

Code No: 56017

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year II Semester Examinations, April - 2018

FINITE ELEMENT METHODS

(Common to AE, ME)

Time: 3 hours

Max. Marks: 75

Answer any five questions
All questions carry equal marks

- 1.a) What are the basic steps involved in finite element method? Explain with examples.
b) Determine the displacement of nodes of the spring system shown in the figure 1. [7+8]

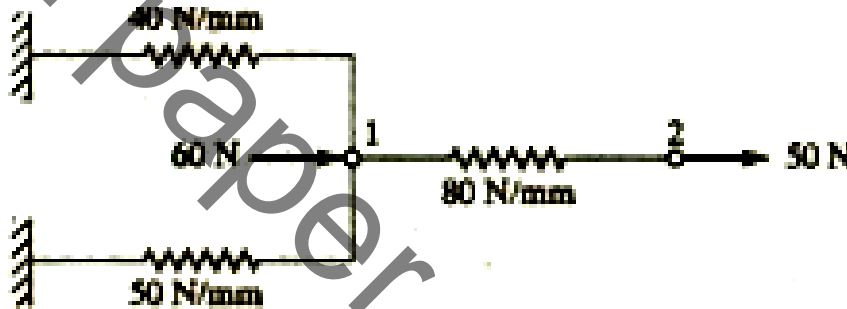


Figure 1

- 2.a) Define the stiffness matrix and describe the characteristics of the stiffness matrix.
b) An axial load $P = 300 \times 10^3$ N is applied at 20°C to the rod shown in figure 2. The temperature is then raised to 60°C , find the nodal displacements and element stresses. [6+9]

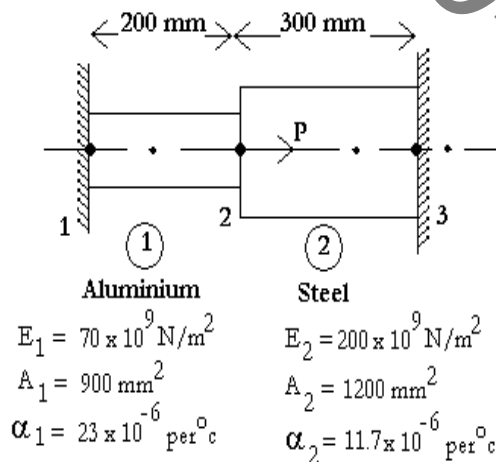


Figure 2

3. Consider the truss element with the coordinates $i(10,10)$ and $j(50,40)$ if the displacement vector is $q=[15 \ 10 \ 21 \ 43]^T$ mm, then determine
a) The trace vector F
b) Stress in each element
Stiffness matrix if $E=70$ GPa and $A=200 \text{ mm}^2$. [15]

- 4.a) Discuss the usefulness and limitations of Hermite shape functions.
 b) Find the deflections and support reactions for the beam shown in figure 3. Take $E = 200 \text{ GPa}$. [6+9]

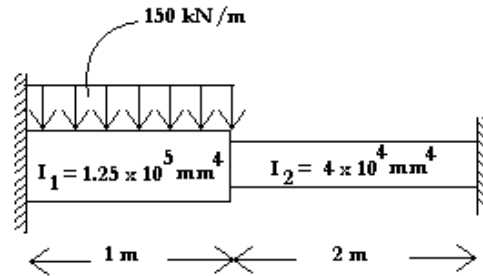


Figure 3

- 5.a) Derive the elemental stiffness matrix for two noded beam element.
 b) Explain in detail how the element stiffness matrix and load vector are evaluated in iso-parametric formulations. [6+9]
- 6.a) Find the shape functions of a quadrilateral element in natural coordinates.
 b) Determine the matrix relating strains and nodal displacements for an axisymmetric triangular element. [6+9]
7. One side of the brick wall of width 5 m , height 4 m and thickness 0.5 m is exposed to a temperature of -25°C while the other surface is maintained at 32°C . If the thermal conductivity is 0.75 W/m K and the heat transfer coefficient on the colder side is $50 \text{ W/m}^2 \text{ K}$. Determine the temperature distribution in the wall and the heat loss from the wall. [15]
- 8.a) Discuss the methodology to solve the Eigen value problem for the estimation of natural Frequencies of a stepped bar?
 b) Derive the elemental lumped and consistent mass matrices for 1-D plane truss element. [7+8]

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