Roll No. | | | | | | | | | | | | Total No. of Pages : 02

Total No. of Questions : 08

M.Tech. (ME) (Sem.–1)

FINITE ELEMENT ANALYSIS

Subject Code : MTME-102

M.Code : 74716

Date of Examination : 16-05-2023

Time : 3 Hrs. Max. Marks : 100

INSTRUCTIONS TO CANDIDATES :

1. **Attempt any FIVE questions in all.**
2. **Each question carries TWENTY marks.**

1. Analyse a simply supported beam subjected to a uniformly distributed load throughout using Rayleigh Ritz method. Adopt one-parameter trignometric function. Evaluate the maximum deflection and bending moment and compare with the exact solution.

2. Write short note on the following :

   a) Natural coordinates in FEA

   b) Use of Numerical integration in FEA

   c) Stream function-vorticity formulation

   d) Viscous flow and incompressible flow.

3. For the plane strain elements shown in Fig. 1, the nodal displacements are given as u_1 = 0.005 mm, v_1 = 0.002 mm, u_2 = 0.0 mm, v_2 = 0.0 mm, u_3 = 0.005 mm, v_3 = 0.30 mm. Determine the element stresses and the principle angle. Take E = 70 GPa and Poisson's ratio = 0.3 and use unit thickness for plane strain. All coordinates are in mm.

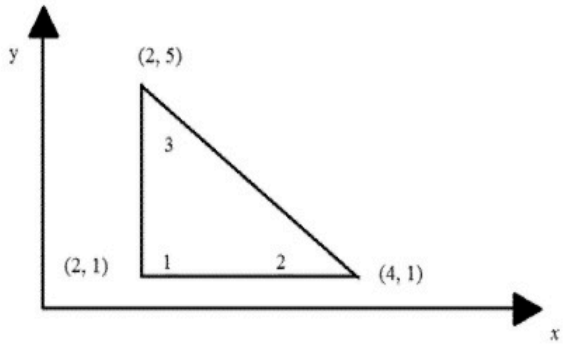

Fig. 1

4. A metallic fin 20 mm wide and 4 mm thick, is attached to a furnace whose wall temperature is 180°C. The length of the fin is 120 mm. If the thermal conductivity of the material of the fin is 350 W/m°C and convection coefficient is 9 W/m^2 °C, determine the temperature distribution assuming that the tip of the fin is open to the atmosphere and that the ambient temperature is 25°C.

5. Solve the ordinary differential equation $(d^2y/dx^2) + 10\,x^2 = 0$ for $0 \leq x \leq 1$

   Subject to the boundary conditions $y(0) = y(1) = 0$ using the Galerkin method with the trail functions $N_0\,(x) = 0$; $N_1x = x\,(1 - x^2)$.

6. A concentrated load P = 50 kN (Fig. 2) is applied at the centre of a fixed beam of length 3 m, depth 200 mm and width 120 mm. Calculate the deflection and slope at the midpoint. Assume E = 2×10^5 N/mm^2.

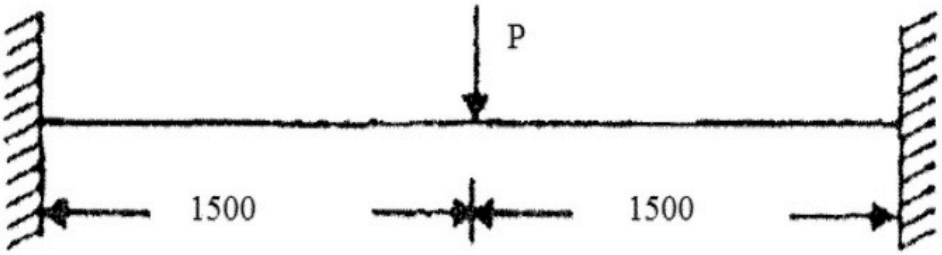

Fig. 2

7. Develop a one-dimensional finite element model of heat transfer including both conduction and convection for a solid cylindrical body surrounded by a fluid medium. Assume boundary conditions.

8. a) What are the non-zero strain and stress components of axis symmetric element? Explain.

   b) Derive the stiffness matrix of an axis symmetric element using potential approach.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.