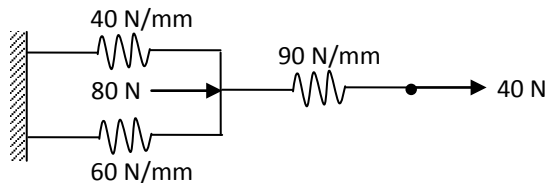B.Tech III Year I Semester (R13) Regular Examinations December 2015
FINITE ELEMENT METHODS IN CIVIL ENGINEERING
(Civil Engineering)

Time: 3 hours
Max Marks: 70

Answer any FIVE questions
All questions carry equal marks
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1   Determine the displacement of nodes of the spring systems shown in figure below.

2   What is constitutive law? Write the constitutive relationships for plane stress, plane strain and axi-symmetric states of stress.

3   Analyze the given structure in figure below using finite element concept. Take $E = 200\mu Pa$.
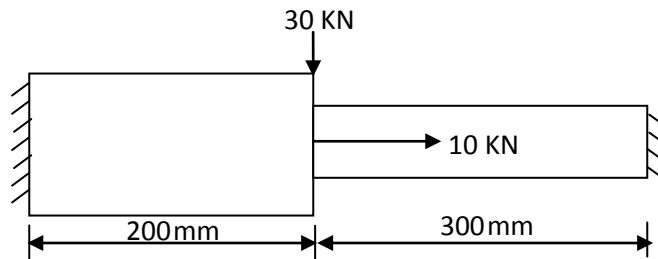
Take moment of inertia as $12 \times 10^4 \text{ mm}^4$ and cross sectional area as 1000 mm^2.

4   (a)   Derive the relation between the nodal displacements and generalized co-ordinates from basics.
     (b)   Explain geometric invariance in FEM.

5   Derive the shape function matrix strain displacement matrix, stiffness matrix and nodal load vectors for a CST element.

6   For the element shown in figure below, determine the Jacobian matrix and strain displacement matrix for the Gaussian point (0.6, 0.6).
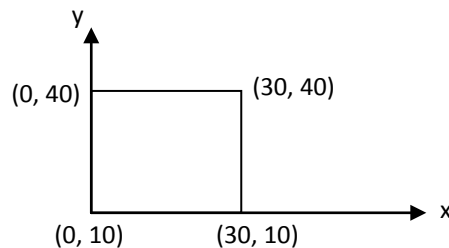
7   Derive the strain displacement matrix and stiffness matrix for 4-noded iso-parametric axi-symmetric element.

8   Write short notes on:
     (a)   Numerical integration.
     (b)   Natural co-ordinate system.

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