Code: 9A03703

R09

B.Tech IV Year I Semester (R09) Regular & Supplementary Examinations December 2014

FINITE ELEMENT METHODS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

Answer any FIVE questions
All questions carry equal marks
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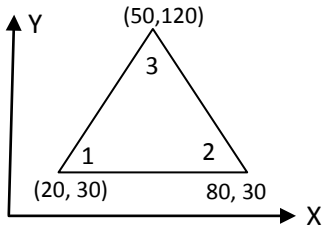
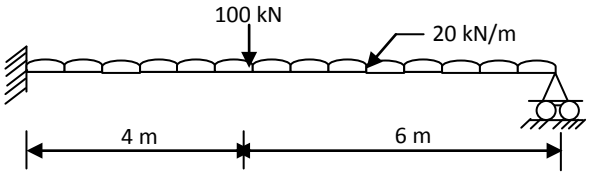
1 (a) Is there any connection between the FEM and the boundary element method (BEM)?
(b) Explain the stress-strain relation.
) (c Draw a typical three dimensional element and indicate state of stress in their positive senses.

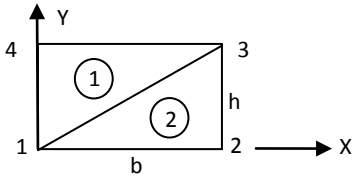
2 Evaluate the stiffness matrix for the elements shown in figure below. The coordinates are given in units of millimeters. Assume plane stress conditions. Let E = 210 GPa, passion ratio 0.25, and thickness 10 mm:



3 Determine the consistent nodal vector due to loads acting on the beam shown in figure:

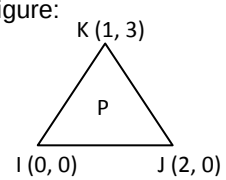


4 Compute the stiffness matrix of element 1 of the two-triangle element model of the rectangular plate in plane stress shown in figure. Then use it to compute the stiffness matrix of element 2.



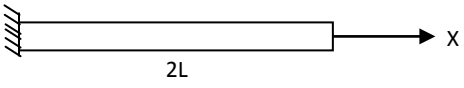
5 (a) Using natural coordinates derive the shape function for a linear quadrilateral element.
(b) Write short notes on:
(i) Uniqueness of mapping of isoparametric elements. (ii) Gaussian quadrature integration technique.

6 Find the temperature at a point P(1,1.5) inside a triangular element shown with nodal temperatures given as $T_i = 40℃, T_j = 34℃ \; and \; T_k = 46℃$. Also determine the location of the $42℃$ contour line for the triangular element shown in figure:



7 Explain the Flowchart of two-dimensional fluid-flow process.

8 Determine the first two natural frequencies, for the bar shown in figure, with length 2L, modulus of elasticity E, mass density ρ, and cross-sectional area A,



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