Ex. Seat No._____

GANPAT UNIVERSITY

B.Tech Sem VII th (Mechatronics)
Regular Examination December 2012
MC-703 Computer Aided Design

Time: 3 Hrs **Marks: 70**

Instructions:

(i) All questions are compulsory.
(ii) Answers to two sections must be written in separate answer sheets.
(iii) Assume suitable data wherever necessary.
(iv) Figure to right indicates marks.

SECTION - I

Q1 **Answer the following Questions:**

(a) Define : Aspect ratio, Resolution, World coordinate, frame rate 2
(b) What is CAD? Explain CAD cycle in brief. 3
(c) Expalin in Brief : GKS, IGES 3
(d) For a circle radius r=8,calculate the pixels by midpoint algorithm in first quadrant from x=0 to x=y. 3

Q2 **Answer the following Questions:** 12

(a) Explain B spline surface with equation and explain how constants are calculated. Also give properties of B spline surface.
(b) What is CSG in solid Modeling? Explain in brief.
(c) The co-ordinates of four control point relative to a current WCS are given by $P_0=[3\ 3\ 0]^T$,$P_1=[3\ 4\ 0]^T$, $P_2=[4\ 4\ 0]^T$, $P_3=[4\ 3\ 0]^T$, find the equation of resulting Bezier curve. Also find point on the curve for u=0,1/4,1/2,3/4, and 1.

OR

Q2 **Answer the following Questions:**

(a) Write short note : "B-rep" Solid modeling. 12
(b) Write program for Bazier surface for four data point.
(c) "Assembly modeling "Explain in brief.

Q3 **Answer the following Questions:** 12

(a) Prove that uniform scaling and rotation form a commutative pair of operations but in general scaling and rotation are not commutative.
(b) For ΔABC having co-ordinates A(4,4) , B(7,4) and C(4,9). Determine new vertex position if it is reflected about a line y=3x+4.
(c) Show that transformation matrix for reflection about the line y=x is equivalent to reflection relative to x axis followed by an anticlockwise of 90^0.

OR

Q3 **Answer the following Questions:** 12

(a) ΔABC having co-ordinate A(8,4) , B(6,2) and C(5,3) rotate it by an angle 40^o about point A. Give the co-ordinate of rotated triangle.
(b) Prove that multiplication of transformation matrix for each of the following. (1).Two successive rotations (2). Two successive scaling
(c) Write a orthographic projection transformation matrix for x = 0, y = 0,z=0. axis find ortho projection for.

$$P = \begin{bmatrix} 0 & 0 & 1 & 1 \\ 1 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 \\ 0 & 1 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 1 \end{bmatrix}$$

Section -2

Q.4 **Answer the following questions.** 11

(a) Explain the penalty approach used in FEA.

(b) Write applications of Finite Element Analysis.

(c) A tapered bar having circular section 150 mm^2 and 60 mm^2 respectively for big end and small end. Big end is fixed while small end is having a point load of 60 kN. And length of tapered bar is 300mm. plot the deflection in the bare at 100mm and 200mm respectively form the fixed end for each of the cases, assume modulus of elasticity as 200 GPa.

OR

Q.4 **Answer the following questions.** 11

(a) Explain Minimum Potential Energy principal for FEA.

(b) For the compound section shown in fig.1 fixed at both ends. Estimate reaction at both ends and stress, when a force of 1000N is applied at the change of cross section.

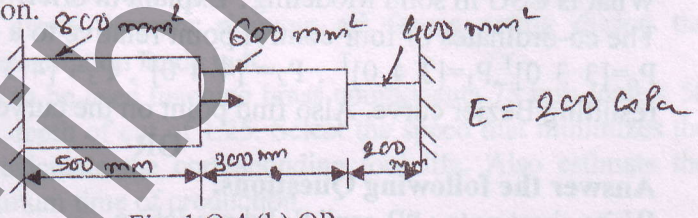


Fig. 1 Q.4 (b) OR

Q.5 **Answer the following questions.** 12

(a) Derive a matrix B (Strain displacement matrix) for bar element and also calculate the strain in each element if nodal displacements are $q_1 = 2.0e^{-4}$, $q_2 = 2.0e^{-3}$, $q_3 = 2.0e^{-02}$ and $q_4 = 2e^{-01}$ respectively.

Use shape functions for both nodes in the bar element as under :

$$N_1 = \sin\frac{\pi}{6}x.\cos\frac{\pi}{3}x \quad N_2 = \sin\frac{\pi}{3}x.\cos\frac{\pi}{6}x$$

(b) Write down importance of nodal connectivity information and explain by one example.

OR

Q.5 **Answer the following questions.** 12

(a) Write a short note on plane stress and plane strain in FEA.

(b) Explain local and global coordinate system for truss element? Derive the expression for stiffness and stress in truss element.

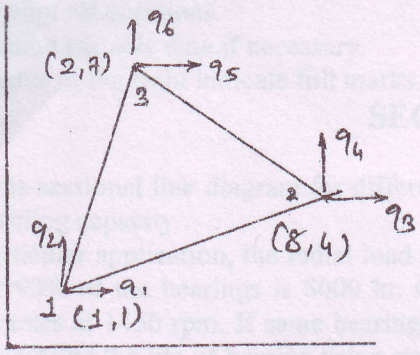
(c) Give name of different types of 1D and 2D elements with their applications.

Q.6 **Answer the following questions.** 12

(a) Explain Constant-Strain Triangle for two dimensional problem. And derive

displacement field isoparametric matrix.

(b) For the triangular element shown in figure 2, obtain the strain-displacement relation matrix B and determine the strains ε_x, ε_y and γ_{xy}.



$q_1 = 0.001$ $q_2 = -0.004$

$q_3 = 0.003$ $q_4 = 0.002$

$q_5 = -0.002$ $q_6 = 0.005$

Fig. 2. Q. 6(b)

End of Paper