

**R18**

Code No: 156AZ

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, August/September - 2021

FINITE ELEMENT METHODS

(Common to ME, MCT)

Time: 3 Hours

Max. Marks: 75

Answer any five questions  
All questions carry equal marks

- 1.a) Discuss advantages, limitations and applications of FEM.  
b) Explain plane stress and plane strain conditions with suitable examples. [7+8]

2. Derive the stiffness matrix and consistent load vector for one dimensional quadratic element. [15]

3. Find the nodal displacements and stresses in horizontal member and support reactions of truss shown in the below figure 1. [15]

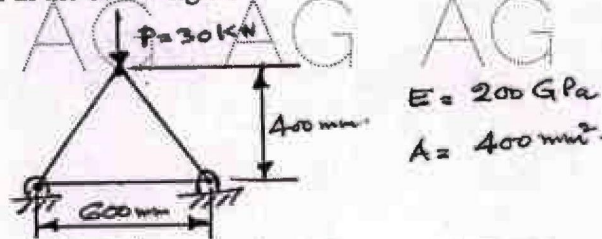


Figure 1

4. Determine the displacement at the midpoint of a fixed beam of length 1 m with uniformly distributed load of 6 kN/m through the span. Use two beam elements. Take  $E = 200 \text{ GPa}$  and  $EI = 2 \times 10^4 \text{ N.m}^2$ . [15]

5. Determine the stiffness matrix for the constant strain triangular (CST) element shown in the figure 2. The coordinates are given in units of millimetres. Assume plane stress conditions. Take  $E = 200 \text{ GPa}$ ; Poisson's ratio ( $\nu$ ) = 0.3; Thickness ( $t$ ) = 10 mm. [15]

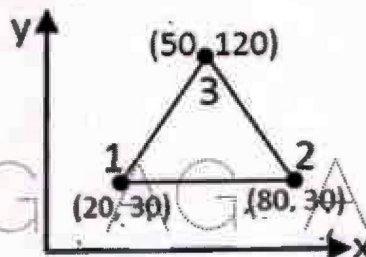


Figure 2

- 6.a) Derive Shape functions four- node quadrilateral Element and discuss salient points.
- b) Evaluate the integral  $\int_{-1}^{+1} \cos \frac{\pi x}{2}$  by applying one and two-point point Gaussian quadrature. Compare the results with exact results and comment. [9+6]
7. For the composite wall shown in the figure 3 below, compute the interface temperatures considering three elements. Take  $K_1=5$  W/m-K,  $K_2=0.6$  W/m- K,  $K_3=20$  W/m- K,  $T_1=100^\circ\text{C}$ ,  $T_4=400^\circ\text{C}$ . [15]

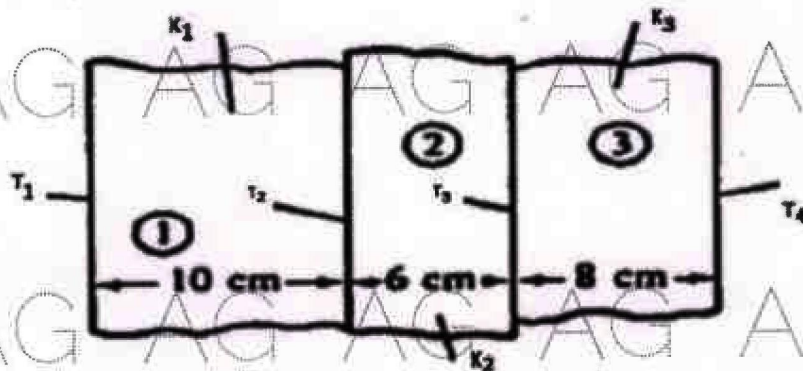


Figure 3

- 8.a) Derive consistent mass matrix for truss element and also write the lumped mass matrix for the same element.
- b) Discuss the importance of semi-automatic meshing and auto mesh along with the practical applications. [7+8]

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