Code No: 56017 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, November/December - 2020
FINITE ELEMENT METHODS
(Common to ME, AE)

Time: 2 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
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1. A simply supported beam subjected to uniformly distributed load over entire span and it is subject to a point load at the centre of the span. Calculate the bending moment and deflection at mid-span by using Rayleish – Ritz method. [15]

2. An axial load of 4×10^5 N is applied at 30^0C to the rod as shown in figure 1. The temperature is then raised to 60^0C. Calculate the following (a) Nodal displacements (b) Stresses in each material. [7+8]
For Aluminium- $A_{Al} = 1000$ mm^2, $E_{Al} = 0.7 \times 10^5$ N/mm^2, $\alpha_{Al} = 23 \times 10^{-6}$ /^{0}C
For steel- $A_{St} = 1500$mm^2, $E_{St} = 2 \times 10^5$ N/mm^2, $\alpha_{St} = 12 \times 10^{-6}$ /^{0}C

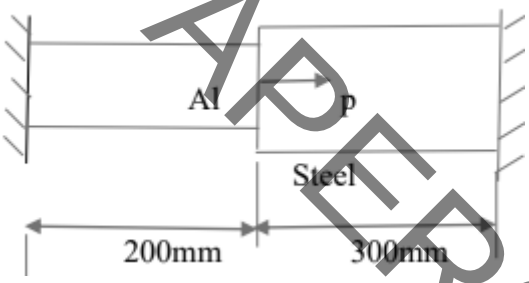

Figure 1

3. Determine the force in the members of the truss as shown in figure 2. Take E=200GPa. [15]

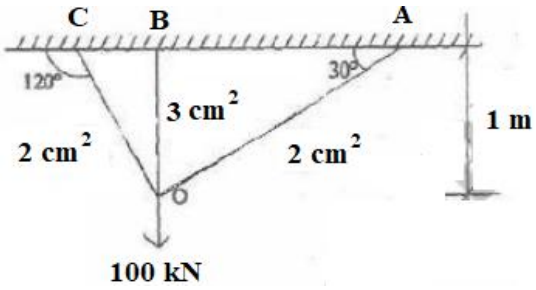

Figure 2

4. Assemble the stiffness matrix for a plane beam element oriented at angle θ to the x-axis. Explain its use in FEA. [15]

5. Write short notes on Isoparametric elements and their advantages. [15]

6. Determine the stiffness matrix for the axisymmetric element shown in figure 3 take $E = 2.1 \times 10^6$ N/mm^2 and Poisson's ratio as 0.3. All dimensions are in mm. [15]

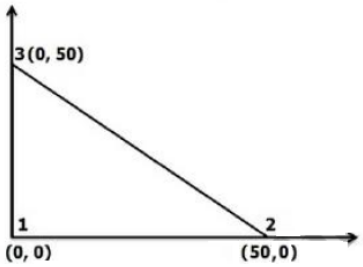

Figure 3

7. Derive finite element expression for 1 dimensional three noded heat conduction element from fundamentals. [15]

8. Find the second and third Eigen values of the matrix with the vector X_1 and λ_1 are given as follows: [15]

$$[H] = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix} \overline{X_1} = \begin{Bmatrix} 1.0 \\ -1.4142 \\ 1.0 \end{Bmatrix}, \lambda_1 = 3.4142$$

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