

Dec 2006 Paper

[Total No. of Questions : 12]

P1314

[3064]-424

**B.E. (Mech. & Mech. S/W)
CAD/CAM & AUTOMATION
(2003 Course)**

[Time : 3 Hours]

[Max. Marks : 100]

Instructions to the candidates :

- i) *Answers to the two sections should be written in separate books.*
- ii). *Neat Diagrams must be drawn wherever necessary.*
- iii). *Assume suitable data, if necessary.*
- iv). *Figures to the right indicate full marks.*
- v). *Use of electronic pocket calculator is allowed.*

SECTION - I

- Q1).** a) What is the significance of homogeneous coordinates in geometric transformation ? Explain the two dimensional Translation, Rotation, Scaling and Reflection. [8]
- b) A triangle ABC with vertices A (0, 0), B (60, 30), and C (0, 30) is to be scaled by a factor of 2 about point (60, 30). Determine : [8]
- (i) The composite transformation matrix; and
 - (ii) The coordinates of the vertices for a scaled triangle.

OR

- Q2).** a) Explain the following [6]
- i) Concatenated Transformation
 - ii) Inverse Transformation
- b) A triangle ABC with vertices A (2, 4), B (4, 6), and C (2, 6) is to be reflected about the line $x - 2y + 4 = 0$. Determine : [10]
- i) The composite transformation matrix; and
 - ii) The coordinates of the vertices for a reflected triangle.
- Q3).** a) Find the unit tangent vector in the direction of a line parallel to an existing line. [6]
- b) Find the radius and the center of a circle whose diameter is given by two points. [8]
- c) Explain Constructive Solid Geometry [5]

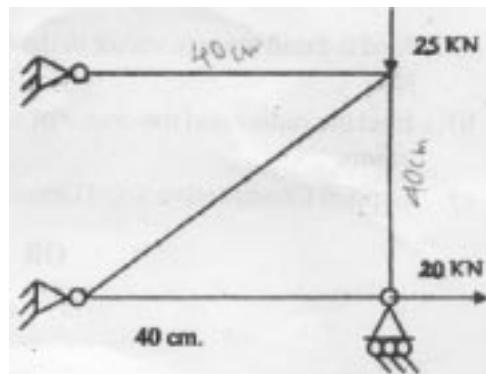
OR

- Q4).** a) Explain Bezier surface and B-Spline surface. [5]
- b) The parametric equation of a sphere of radius R and center at point $P_o (X_o, Y_o, Z_o)$ is given by :
- $$X = X_o + R \cos u \cos v$$
- $$Y = Y_o + R \cos u \sin v$$
- $$Z = Z_o + R \sin u$$
- Where $-\pi/2 \leq u \leq \pi/2$ and $0 \leq v \leq 2\pi$
- Find the sphere implicit equation. [6]
- c) Explain Feature Based Modeling. [5]

- Q5).** a) What are the properties of Global Stiffness Matrix ? [4]
 b) Obtain an element stiffness matrix in global coordinate system for two dimensional truss elements. [8]
 c) The two node one dimensional element has nodes 1 and 2 located at the distance of 200 and 360 mm respectively from y axis. The displacement of nodes 1 and 2 are 0.03 and - 0.05 mm respectively. At point P, located at a distance 40 mm from node 1 within the element; determine : [6]
 i) The natural coordinates
 ii) The linear shape function and
 iii) The displacement.

OR

- Q6)** a) Obtain the Element Strain-Nodal Displacement relationship for two-noded one-dimensional element. [5]
 b) For a typical three-noded quadratic element, what are quadratic shape functions and write the displacement field (u) within the element in terms of nodal displacements. [5]
 c) Consider the four bar truss as shown in the figure. It is given that $E = 29.5 \times 10^6 \text{ N/cm}^2$ and $A = 1 \text{ cm}^2$ for all elements. Determine [8]
 i) Global Stiffness matrix
 ii) The nodal displacement
 iii) The reaction forces.



SECTION - II

- Q7)** a) Evaluate the shape functions at the interior point P for the triangular element with nodes at node 1 (1.5, 2), node 2 (7, 3.5) and node 3 (4, 7). Also determine the Jacobian transformation J for the same element. [8]
 b) Explain how to model and apply boundary conditions to following types of problem. [8]
 i) Cylinder subjected to internal pressure.
 ii) Belleville Spring.

OR

- Q8)** a) Explain Shape functions of CST element. Also explain the physical representation by area coordinates [6]
 b) What are different types of symmetry used in FEA ? Explain with applications. [5]
 c) Explain why Higher Order Elements are used. Draw the following higher order elements. [5]
 i) Eight-node quadrilateral
 ii) Nine-node quadrilateral

- Q9)** a) Write down step by step procedure to machine any job on any CNC system. [6]
b) Explain with suitable sketch, axis format of CNC systems. [5]
c) Explain the following terms related to CNC machine. [5]
i) Job zero
ii) Home zero
iii) Tool offsets.

OR

- Q10)** a) What are canned cycles ? How does a canned cycle reduce program lengths ? [5]
b) How circular motion of tool is defined by G codes in CNC lathe. Explain with neat sketch. [5]
c) What are different ways to define 'Circle' using geometric statements of APT programming ? [6]

- Q11)** a) State differences between : [6]
i) Hard and soft automation.
ii) Tool oriented and job oriented FMS.
b) Draw a sketch showing typical layout of computers used in CIM and explain the functions of each computer. [6]
c) What are various configurations of a robot ? Explain with suitable sketches. [6]

OR

- Q12)** a) Discuss different types of tool magazines used in CNC machining centers. [6]
b) Explain with a suitable sketch the meaning of the following terms : [6]
i). Pitch
ii). Yaw
iii). Roll
c) What is robot vision system ? Explain the applications of robot vision system. [6]

