PVP 14

Code: ME7T3

IV B.Tech - I Semester – Regular/Supplementary Examinations
October - 2018

FINITE ELEMENT METHODS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

Answer ***all*** the questions. All questions carry equal marks

11 x 2 = 22 M

1.

a) Differentiate isotropic and orthotropic materials.
b) State the principle of minimum potential energy.
c) Discuss penalty approach for handling boundary condition.
d) Explain the concept of global numbering.
e) Discuss the different types of loading that act on a structure.
f) Mention the characteristics of shape function.
g) Explain about constant strain triangle.
h) Discuss Jacobian transformation matrix.
i) Mention the matrix relating the strains and nodal displacements for an axi symmetric triangular element
j) State the Fourier's law of heat conduction
k) Explain the governing equations for one dimensional heat conduction

PART – B

Answer any ***THREE*** questions. All questions carry equal marks.

3 x 16 = 48 M

2. a) In a plane strain problem, σ_x= 1360 bar and σ_y= -680 bar, υ= 0.3 and E = 2 x 10^6 bar, find the value of the stress σ_z. 4 M

b) Using Rayleigh Ritz method find the displacement at the midpoint of the rod shown in the below Fig 1. 12 M

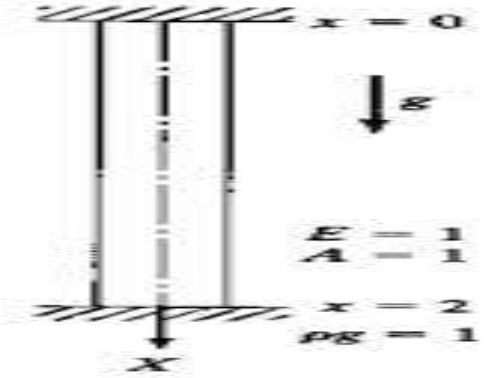

Fig 1.

3. Consider a load of 60 x 10^3 N is applied on the bar shown in the below Fig 2. Determine the displacement field, stress and support reactions in the body. Take E=20 x 10^3 N/mm^2. 16 M

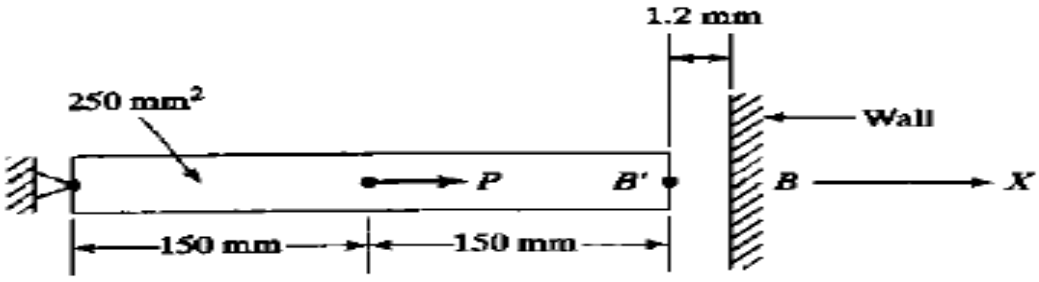

Fig 2.

4. Derive the Jacobian matrix for the quadrilateral element with the nodal coordinates (0,0) (10,1) (10,8) and (1,7) for the nodes 1, 2, 3 and 4 respectively. Determine the determinant of the Jacobian at the nodes and at the centroid of the element. 16 M

5. a) Evaluate the shape functions N_1, N_2 and N_3 at the interior point P for the triangular element shown in the Fig 3. 8 M

