Code No. 2149

FACULTY OF ENGINEERING

B.E. 3/4 (AE) II-Semester (Main) Examination, May 2013

Subject : Finite Element Analysis

Time : 3 Hours **Max. Marks: 75**

Note: Answer all questions of Part - A and answer any five questions from Part-B.

PART – A (25 Marks)

1. Write the Relationship between natural coordinates and global coordinates for 1D linear element. (2)
2. State the minimum potential energy principle. (3)
3. Write the temperature load vector for 1-D linear element. (2)
4. Derive the Transformation matrix for Truss element. (3)
5. Write the material property matrix for plane stress and plane strain condition. (3)
6. State boundary conditions in Heat transfer analysis. (2)
7. Write the Heat capacitance matrix in Heat transfer analysis. (2)
8. Differentiate between lumped mass and consistancy mass. (2)
9. State the Requirements of convergence. (3)
10. State advantages of penalty approach in handling boundary conditions. (3)

PART – B (5x10=50 Marks)

11. Find the Nodal displacements and element stresses for the bar shown in figure 1.

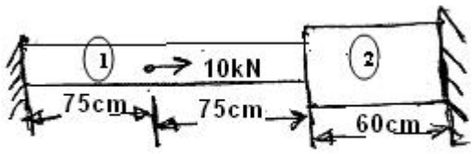


Fig.1

$E_1=E_2=200GPa$, $\alpha_1 = \alpha_2 = 11 \times 10^{-6}$ °C $\delta_T=10^oC$

12. Determine nodal displacements and element stresses of the truss shown in figure 2. The Truss members are subjected to a temperature rise of 50°C.

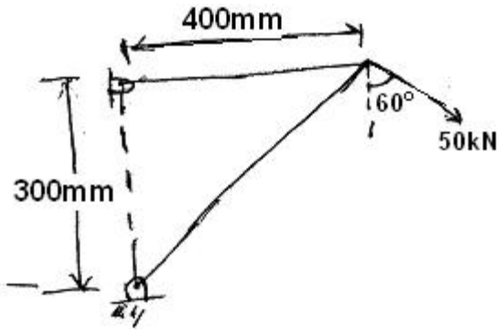


Fig.2

E=200 GPa, A=500 mm^2 for all members $\alpha = 10 \times 10^{-6}$ °C $\Delta t = 50^oC$

..2

13. Determine the deflection and slope under the point load for the beam shown in figure 3.

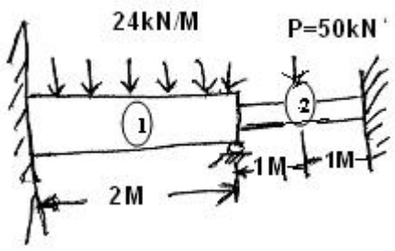


Fig.3

E=200GPa $I_1=4x10^{-6}$ m^2 $I_2=2 \times 10^{-6}$ m^2

14. For the triangular element shown in figure 4.

(a) The x-coordinate at an interior point is 3.5 and $N_1=0.3$. Determine the y coordinate of the point and other shape functions.

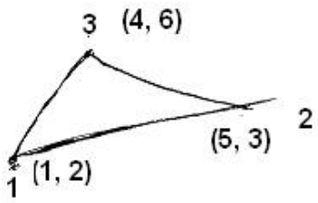


Fig.4

(b) The Nodal displacements are [0, 0.1, 0.2, 0.0, 0.3, 0.0] mm then find the element displacement at the point.

15. Find the Nodal temperatures for an insulated tip fin using one dimensional steady state conduction analysis with two elements.

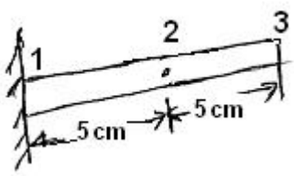


Fig. 5

Base temperature $\Phi_1 = 150^oC$

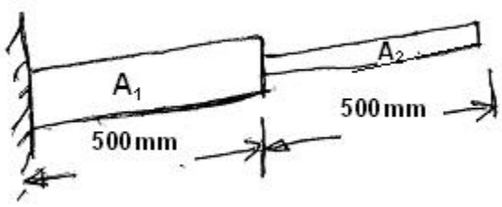
Thermal conductivity K = 50 w/cm^2 ^oK

h=10 w / cm K

Ambient temperature $\Phi_\alpha = 25^oC$

Diameter of fin = 2 cm

16. Determine the natural frequencies of longitudinal vibrations of a steeped bar shown figure 5.



$A_1=1500mm^2$ E=200GPa

$A_2=750mm^2$ $\rho=7800kg/m^3$

17. Write short notes on the following:

(a) Axisymmetric Triangular element

(b) Shape functions for Quadilateral elements

(c) FEM software

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