Exam.Code:0943
Sub. Code: 6390

1078
B.E. (Mechanical Engineering)
Seventh Semester
EE-703: Finite Elements Methods

Time allowed: 3 Hours

Max. Marks: 50

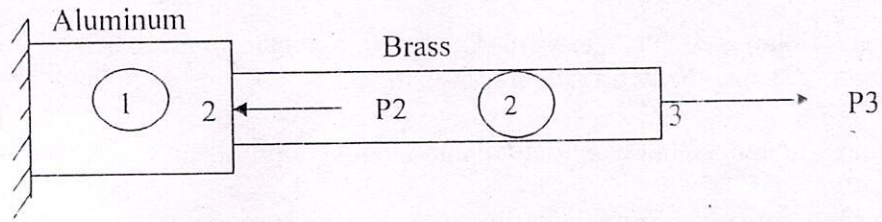
NOTE: Attempt five questions in all, selecting atleast two questions from each Section. Assume suitable/ missing data wherever applicable. Wherever applicable, the explanation should be with suitable example/sketch.

x-x-x

Section A

Q1. For the axially loaded member as shown in the figure below, Determine : 10

a) Displacements at node 1, 2 and 3 , b) Stress in the two sections and
c) Reaction at the end.



Given that

Area of the Aluminum rod = 39 x 10^{-4} m^2, Area of the Brass rod = 13 x 10^{-4} m^2
Length of the Aluminum rod = 1m, Length of the Brass rod = 2m
Modulus of elasticity of Aluminum = 70 GPA, Modulus of elasticity of Brass = 100 GPA
Axial Load P2 = 300 kN, Axial Load P3 = 100 kN

Q2. a) Explain in detail about Weighted- Residual method for FEA. 6

b) What is Saint Venant principle? Write its significance in FEA. 4

Q3. a) Explain about the elimination approach and penalty approach to handle boundary conditions. 5

b) For a triangular element, the coordinates at node 1 are (2, 2), at node 2 are (8, 4) and at node 3 are (4, 8). Determine the strain displacement matrix and hence determine the strains, if nodal disp are q1 = 0.001, q2 = -0.004, q3= 0.003, q4 = 0.002, q5 = -0.002, q6=0.005 5

Q4. a) Derive the stress strain relations for a three-dimensional element? 5

b) What are the conditions for the problem to be Axisymmetric? List any four commonly used axisymmetric elements mentioning their application 5

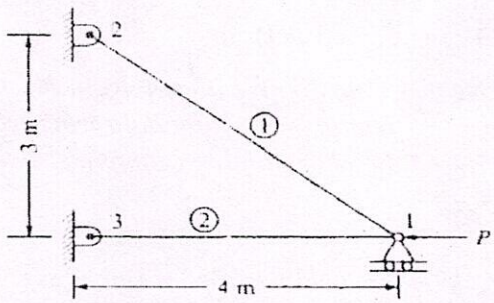
Section B

Q5. a) Derive the load vector for uniformly distributed load in beam. 6

b) Differentiate among Bar element, Truss element and Beam element indicating D.O.F and geometry characteristics. 4

P.T.O.

Q6. For the two bar truss system, determine the nodal displacements, element stresses and support reactions. A force of P=1050 kN is applied at node 1. Assume E= 200 GPa and A= 600 mm^2 for each element. 10



Q7. a) Write the difference between static and dynamic finite element analysis. How Guyan reduction is helpful in the analysis. 5

b) Determine the element mass matrix for one-dimensional dynamic structural analysis problems. Assume the two-node, linear element. 5

Q8. a) What do you understand by structural and topology optimization? Explain 5

b) Write short note on deformed configuration and mode shape. 5

x-x-x