Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VI (NEW) EXAMINATION – SUMMER 2022**

**Subject Code:3161903 Date:03/06/2022**

**Subject Name:Computer Aided Design**

**Time:10:30 AM TO 01:00 PM Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

| | | | **MARKS** |
|---|---|---|---|
| **Q.1** | **(a)** | List different applications of CAD in mechanical engineering. Discuss the reasons for implementing CAD. | **03** |
| | **(b)** | Differentiate between<br>i) Raster Scan and Vector Scan Displays<br>ii) Analytic curves and Synthetic curves | **04** |
| | **(c)** | Explain the steps involved to solve static structural problem using finite element method. | **07** |
| **Q.2** | **(a)** | State the role of graphics standards in CAD. List various graphics standards with their full name. | **03** |
| | **(b)** | What is the need of homogenous transformations? Represent translation, scaling and rotation matrices for 3D transformations in homogenous form. | **04** |
| | **(c)** | Explain Bresenham's algorithm for drawing a line with slope m < 1. | **07** |
| | | **OR** | |
| | **(c)** | Determine the pixels for a straight line connecting two points (5,5) and (15,10) using DDA algorithm. | **07** |
| **Q.3** | **(a)** | Explain CSG techniques in solid modeling. | **03** |
| | **(b)** | Derive the expression of top view of an orthographic projection. | **04** |
| | **(c)** | Explain Bezier curve along with its properties. | **07** |
| | | **OR** | |
| **Q.3** | **(a)** | The end points for line $L_1$ are $P_1$ (5, 7, 9) and $P_2$(6, 8, 2). Determine (a) the parametric equation of the line (b) tangent vector of the line (c) Length of the line. | **03** |
| | **(b)** | Discuss in detail about the applications of optimization in engineering. | **04** |
| | **(c)** | Derive from fundamentals the parametric equation for the Hermite Cubic spline. Represent the equation in matrix form. | **07** |
| **Q.4** | **(a)** | Explain the three forms of equations used in Johnsons' method of optimum design. | **03** |
| | **(b)** | Explain the following surface entities.<br>i) Surface of revolution ii) Tabulated surface | **04** |
| | **(c)** | Consider a triangle ABC having coordinates A (1,3), B (-1,4), C (-1,2). Determine the vertices of the triangle after it being reflected about a line $y = 3x + 2$. | **07** |
| | | **OR** | |
| **Q.4** | **(a)** | "Finite element method gives approximately exact solutions". Justity. | **03** |
| | **(b)** | For a system shown in figure 1 below, the temperature at Node 1 is $100^0$ c and at Node 2 is $40^0$ c. The length of the element is 200 mm. Calculate the | **04** |

temperature at point 'P' situated at 150 mm from Node 1. Assume a linear shape function.

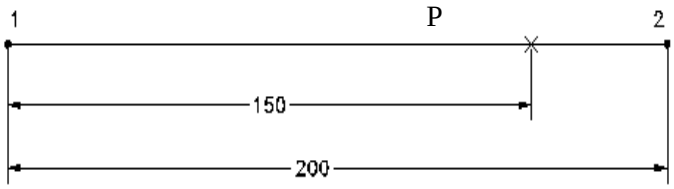


**Figure 1**

**(c)** Derive the element stiffness matrix of a truss element. **07**

**Q.5** **(a)** Differentiate between Plane truss and Space truss. **03**

**(b)** Explain 2D and 3D elements used in FEM along with their applications. **04**

**(c)** For a bar shown in figure 2 below, determine the nodal displacements and stresses in each element. Assume $A_1$ = 2400 $mm^2$, $E_1$ =70 GPa, $A_2$ = 600 $mm^2$, $E_2$ = 200 GPa, Take P = 20000 N. **07**

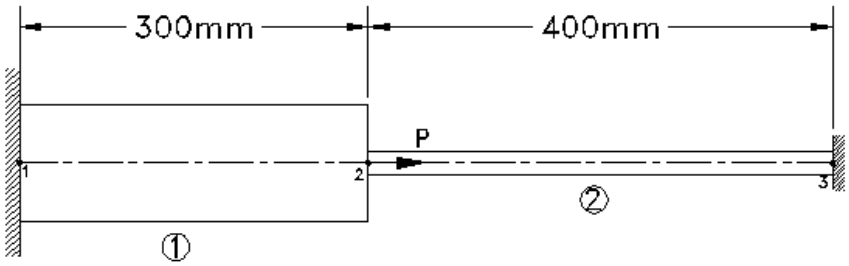


**Figure 2**

**OR**

**Q.5** **(a)** What are the properties of global stiffness matrix? **03**

**(b)** Explain Penalty approach for FEA. **04**

**(c)** For a compound section shown is figure 3 below, determine the nodal displacements and stresses in each element when a force F=1600 N is applied at the change of cross section. Use Penalty approach to solve the problem. **07**

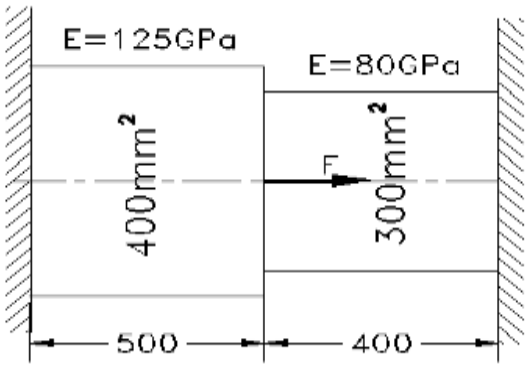


**Figure 3**

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