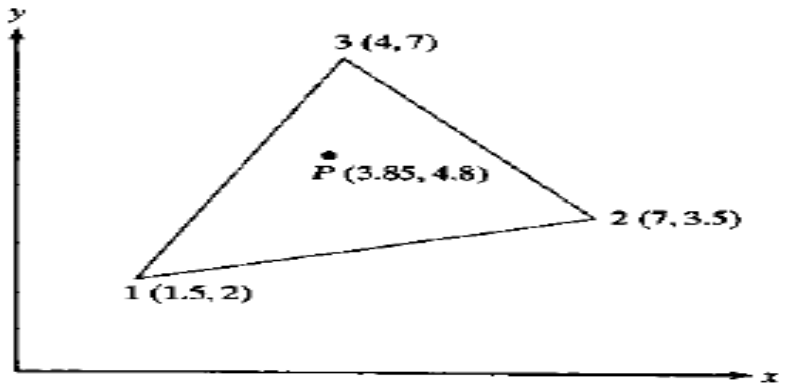

Fig 3.

b) Determine the Jacobian transformation for the element shown in the Fig 4. 8 M

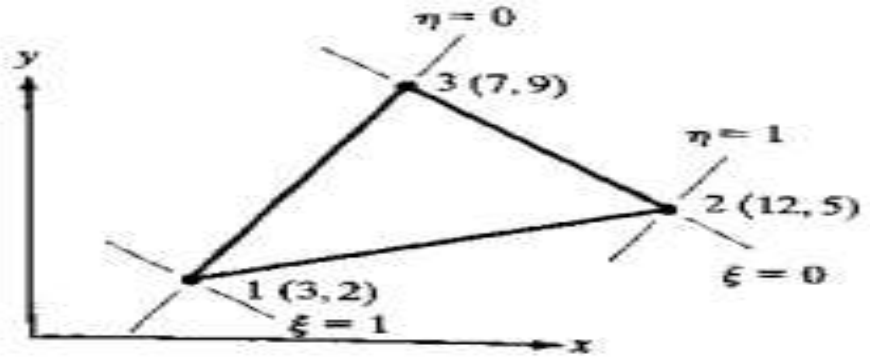

Fig 4.

6. a) An open ended steel cylinder shown in the below Fig 5. Is subjected to an internal pressure of 5 MPa. Find the deformed shape and distribution of principal stresses. 10 M

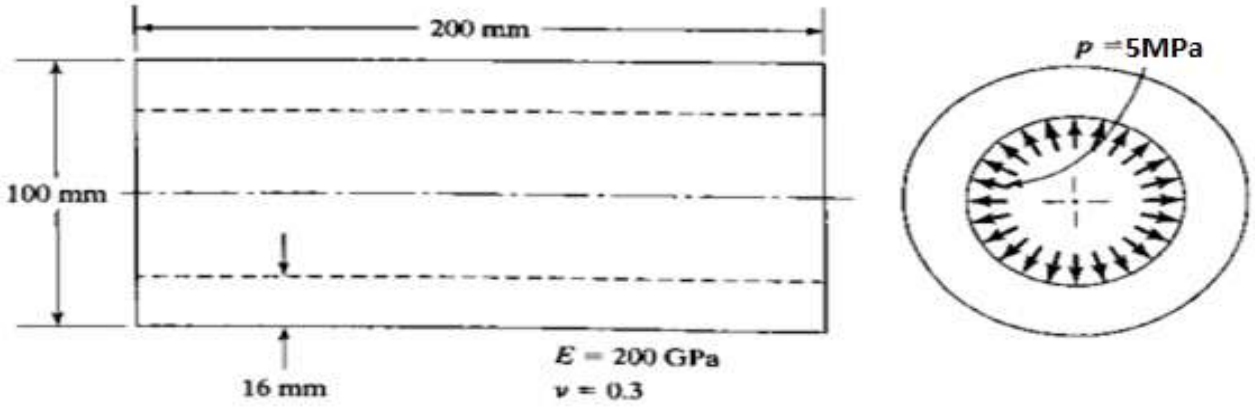

Fig 5.

b) Heat is generated in a large Wall (K = 0.8 W/m.^{0}C) at the rate of 4000 W/m^3. The plate is 25 cm thick. The outside surfaces of the plate is exposed to ambient air at 30^{0}C with a convective heat transfer coefficient of 20 W/m^2. Determine the temperature distribution in the wall. 6 M