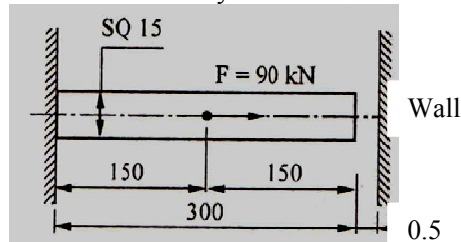


GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER-VII • EXAMINATION – WINTER 2013

Subject code: 172006**Date: 03/12/2013****Subject Name: CAD for Mechatronics****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.

- Q.1 (a)** Consider the bar is shown in fig. 1. Determine the nodal displacements, element stresses and support reactions. Use Penalty methods for handling boundary conditions. Modulus of elasticity as 80000 N/mm^2 . **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**

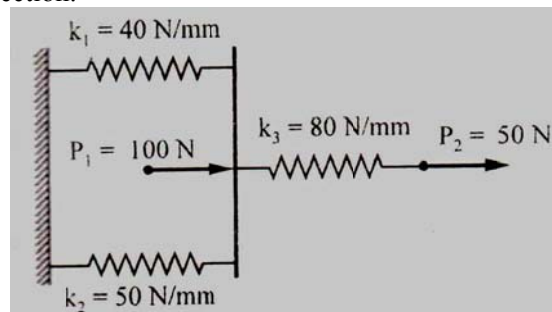


Fig. 2

- Q.2 (a)** Differentiate between: **07**
1. Ink-jet printer and Dot matrix printer
 2. CRT display and LCD display
- (b)** Explain the components of hardware of CAD system. **07**
- OR**
- (b)** Explain three techniques of displaying computer graphics. **07**

- Q.3 (a)** Write short notes on: **07**
1. Constructive Solid Geometry. (CSG or C-rep)
 2. Boundary Representation. (B-rep)
- (b)** The generalized cubic spline equation is **07**
- $$P(u) = (2u^3 - 3u^2 + 1)P_0 + (-2u^3 + 3u^2)P_1 + (u^3 - 2u^2 + u)P_0' + (u^3 - u^2)P_1'$$
- Develop the conditions necessary for 2nd order continuity between two segments of a cubic curve.

OR

- Q.3 (a)** Determine Hermit matrix and Hermit tangent matrix for a cubic curve. **07**

- (b) The end point of a Bezier curve are $P_0 (1, 3)$ and $P_3 (7, 2)$. The other control points of the Bezier curve are $P_1 (5, 6)$ and $P_2 (6, 0)$. 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) What are the different types of 1D, 2D and 3D element used in FEA? Explain with applications. 03

- (b) A thin plate shown in fig 3. has a uniform thickness of 20 mm and modulus of elasticity $200 \times 10^3 \text{ N/mm}^2$ and a density of 7800 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.
4. Displacement at nodal points.

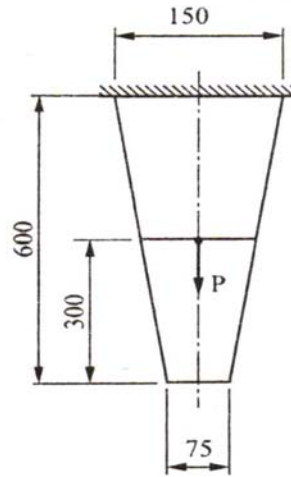


Fig. 3.

OR

Q.4 (a) Explain with sketch the shape function in natural co-ordinate system. 07

- (b) A three bar truss is shown in fig 4. The modulus of elasticity of the material is $300 \times 10^3 \text{ N/mm}^2$. The area of the bar used for the truss is 60 mm^2 for all the elements. The length $L_1 = 750 \text{ mm}$ and $L_2 = 100 \text{ mm}$. the load $P_1 = 20 \text{ kN}$ and $P_2 = 25 \text{ kN}$. 07

Determine:

1. The element stiffness matrix for each element.
2. Global stiffness matrix.
3. Nodal displacement.

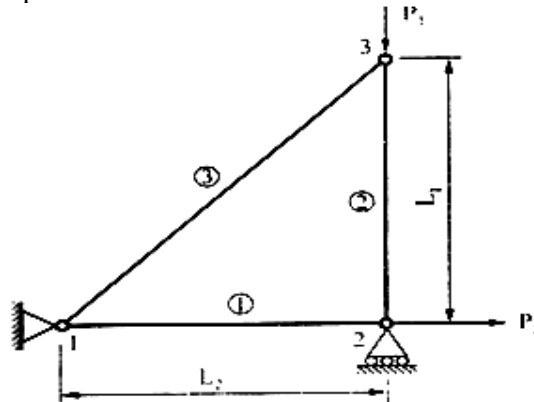


Fig.4.

- Q.5 (a)** Consider a triangle ABC having coordinates A(5,5), B(8,5) and C(5,10). **07**
Determine the new vertex positions if:
1. The triangle is rotated by 60° anticlockwise about vertex A.
 2. The triangle is scaled by 2 times in X direction and 3 times in Y direction
- (b)** (i) A 32 bit raster display has a resolution of 1024(H) by 768(V) and **04**
refresh rate of 75 Hz non- interlaced. Find:
1. RAM size of refresh buffer
 2. Active display area if the dot pitch resolution is 0.20 mm
 3. Data transfer rate per second.
- (ii) Determine the pixels to be plotted when a line is to be drawn from the **03**
position (8, 3) to (1, 1) using DDA algorithm.

OR

- Q.5 (a)** Triangle PQR has vertices as P(2, 4), Q(4, 6), and R(2, 6). It is desired to **07**
reflect through an arbitrary line L whose equation is $Y = 0.5X + 2$.
Calculate the new vertices of triangle.
- (b)** Explain the four most popular graphic standards are GKS, DXF, PDES and **07**
IGES. Write the full form of these acronyms.
