

**GUJARATTECHNOLOGICAL UNIVERSITY**  
**BE SEMESTER– 7th EXAMINATION – SUMMER 2015**

Subject code:172006

Date: 06/05/2015

Subject Name: CAD for Mechatronics

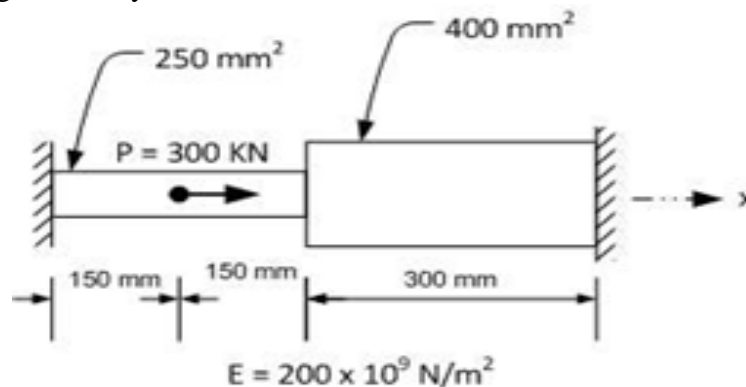
Time: 02.30PM-05.00PM

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) Consider the bar is shown in fig. 1. Determine the nodal displacements, element stresses, and support reactions. Use elimination method for handling boundary conditions. **07**



All dimensions are in mm.

Fig. 1

- (b) A three spring systems are shown in fig 2. Calculate the displacement at nodal points and deflection. **07**

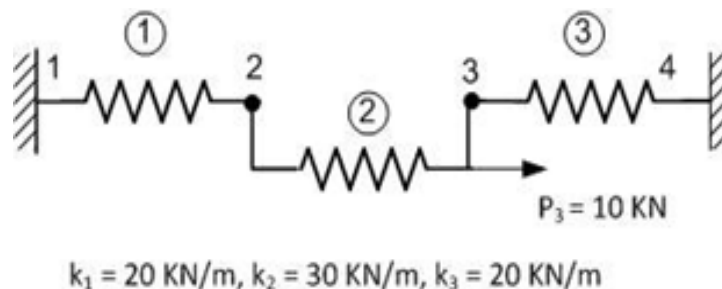


Fig. 2 (All dimensions are in mm)

- Q.2** (a) Differentiate between surface and solid modeling **07**  
 (b) Explain the components of software of CAD system. **07**

**OR**

- (b) What is the need of graphics standards? List various graphics standards used in various CAD softwares. **07**

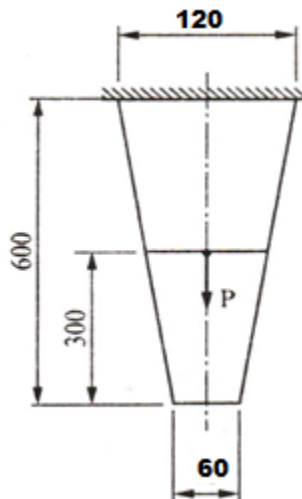
- Q.3** (a) Write short notes on: **07**

1. Constructive Solid Geometry. (CSG or C-rep)
2. Boundary Representation. (B-rep)

- (b) Explain the following types of surfaces: **07**  
 Ruled surface, tabulated surface and revolved surface

**OR**

- Q.3** (a) Plot Hermite cubic spline having endpoints  $P_0 = (1, 1)$  and  $P_1 = (7, 4)$ . The tangent vector at  $P_0$  is defined by a line joining  $P_0$  and another point  $P_2 = (8, 7)$ , whereas the tangent vector at  $P_1$  is defined by a line joining  $P_1$  and  $P_2$ . **07**
- (b) The end point of a Bezier curve are  $P_0 (1, 4)$  and  $P_3 (7, 3)$ . The other control points of the Bezier curve are  $P_1 (5, 6)$  and  $P_2 (7, 0)$ . Value for  $u = 0, 0.2, 0.4, 0.6, 0.8$  and  $1$ . **07**
1. Determine the parametric equation of curve.
  2. Plot the Bezier curve if the direction of polygon is  $P_0 - P_1 - P_2 - P_3$ .
- Q.4** (a) i. Write the general steps to be followed in FEA. **07**  
 ii. Write the properties of global stiffness matrix.
- (b) A thin plate shown in fig 3. has a uniform thickness of 10 mm and modulus of elasticity  $200 \times 10^3 \text{ N/mm}^2$  and a density of  $7800 \text{ kg/m}^3$ . In addition to its self weight, the plate is subjected to a point load  $P$  of 500N which is applied as shown in fig. Find: **07**
1. Finite element model with two elements.
  2. Global stiffness matrix.
  3. Global load vector.



All dimension are in mm.

Fig. 3

**OR**

- Q.4** (a) Explain with sketch the shape function in natural co-ordinate system. **07**
- (b) A square has diagonal coordinates of  $(300, 300)$  and  $(400, 400)$  pixels. Calculate the final vertex coordinates after the following consecutive transformations. **07**
- i. Uniform scaling with reference to  $(350, 350)$  by a scale factor of 2
  - ii. Rotation about  $(350, 350)$  by an angle of  $30^\circ$  ccw.
- Q.5** (a) Consider a triangle ABC having coordinates  $A(5,5)$ ,  $B(8,5)$  and  $C(5,10)$ . Determine the new vertex positions if: **07**
1. The triangle is rotated by  $60^\circ$  anticlockwise about vertex A.
  2. The triangle is scaled by 2 times in X direction and 3 times in Y direction
- (b) What would be the size of frame buffer (in Mb) if color display has a resolution of  $1024 \times 1024$  pixels and displays 24-bit color. How many colors can simultaneously be displayed? How can we reduce the size of frame buffer? **04**
- Determine the pixels to be plotted when a line is to be drawn from the position  $(7, 3)$  to  $(2, 1)$  using DDA algorithm. **03**

**OR**

- Q.5** (a) A triangle ABC has vertices A(20,20), B(30,40) and C(20,40). This triangle is to be reflected about a line joining point P(10,10) and Q(40,20). Determine the new coordinates of the vertices. **07**
- (b) With the help of neat diagram, explain the design phase of product life cycle. **07**

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