PVP 14

Code: ME7T3

IV B.Tech - I Semester – Regular/Supplementary Examinations
October - 2019

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) What is plane stress condition?
   b) What are the equations of equilibrium for 3-D body?
   c) Define minimum potential energy principle.
   d) What is isoparametric representation? Briefly explain.
   e) Define bandwidth of a stiffness matrix.
   f) What is CST? Why it is named as CST?
   g) Write the relation for Jacobian transformation of triangular element?
   h) What is axi symmetric loading?
   i) Explain about Hermite shape functions with neat sketches.
   j) Specify the boundary conditions for steady state heat transfer problem.
   k) Differentiate Local and Global coordinate systems incase of truss elements.

PART – B

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

3 x 16 = 48 M

2. a) Derive the equilibrium equations for three dimensional stress system of rectangular element and tetrahedral element. 12 M

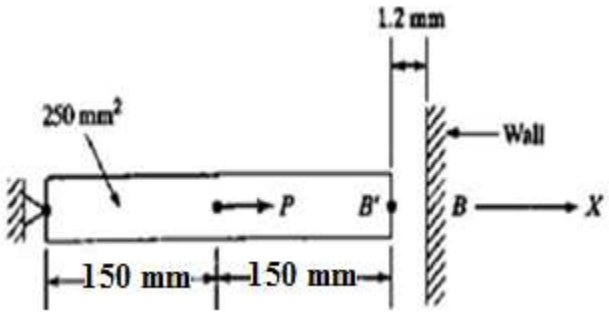
b) If a displacement field is described by 4 M

$u = (-2x + 3y^2 + xy)10^{-4}$ and $v = (x^2 + 5y - y^2)10^{-4}$

Determine ϵ_x, ϵ_y, and ϵ_{xy} at the point x = 2, y = 1.

3. Determine the displacements, stress and support reactions in the structure shown in the figure. 16 M

Take $P = 62 \times 10^3$ N, $E = 20 \times 10^3$ N/mm^2, $A = 250$ mm^2

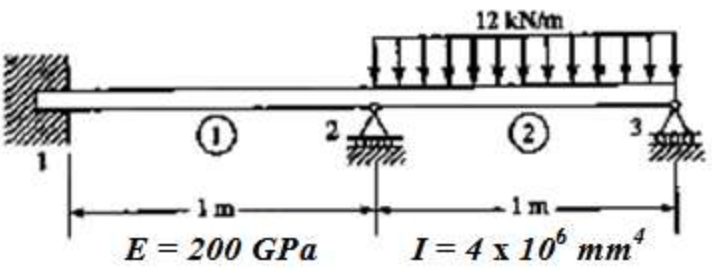


4. a) Derive the stiffness matrix for a truss element. 6 M

b) For the beam as shown in figure, determine 10 M

i) The slopes at 2 and 3 and

ii) Vertical deflection at the midpoint of the distributed load.



5. a) Derive the element strain displacement matrix for three noded CST element. 8 M

   b) Calculate the element stiffness matrix of a CST element under plane stress condition with vertices 1(0,0), 2(300,0) and 3(300, 200) mm. Take E = 300 GPa and $\upsilon = 0.25$. Thickness of the element is 10 mm. 8 M

6. A long hollow cylinder of inside diameter 100mm and outside diameter 120mm is firmly fitted in a hole of another rigid cylinder over its full length as shown in fig. The cylinder is then subjected to an internal pressure of 2 MPa. By using two elements on the 10mm length, calculate the displacements at the inner radius. Take E = 210 GPa. $\upsilon = 0.3$. 16 M