

2054

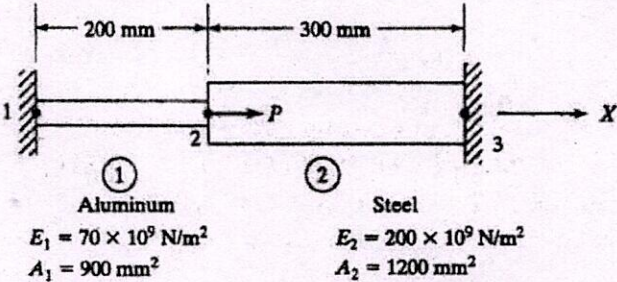
B.E. (Mechanical Engineering)-6th Semester
MEC-602: Finite Element Methods

Time allowed: 3 Hours

Max. Marks: 50

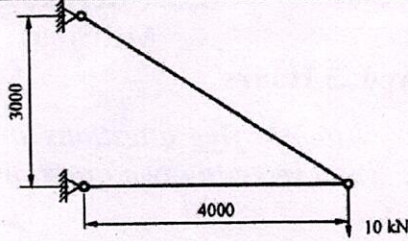
NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part.

x-x-x

1	<p>a. Describe the role of Von Mises Stress in FEM.</p> <p>b. Write the shape functions of 1 d quadratic element.</p> <p>c. Draw a 2d CST element with the degrees of freedom indicated on it.</p> <p>d. Give two applications where axisymmetric elements can be used?</p> <p>e. What is meant by Eigenvalue in dynamic analysis?</p>	(2x 5 = 10)
Part A		
2	<p>An axial load $P = 300 \times 10^3$ N is applied to the rod as shown below. Assemble the stiffness matrices and determine global stiffness matrix. Find the nodal displacements, elemental stresses and reactions.</p>  <p align="center"> ① ② Aluminum Steel $E_1 = 70 \times 10^9 \text{ N/m}^2$ $E_2 = 200 \times 10^9 \text{ N/m}^2$ $A_1 = 900 \text{ mm}^2$ $A_2 = 1200 \text{ mm}^2$ </p>	(10)
3	<p>a) For a triangular element, the coordinates at node 1 are (1, 1), at node 2 are (8, 4) and at node 3 are (2, 7). Given nodal disp are $q_1 = 0.001$, $q_2 = -0.004$, $q_3 = 0.003$, $q_4 = 0.002$, $q_5 = -0.002$, $q_6 = 0.005$, Determine:</p> <ol style="list-style-type: none"> Strain displacement matrix Jacobian for the triangular element. Strains <p>b) What are the characteristics of a 1d quadratic element? Describe the distribution of body and traction load over 1d quadratic element?</p>	(6) (4)
4	<p>a) Sketch an axisymmetric finite element model mentioning d.o.f. Compare this element with triangular element.</p> <p>b) How stress will change with the effect of temperature in bar element.</p> <p>c) Explain the elimination method of imposing boundary conditions with example problem. In axially loaded cases, how do you find the support reactions after getting required displacements?</p>	(4) (3) (3)
Part B		
5	<p>a) Why mesh generation is required. Write a procedure for model creation and mesh generation for any 2d shape.</p> <p>b) Out of Consistent Mass Matrix and Lumped Mass Matrix, Discuss which is more accurate and why? Write the expression of Consistent Mass Matrix and Lumped Mass Matrix for bar element and truss element.</p>	(5) (5)

P.T.O.

(2)

6	<p>a) A two member truss is shown in the diagram. The cross-sectional area of each member is 200 mm^2 and the modulus of elasticity is 200 GPa. Determine the nodal displacements and elemental stresses in each of the members.</p> <p>b) Differentiate between beam and truss element.</p>		(8) (2)
7	<p>Write short note on followings:</p> <p>a) Guyan Reduction technique</p> <p>b) Optimization using FEM: Need and Techniques</p>	(5) (5)	

x-x-x