

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER-VI EXAMINATION – WINTER 2025

Subject Code:3161903

Date:17-11-2025

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.

MARKS

- Q.1**
- (a) What are the main stages of a typical product cycle? **03**
 - (b) With proper sketch explain Interactive Computer Graphics. **04**
 - (c) Draw line segment joining (20, 10) and (25, 14) using Bresenham line generation algorithm. **07**
- Q.2**
- (a) Explain types of surfaces in brief. **03**
 - (b) Differentiate between Constructive Solid Geometry and B-Representation. **04**
 - (c) Describe the properties of Bezier curves, such as endpoints, control points, and curve shape. **07**
- OR**
- (c) Based on Bezier curve definition, derive the equation of three point Bezier curve defined by the following control points.
(-1,0), (0,2), and (1,0). **07**
- Q.3**
- (a) Explain Homogeneous Coordinate system? **03**
 - (b) Differentiate between the Scaling and Shearing transformation. **04**
 - (c) Obtain the mirror reflection of the triangle formed by vertices A (0, 3), B (2, 0), C (3, 2) about the line passing through the points (1, 3) and (-1,-1). **07**
- OR**
- Q.3**
- (a) Write the transformation matrix for 2D Rotation, Reflection and Shearing Transformation. **03**
 - (b) Find the 3x3 homogeneous co-ordinate transformation matrix for each of the following: **04**
 - i. Shift an image to the right by 3 units.
 - ii. Shift the image up by 2 units and down 1 units.
 - iii. Move the image down 2/3 units and left 4 units.
 - (c) Prove that the multiplication of three dimensional transformation matrices for each of the following sequence of operations is commutative: **07**
 - (a) Two successive rotations about any one of the coordinate axis.
 - (b) Two successive translations.
 - (c) Two successive scaling.
- Q.4**
- (a) Define Finite Element Analysis (FEA) and explain its application in engineering. **03**
 - (b) Explain the purpose of each step in the FEA process. **04**
 - (c) Consider the bar shown in given Fig. 1 An axial load $P = 200 \times 10^3$ N is applied as shown. Determine the nodal displacements Using the penalty approach for handling boundary conditions **07**

- Q.4** (a) List the basic steps involved in solving a problem using FEA. **03**
 (b) What is discretization? How it is done in FEM. **04**
 (c) Explain in detail the General procedure of Finite Element Method **07**

- Q.5** (a) Explain optimization in the context of engineering. **03**
 (b) Discuss Euler-Bernoulli beam theory. **04**
 (c) Describe the purpose of optimization techniques in engineering design. Explain the difference between constrained and unconstrained optimization. **07**

OR

- Q.5** (a) Define engineering optimization and explain its importance in the design of machine elements. **03**
 (b) Explain how the stiffness matrix is derived from the strain-displacement matrix for structural problems. **04**
 (c) What is Johnson's method used for in engineering design? Define the key steps involved in Johnson's method. **07**

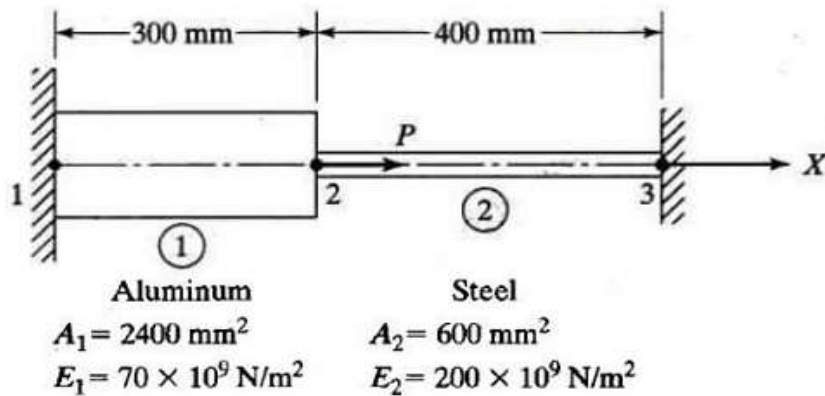


Fig: 1 {Que: 4 (c)}