systems: Objectives of modern fabrication system design - System design methodology - Preliminary system feasibility study - Perform detailed work content analysis - Define alternative fabrication configurations - Configuration design and layout - Human resource considerations - Evaluate technical performance of solution.

Case studies: Automobile air conditioning module - Robot assembly of automobile rear axles.

Reference:

1. Concurrent Design of Product and Processes by James L. Nevins and Daniel E. Whitney, McGraw-Hill Publishing Company, 1989.

Elective - II –(A)CADM 206 SIGNAL ANALYSIS AND CONDITION MONITORING

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.

Ses. : 30 Exam: 70

Examination (Theory): 3hrs.

Credits: 4

Introduction: Basic concepts. Fourier analysis. Bandwidth. Signal types. Convolution.

Signal analysis: Filter response time. Detectors. Recorders. Analog analyzer types.

Practical analysis of stationary signals: Stepped filter analysis. Swept filter analysis. High speed analysis. Real-time analysis.

Practical analysis of continuous non-stationary signals: Choice of window type. Choice of window length. Choice of incremental step. Practical details. Scaling of the results.

Practical analysis of transients: Analysis as a periodic signal. Analysis by repeated playback (constant bandwidth). Analysis by repeated playback (variable bandwidth).

Condition monitoring in real systems: Diagnostic tools. Condition monitoring of two stage compressor. Cement mill foundation. I.D. fan. Sugar centrifugal. Cooling tower fan. Air separator. Preheater fan. Field balancing of rotors. ISO standards on vibrations.

References:

1. Condition Monitoring of Mechanical Systems by Kolacat.
2. Frequency Analysis by R.B.Randall.
3. Mechanical Vibrations Practice with Basic Theory by V. Ramamurti, Narosa Publishing House.

Elective - II –(B)CADM 206 FLEXIBLE MANUFACTURING SYSTEMS

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 4 Th.

Ses. : 30 Exam: 70

Examination (Theory): 3hrs.

Credits: 4

Introduction: The economic justification of FMS, The basic components of FMS and their integration in the data processing system, The concept of the 'total system'.

Management decisions during FMS project planning, design and implementation: Designing the FMS, Data processing design, FMS project and software documentation.

Artificial intelligence in the design of FMS: LISP, PROLOG, Expert systems, Expert systems in FMS design and control, Integrative aspects of AI languages.

Distributed processing in FMS: Introduction to database management systems (DBMS) and their application in CAD/CAM and FMS, Distributed systems in FMS.

Distributed tool data bases in FMS: The distributed tool data structure with a general purpose tool description facility, Implementation of the FMS tool data base, Application possibilities of the FMS tool data base.

FMS database for clamping devices and fixtures: The FMS clamping device and fixture data base, The analysis and calculation of pallet alignment and work mounting errors, Mating surface description methods for automated design and robotised assembly, Application of industrial robots in FMS, The application of automated guided vehicle (AGV) systems.

Coordinate measuring machines in computer integrated systems: Overview of coordinate measuring machine, Contact and non-contact inspection principles, Part programming coordinate measuring machines, In-cycle gauging.

References:

1. The Design and Operations of FMS by Dr. Paul Ranky, IFS (Publications) Ltd., UK, 1983.
2. Flexible Manufacturing Systems in Practice by Joseph Talavage and Roger G. Hannam, Marcel Dekker Inc., New York.
3. Robotics Technology and Flexible Automation by S.R. Deb, Tata McGraw Hill Company Ltd.

CADM 207 CAM LAB

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Periods/week: 3Pr

Ses. : 50

Credits : 2

Manual and computer assisted part programming exercises on CNC machine tools.

Surface generation, Tool selection, NC code generation and Tool path simulation for turning and milling operations using CAM packages like CATIA, Gibbs CAM, Master CAM.

Robot programming off-line and on-line.

THIRD SEMESTER**CADM 301 PROJECT**

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Project (to be continued in Fourth semester)

Periods per week: 12

Credits: 14

Semester end appraisal of Project through a seminar by a committee consisting of Head of the Department, Chairman, Board of Studies & Guide

FOURTH SEMESTER

(Four-Semester Course -Credit System- w.e.f. 2007-2008)

Project (continued from Third semester)

Periods per week: 12

Presentation followed by Viva-Voce Examination with the following members.

1. Chairman, Board of Studies.
2. Head of the Department.
3. External Examiner.
4. Internal Guide and External Guide (if any).

No marks are allotted for the Project work.

Viva-voce - Examination: Recommended/Not recommended.

For final result the dissertation credits are not added for CGPA..