CODE: 17CD03101

M. Tech I Year I Semester Regular Examinations, February 2018

ADVANCED FINITE ELEMENT MENTHODS
(CAD/CAM)

Time: 3 hours Max Marks: 60

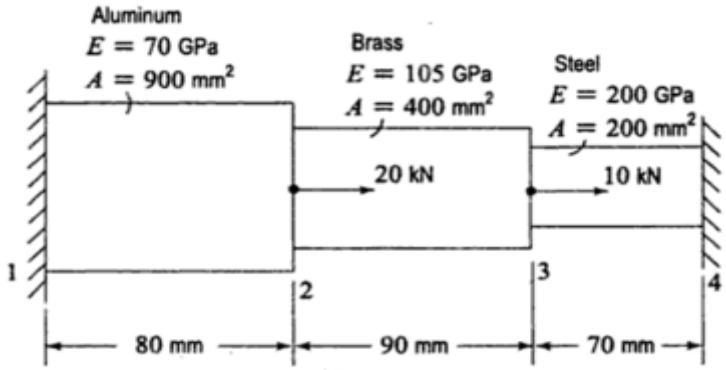
Answer all **five** units. (5 x 12 = 60 Marks)

UNIT-I

1. (a) What is Finite Element Analysis (FEA)? What areas can FEA are applied?
(b) Mention the various coordinates in FEM. Explain any one.

OR

2. For the three-stepped bar shown in the figure, determine the displacements at nodes 2 and 3, stresses in the three sections and reactions at the ends.



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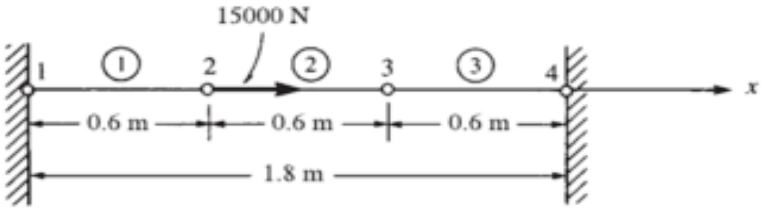
UNIT-II

3. For the three-bar assemblage shown in the figure, determine
(a) Global stiffness matrix
(b) Displacements at nodes 2 and 3
(c) Reactions at nodes 1 and 4

A force of 15000 N is applied in the x direction at node 2. The length of each element is 0.6 m. Let E = 2 * 10^{11} Pa and A = 6 * 10^{-4} m^2 for elements 1 and 2, and let E = 1 * 10^{11} Pa and A = 12 * 10^{-4} m^2 for element 3.
Nodes 1 and 4 are fixed.



OR

4. The bending moment (M) and transverse deflection (w) in a beam according to the Euler—Bernoulli beam theory are related by

$$-EI\frac{d^2w}{dx^2} = M(x)$$

For statically determinate beams, one can readily obtain the expression for the bending moment in terms of the applied loads. Thus, M(x) is a known function of x. Determine the maximum deflection of the simply supported beam under uniform load using the finite element method.

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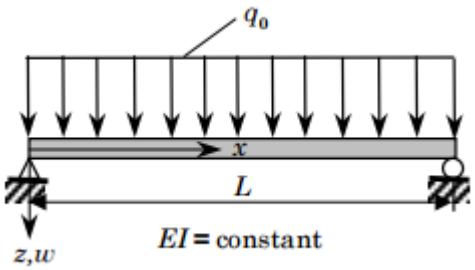


UNIT-III

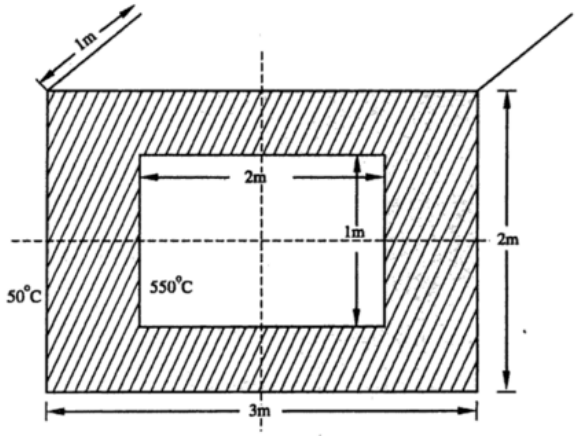
5. (a) Derive the stress – strain relationship to plane problems.
(b) Compare Superparametric and isoparametric representations of triangular element.

OR

6. (a) Sketch and explain the Axisymmetric solid "ring" element.
(b) Write a note on the Strain-Displacement Matrix.

UNIT-IV

7. (a) A furnace wall is made of fireclay brick (k = 1.04 W/mK). In steady state the inside and outside surfaces of the wall are at 550^0 C and 50^0 C, respectively. A schematic of the furnace wall is shown in the figure. Determine the conduction shape factor and the rate of heat conduction per metre length of the furnace.



(b) A horizontal pipe of 10 cm radius and 5 m length is buried in a masonry brick work at a depth of 30 cm. if the pipe wall is at 60^0 C while the earth's surface is at 5^0 C, calculate the rate of heat loss by the pipe, by estimating the conduction shape factor. The thermal conductivity of masonry brick is 0.69 W/mK.

OR

8. Derive an expression for element stiffness and mass matrices for heat conduction in a thin rod.

UNIT-V

9. Explain the element consistent and lumped mass matrices for one and two dimensional linear elements.

OR

10. Find the approximate first two natural frequencies of a simply supported beam using one element.

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