

Roll No.

Total No. of Pages : 02

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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 trigonometric 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.

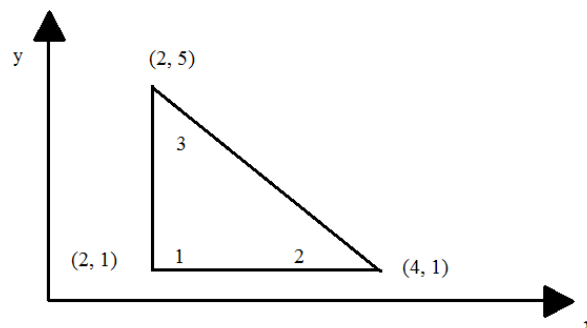


Fig. 1

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/m² °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 $(d^2y/dx^2) + 10x^2 = 0$ for $0 \leq x \leq 1$

Subject to the boundary conditions $y(0) = y(1) = 0$ using the Galerkin method with the trial functions $N_0(x) = 0$; $N_1(x) = x(1 - x^2)$.

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 $E = 2 \times 10^5$ N/mm².

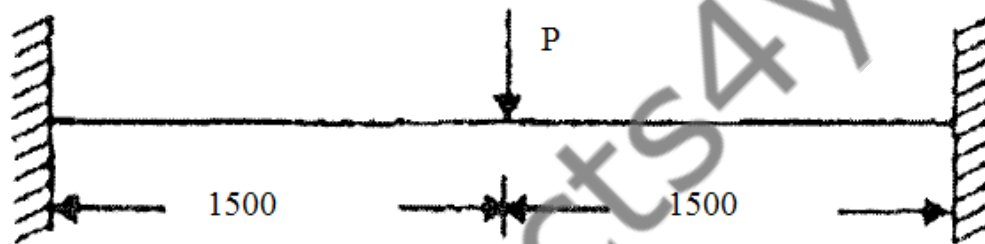


Fig. 2

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.