Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER-VI (NEW) - EXAMINATION - SUMMER 2017

Subject Code: 2161903

Subject Name: Computer Aided Design

Time: 10:30 AM to 01:00 PM

Total Marks: 70

Date: 08/05/2017

Instructions:

Q.2

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

MARKS

Q.1 Short Questions

- 1 DVST stands for a. Digital View Storing Table b. Direct Visual Storage Tube c. Direct View Storage Tube d. Digital View Storage Tube modeler defines model without mass properties. 2 Α a. wireframe b. primitive c. B-rep d. CSG 3 What is persistence? 4 A triangle has vertices at A(2, 3), B(4, 3), and C(3, 6). Which transformation would produce an image with vertices A'(3, -2), B'(3, -4), C'(6, -3)? b. a reflection over the y-axis a. a reflection over the *x*-axis c. a rotation 90° clockwise at origin d. a rotation 90° counterclockwise at B-rep and C-Rep are the methods of 5 a. Solid modeling b. Surface modeling c. Wire frame modeling d. 2D modeling The degree of Bezier curve with n control points is: 6 a. (n+1) b. (n-1) c. (n+2) d. (n-2) C^1 continuity refers to 7 a. Common tangent b. Common curvature c. Common normal d. Common point 8 The rectangle portion of the interface window that defines where the image will actually appear are called a) Transformation viewing b) View port c) Clipping window d) Screen coordinate system 9 State limitations of wire-frame modeling. 10 State any two advantages of homogeneous coordinate transformations. 11 Write two characteristics of any shape functions. 12 What is a difference between bar elements and beam elements? 13 What are the type of loading acting on structure? 14 Name any three FEM software. **(a)** State the various stages for a design process, in which various CAD tools can 03 be used to improve productivity. For the position vectors P_1 [3 7] and P_2 [8 9], determine the parametric **(b)** 04 representation of line segment between them. Also determine the slope 07
- (c) Write steps required to plot a line whose slope is between 45° & 90°, using 07 Bresenham's algorithm.

OR

(c) Determine the pixels for a straight line connecting two points (2, 7) and (15, 07)

10) using Bresenham's algorithm.

- Q.3 (a) State the properties of Hermite Cubic Splines. How these curves are differing 03 from Bezier curves?
 - (b) A point P is translated by (4,6,0) rotated about x-axis by 45° CCW and then rotated about z- axis by 30° CCW. Obtain the concatenated homogeneous transformation matrix and final coordinates of a point P.
 - (c) Differentiate between surface and solid modelling.State the limitations and applications of each of these modelling techniques.

OR

- Q.3 (a) Derive the orthographic projection matrices for the Top view and Right Hand 03 side view of a 3D model.
 - (b) Find reflection matrix, when the axis of reflection is given by the equation 04 y=5x.
 - (c) The vertices of a Bezier polygon are A_0 [2, 2], A_1 [3, 4], A_2 [3, 4] and A_3 [5, **07** 4]. Determine 4 points on the Bezier curve.
- Q.4 (a) Draw a sketch of following elements showing nodes: 03 (1) Quadrilateral (2) Six noded triangular (3) Tetrahedral
 - (b) Consider the bar shown in figure-1 below. Determine the nodal displacement 04 and element stresses.



(c) Formulate the finite element model using 1D-bar element for the system shown in figure-2 below. Area at the junction shown below is $A_J = 250 \text{ mm}^2$, at the left end is equal to $A_L = 750 \text{ mm}^2$ and at the right end is equal to $A_R = 500 \text{ mm}^2$. Length up to junction from any end is 200 mm. Load P=500kN is acting at the junction. Young's modulus of elasticity E= 200 GPa. The temperature of the system is raised by 40°C. Co-efficient of thermal expansion is 11×10^{-6} per °C. Assemble the stiffness matrix & force vector.



- **Q.4** (a) What do you mean by Iso-parametric representations?
 - (b) Find the nodal displacements and elemental stresses for the axially loaded 04 stepped bar as shown in figure-3 below using Penalty approach. E=200GPa, A_1 = 200 mm², A_2 =180 mm² and Δx = 0.1 mm.

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07

(c) A thin plate as shown in figure-4 has a uniform thickness of 10 mm and modulus of elasticity is 200 GPa. The plate is subjected to a point load P = 500 N as shown in figure. Model the problem with two elements and find stresses in each element.



Q.5 (a) Discuss quadratic shape functions and their uses.

(c) For the one dimensional fluid flow problem as shown in figure 5 with velocity07 known at right end, determine velocities at nodes 1 and 2. Let Kxx=2cm/s

$$1 \quad A_1 = 5 \text{ cm}^2 \quad 2 \quad A_2 = 3 \text{ cm}^2 \quad 3 \quad v_3 = 2 \text{ cm/s}$$

$$5 \text{ cm} \quad 5 \text{ cm}$$

OR

- Q.5 (a) Write the general steps to be followed in FEA to solve a structural problems. 03
 - (b) Evaluate the shape functions N1, N2 and N3 at the interior point P for the triangular element as shown in figure 6.
 - (c) A three element truss as shown in figure 7 has modulus of elasticity E= 200 07 GPa. The area of each element is 50 mm². The length $L_1= 1000$ mm and $L_2=750$ mm. The load $P_1=25$ KN and $P_2 = 30$ kN are applied as shown. Determine the nodal displacements, reaction forces and elemental stresses.

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