

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-VI (NEW) EXAMINATION – WINTER 2023****Subject Code:2161903****Date:13-12-2023****Subject Name:Computer Aided Design****Time:02:30 PM TO 05:00 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.
5. Abbreviations have usual meaning.

- Q.1** (a) Enlist advantages and limitations of LCD. **03**
 (b) Figure 1 shows a block (A) and a cylinder (B) while constructing a model. Sketch the result of (i) difference $A-B$, (ii) intersection $A \cap B$ Boolean operations on the model. **04**
 (c) Draw a flow chart of the DDA algorithm. **07**
- Q.2** (a) Give three limitations of non-parametric representation of curves. **03**
 (b) A line of 20-unit length is to be drawn from (4, 5, 3) in the direction of unit vector $0.4i + 0.6j - 0.5k$. Write the parametric equation of this line. **04**
 (c) A Hermite cubic spline curve starts from $P_0(0, 3)$ and ends at $P_1(4, 2)$. Point $P_2(4, 7)$ is such that the tangent at start point joins P_0 to P_2 and tangent at end point joins P_2 to P_1 . Find the coordinates of a point on curve for $u = 0.25$. **07**
- OR**
- (c) Compare and contrast Hermite cubic spline curve and Bezier curve with regard to: (i) degree of polynomial, (ii) influence of data points, (iii) data required to generate curve, (iv) control of shape of curve. **07**
- Q.3** (a) Summarize the six sections that make the IGES file format. **03**
 (b) Explain with figures different types in the 'sweeping' approach to solid modeling. **04**
 (c) Develop the concatenated transformation matrix for rotating any entity about any given point in 2-D. **07**
- OR**
- Q.3** (a) Illustrate the geometric and force boundary conditions using the case of a cantilever beam subjected to a uniformly distributed load. **03**
 (b) Compare and contrast C-rep and B-rep solid modeling techniques. **04**
 (c) Consider following two operations for a given point $P(1, 3, -5)$: translation by $d = 2i + 3j - 4k$, rotation by 30° counterclockwise about z-axis. Compute the transformed point P' , when
 1) Translation is done first, and then followed by rotation,
 2) Rotation is done first, followed by translation.
 Comment on the result. **07**
- Q.4** (a) Under which condition 'plane stress condition' can be used to reduce a 3D problem into a 2D form? **03**
 (b) Explain the meaning of global-, local-, and natural-coordinate system used in finite element analysis. **04**
 (c) For the stepped shaft shown in Figure 2, determine nodal deflection in each section using elimination approach. Assume uniform material for the **07**

complete shaft with modulus of elasticity as 200 GPa and the axial force F as 35 kN.

OR

- Q.4** (a) What do you mean by: degree of freedom, discretization, shape function? **03**
 (b) What are different types of 3D elements used in FEA? Explain briefly with applications. **04**
 (c) Solve the problem given in Q.4(c) above using penalty approach. **07**
- Q.5** (a) How will you calculate elemental strain and elemental stress from given nodal displacements? **03**
 (b) Summarize the limitations of FEM. **04**
 (c) Consider the bar shown in Figure 3. Determine the nodal displacements, if the temperature rises by 60 °C. Assume modulus of elasticity for the complete bar as 200 GPa and coefficient of thermal expansion as 12×10^{-6} per °C. **07**

OR

- Q.5** (a) Solution of an engineering problem using an FEA software involves 3 stages: preprocessing, solution, postprocessing. Summarize what is included in each stage. **03**
 (b) A 2-noded linear element is shown in Figure 4. Temperature at node 1 is 100 °C and at node 2 is 40 °C. Calculate the temperature at P using a linear shape function. **04**
 (c) For the truss shown in Figure 5, evaluate the nodal displacements using FEM. **07**
 Take E as 200 GPa.

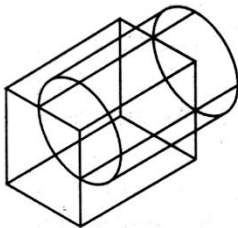


Figure 1

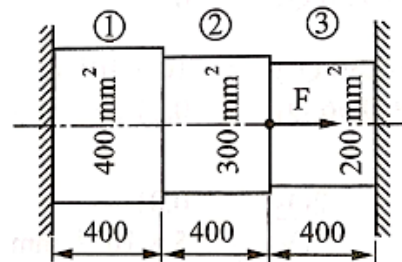


Figure 2

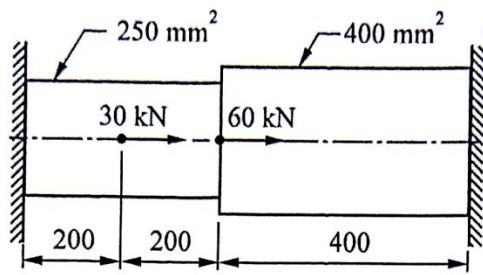


Figure 3

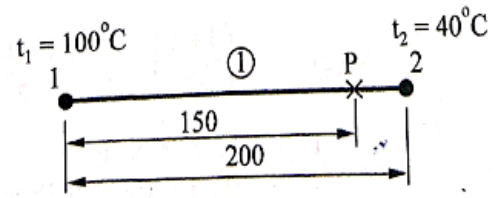


Figure 4

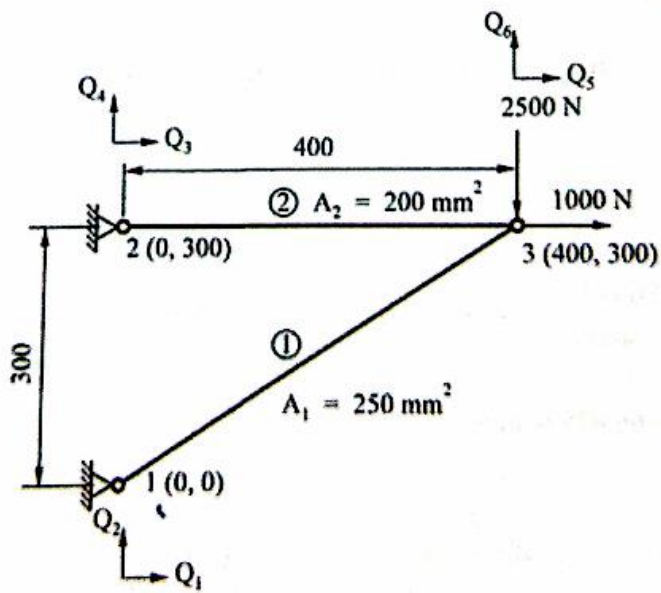


Figure 5
