Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER – VI EXAMINATION – WINTER 2015

Subject Code:161903 **Date:08/12/ 2015**

Subject Name: Computer Aided Design

Time:2:30pm to 5:00pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	(i). Discuss the advantages of finite element analysis	**03**
		(ii). Differentiate between analytic curves and synthetic curves.	**04**
	(b)	Write 3x3 transformation matrix for each of the following effects; (i). Scale the image to be twice as large and then translate it 1 unit to the left. (ii). Scale x direction to be half as large and the n rotate anticlockwise by 90^0 about origin. (iii). Rotate anticlockwise about origin by 90^0 and then scale the x direction by half as large. (iv). Translate down 0.5 unit, right 0.5 unit, and then rotate anticlockwise by 45^0.	**07**
Q.2	**(a)**	Discuss Bresenham's algorithm for generation of line using suitable example.	**07**
	(b)	A triangle PQR has its vertices at P (0, 0), Q (4, 0) and R (2, 3). It is to be translated by 4 units in x direction, and 2 units in y direction, and then it is to be rotated in anticlockwise direction about the new position of point R through 90 degree. Find new position of triangle.	**07**
		OR	
	(b)	Coordinates of four data points P_0, P_1, P_2 and P_3 are (2, 2, 0), (2, 3, 0), (3, 3, 0) and (3, 2, 0) respectively. Find the equation of Bazier curve and determine the coordinates of points on curve for u = 0, 0.25, 0.5, 0.75 and 1.0.	**07**
Q.3	**(a)**	A line is represented by the end points P_1(2, 4, 6) and P_2(-3, 6, 9). If the value of parameter u at P_1 and P_2 is 0 and 1 respectively, determine the tangent vector for the line. Also determine the coordinate of a point represented by; u equal to 0, 0.25, -0.25, 1 and 1.5. Also find the length and unit vector of line between two points P_1 and P_2.	**07**
	(b)	Discuss Initial Graphics Exchange Specification (IEGS) data exchange format.	**07**
		OR	
Q.3	**(a)**	Derive from fundamentals the parametric equation for the Hermite Cubic spline. Represent the equation in matrix form.	**07**
	(b)	Enlist the various methods of geometric modeling. Discuss wire frame modeling in detail.	**07**
Q.4	**(a)**	(i). Discuss the properties of global stiffness matrix.	**03**
		(ii). For one dimensional element shown in Figure 1, temperature at node 1 is 100 ^{0}C and at node 2 is 40 ^{0}C. Evaluate shape function associated with node 1 and node 2. Calculate temperature at point P. Assume linear shape function.	**04**

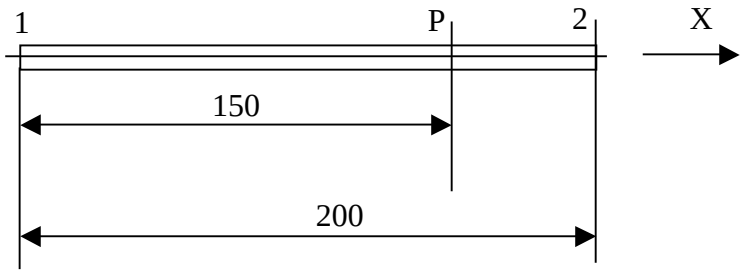

Figure 1

(b) A stepped metallic bar, made of aluminum (E_1 = 70 x 10^3 N/mm^2) and steel (E_2 = 200 x 10^3 N/mm^2), is subjected to the axial force of 5000 N, as shown in figure 2. It is attached to rigid wall at node 1. Determine nodal displacements using finite element analysis. **07**

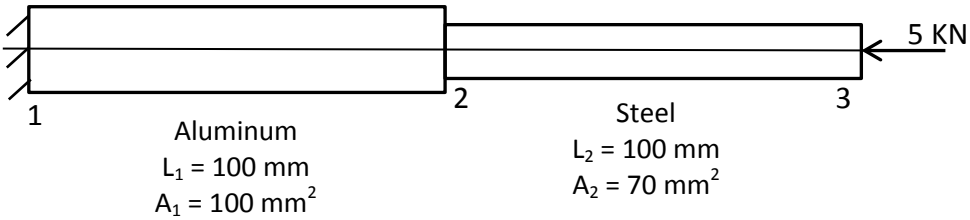

Figure 2

OR

Q.4 (a) Figure 3 shows two springs connected in series, having stiffness 12 and 8 N/mm respectively. One end of the assembly is fixed and a force of 60 N is applied at the end. Using finite element method; **07**

(i). Derive global stiffness matrix

(ii). Derive global load vector

(iii). Find displacement of all the nodes

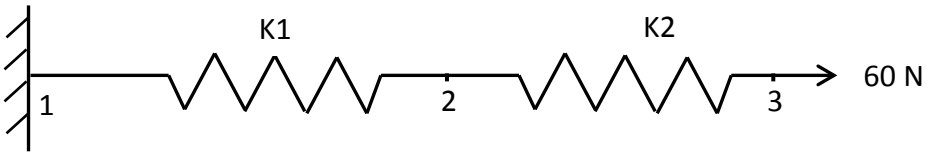

Figure 3

(b) With reference to finite element analysis, discuss the treatment of boundary condition using elimination approach. **07**

Q.5 (a) (i). Briefly discuss the objectives of optimization. **03**

(ii). A firm manufacturers three products A, B and C. Firm has two machines M1 and M2. Profit per product along with required processing time in minutes for each product on each machine is given in the following table. Machine M1 and M2 are available with maximum 2000 and 2500 minutes. Firm must produce minimum 100, 200 and 50 units of products A, B and C respectively. Formulate linear programming problem to maximize the profit. **04**

	Processing time for product (in minute)		
	A	B	C
Machine M1	4	3	5
Machine M2	3	2	4
Profit per unit (in Rs.)	3	2	4

(b) There is a rectangular box with fixed surface area of 20 square meters. Using Lagrange multiplier method, find the dimensions of box so that its volume is maximized. **07**

OR

Q.5 (a) Discuss classification of optimization problem using suitable examples. **07**

(b) Solve following linear programming problem using graphical method. **07**

Maximize $P = 800H + 2000W$

Subject to: $10H + 20W \leq 4000$

$25H + 10W \leq 5000$

$6H + 14W \leq 2100$

$H \geq 0$ and integer; $W \geq 0$ and integer

****