Code: ME7T4

IV B.Tech - I Semester – Regular / Supplementary Examinations November 2016

FINITE ELEMENT METHODS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

Answer any FIVE questions. All questions carry equal marks

1.

a) Derive stress strain relation matrix. 7 M

b) Derive the equilibrium equations for 3D body. 7 M

2.

a) Derive stiffness matrix for one dimensional bar element. 7 M

b) Consider the bar as shown in Figure-1. Calculate the following: 7 M

i) Nodal displacements. ii) Element stresses.

Take E=210 GPa P=10kN

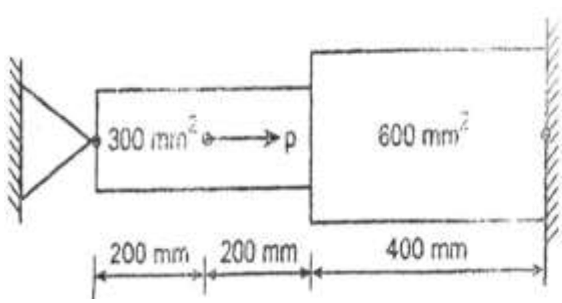

Figure-1

3. A wall of 0.6 m thickness having thermal conductivity of 1.2 W/m K. The wall is to be insulated with a material of thickness 0.006 m having an average thermal conductivity of 0.3 W/m K. The inner surface temperature is 1000^0C and outside of the insulation is exposed to atmospheric air at 30^0C with heat transfer coefficient of 35 W/m^2K. Determine the temperature distribution in the wall. 14 M

4. For the plane truss shown in Figure-2 determine the horizontal & vertical displacements at nodes & the stress in each element. All elements have E=201GPa; $A=4x10^{-4}m^2$. Forces acting at Node 1 are 10 kN & 20 kN. 14 M

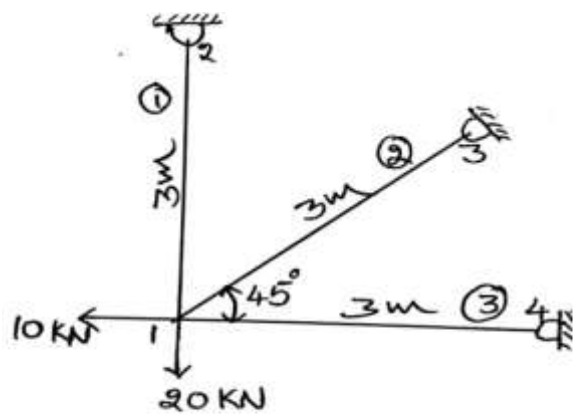

Figure-2

5. For the beam and loading shown in Figure-3. Calculate the rotation at B and C. E = 210 GPa; $I = 6\times10^6 mm^4$ 14 M

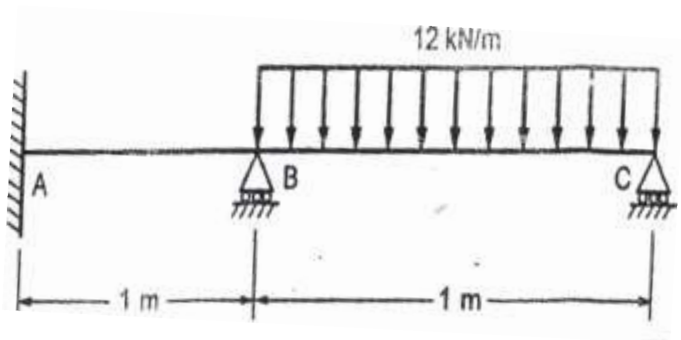

Figure-3

6. Derive strain displacement matrix and stiffness matrix for the CST element. 14 M

7.

a) Derive the shape functions for 4-noded quadrilateral element. 7 M

b) Evaluate the integral I = $\int_{-1}^{+1}(2 + x + x^2)dx$ and compare it with exact solution. 7 M

8. Determine the Eigen values and Eigen vectors for a stepped bar as shown in Figure-4 E= 2 x 10^5 N/mm^2; ρ=800 N/m^3. A_1=100 mm^2; A_2= 50 mm^2. 14 M

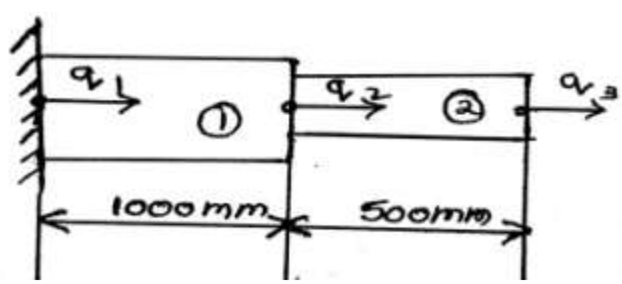

Figure-4