PVP 14

Code: ME7T3

IV B.Tech - I Semester – Regular Examinations – October 2017

FINITE ELEMENT METHODS
(MECHANICAL ENGINEERING)

Duration: 3 hours Max. Marks: 70

PART – A

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

11x 2 = 22 M

1. a) What do you mean by boundary conditions? Explain their types.

b) State the principle of minimum potential energy.

c) Briefly discuss about the effect of temperature on bar element.

d) Derive the shape functions in natural coordinates for a one-dimensional bar element.

e) What are the general features of truss element?

f) Enumerate the methodology to find the stiffness matrix for a 2-noded beam with 2 degree of freedom per node.

g) What is the Jocobian of transformation for a 2-noded isoparametric element?

h) Why is 3-noded triangular element called as CST element?

i) What are the non-zero strain and stress components of axisymmetric element? Explain.

j) Write the heat transfer characteristics of composite wall.

k) Derive the body force vector for a CST element subjected to uniform body force in y-direction.

PART – B

Answer any ***THREE*** questions. All questions carry equal marks. 3 x16 = 48 M

2. a) For the differential equation $\frac{d}{dx}\left[(1+x)\frac{dy}{dx}\right] = 0$ for $0 < x < 1$ with the boundary conditions y(0)=0 and y(1)=1, obtain an approximate solution using Rayleigh-Ritz method. 10 M

   b) Derive stress equilibrium equations. 6 M

3. A vertical plate of thickness of 10 mm is tapered with widths of 100 mm and 80 mm at its top and bottom ends respectively. The plate is fixed at the top end and subjected to a point load of 200 N at its free end in addition to its self-weight. The length of the plate is 400 mm. Take E= 210 GPa and density as 7800 kg/m^3. Model the plate with three spar elements. Determine the nodal displacements. Also calculate element stresses and support reactions. 16 M

4. a) Explain Local and Global coordinate systems used in truss element. 4 M

   b) Compute the rotation at the simple support and reactions at the fixed supports for the two span beam as shown in Fig.1.

The beam is fixed at both ends and supported between the ends with a simple support that allows reaction. 12 M

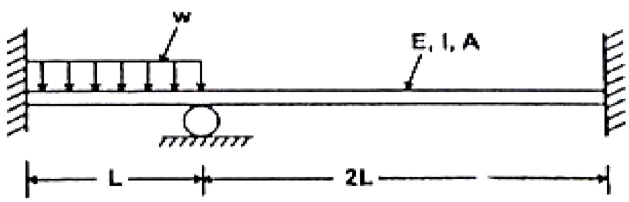

Fig. 1

5. a) Derive the shape function for a 3-noded triangular element. 8 M

b) For the CST element shown in Fig. 2, determine the strain–displacement matrix. The given nodal coordinates are in mm.Take t = 20 mm, E = 2×10^5 N/mm^2.

8 M

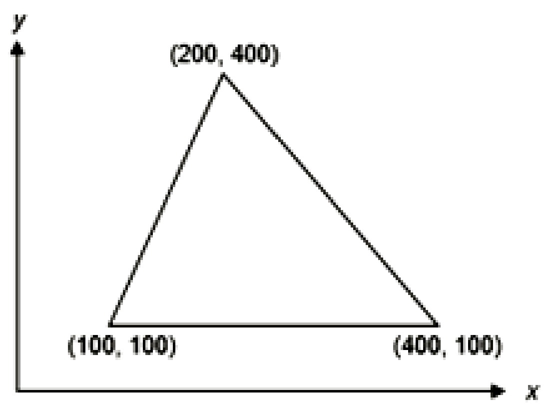

Fig. 2

6. a) The nodal coordinates for an axi-symmetric triangular element at its three nodes are $(r_1,z_1) = (30,10)$, $(r_2,z_2) = (50,10)$ and $(r_3,z_3) = (40,60)$. Determine the strain - displacement matrix for that element. 6 M

b) A pin fin having a diameter of 8 mm and length of 127 mm has a temperature of 65.6 °C at root. The ambient temperature is 26.7 °C and h = 1.76 W/m² °C. Take k = 7.27 W/m °C. Assume that the tip of the fin is insulated. Using a two-element model, determine the temperature distribution and heat loss from the fin.

10 M