Code: 9A01701

R09

B.Tech IV Year I Semester (R09) Supplementary Examinations June 2016

FINITE ELEMENT METHODS IN CIVIL ENGINEERING

(Civil Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks
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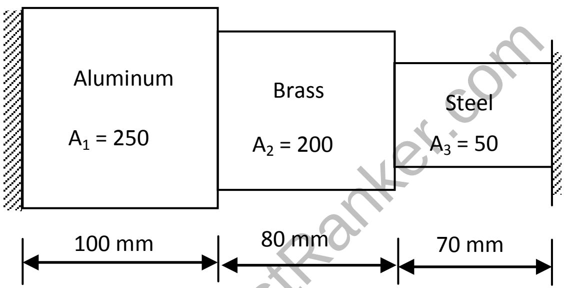
1 (a) What are the merits and demerits of finite element methods?
(b) Discuss the minimization concept of total potential energy.

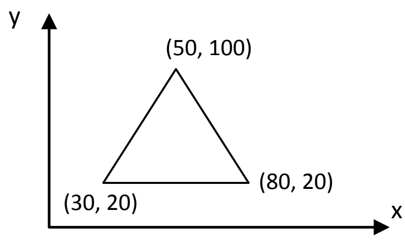
2 (a) Define plane stress and plane strain with suitable examples.
(b) Explain about axisymmetric revolution of loading with a neat sketch.

3 (a) Derive shape function for one dimensional element and state their characteristics.
(b) Determine the displacements and the support reactions for the stepped bar as shown below, $E_{Aluminum}$ = 70 GPa, E_{Brass} = 105 GPa, E_{Steel} = 200 GPa. Take all areas in mm^2.



4 (a) What is geometric invariance?
(b) For a three nodded triangular element, the temperatures are 80℃, 50℃ and 40℃ at the three nodes say 1, 2 and 3 nodes respectively. The nodal coordinates in the global system are $(x_1, y_1) = (2, 3)$, $(x_2, y_2) = (5, 7)$ and $(x_3, y_3) = (3, 9)$. Find the temperature at the point P (4, 6).

5 For the plane stress element shown in the figure below, the nodal displacements are u_1 = 2.0 mm, v_1 = 1.0 mm; u_2 = 0.5 mm, v_2 = 0.25 mm and u_3 = 3.5 mm, v_3 = 1.5 mm, determine the element stresses. Let E = 200 GPa, $\mu = 0.3$ and t = 10 mm.



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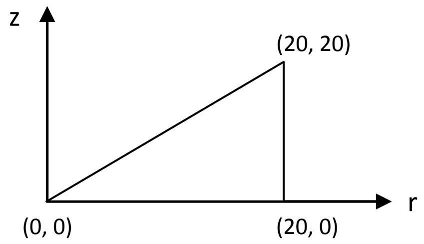
6 (a) Differentiate between isoparametric, sub parametric and super parametric elements.

(b) Consider the iso-parametric quadrilateral with the nodes 1, 2, 3 and 4 at (15, 0), (17, 12), (7, 10) and (6, 2) respectively, which has local coordinates are (0, 0). Compute the Jacobian matrix.

7 For the given plane stress axi-symmetric element as shown below, determine stiffness matrix. Take E = 210 GPa and $\mu = 0.3$.



8 Write short notes on the following:

(a) Static condensation.

(b) Solution technique for static loads.

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