Exam.Code:0942
Sub. Code: 7059

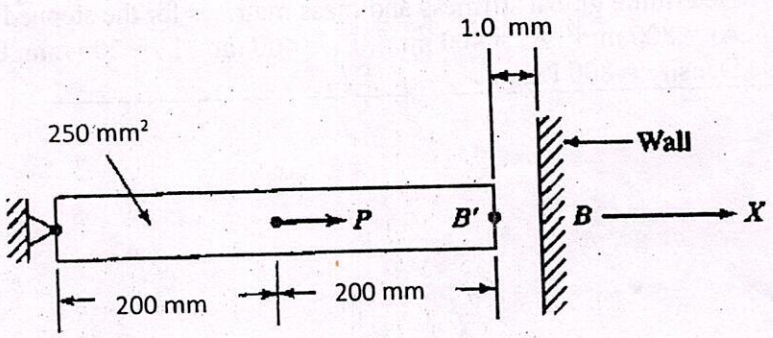
2062

B.E. (Mechanical Engineering)
Sixth Semester
MEC-602: Finite Element Methods

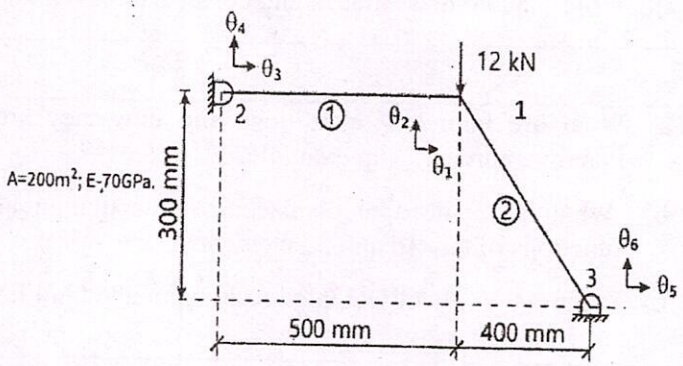
Time allowed: 3 Hours | Max. Marks: 50

NOTE: *Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Part.*

x-x-x

1	a) Differentiate between truss and beam element. b) Write strain displacement matrix for 1d quadratic element. c) Mention the need of banded matrices in FEM with example. d) What is the purpose of h mesh refinement. e) Write lumped mass matrix and consistent mass matrix of 1d bar element.	(2x 5 = 10)
	Part A	
2	a) What are boundary conditions and how they are applied in FEM. Explain Penalty approach with example? b) What is the need of displacement function in FEM. Compare displacement functions of any 1d and 2d element. c) Discuss the role of weighted residual method in FEM.	(4) (3) (3)
3	Determine the nodal displacements and element stresses using penalty approach/ Elimination approach for the bar shown below. Given E = 200 GPa , P=120 X10^{3}N 	(10)
4	a) What are the situations where axisymmetric analysis can be used? Discuss the stress and strain components for axisymmetric elements. b) Derive the temperature load vector for 1-d bar element. c) The triangular element used for ground water flow simulation have nodal co-ordinates (1, 2), (4, 0.5) and (3, 4) respectively. The nodal values of the hydraulic heads at different nodes are [3.5, 2.2, 4.4] respectively. Find the value of hydraulic head at the point [2.5, 2.5] respectively.	(3) (4) (3)

P.T.O.

	Part B	
5	a) Describe the process of determining midspan deflection for the beam subjected to uniformly distributed load by taking suitable example. b) Why Optimization is required in FEM. Discuss the use of topology optimization with finite element analysis by taking suitable example.	(5) (5)
6	Determine nodal displacements, stresses and reactions for the following two-bar truss. (Take node numbers as given in the diagram) 	(10)
7	a) Describe any Mesh generation technique with a suitable example. b) Determine global stiffness and mass matrices for the stepped bar with $A_1 = 800\ mm^2$, $A_2 = 400\ mm^2$, $L_1 = 400$ mm, $L_2 = 200$ mm, E=200 GPa and Density = 800 Kg/m^3.	(5) (5)

x-x-x