Code: 13A01606

R13

B.Tech III Year II Semester (R13) Regular & Supplementary Examinations May/June 2017

FINITE ELEMENT METHODS IN ENGINEERING

(Civil Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) What is discretization?

(b) Write the strain-displacement relationships in matrix form for a 3-D element.

(c) Write the shape functions for a 3-noded 1-D element.

(d) Draw the Pascal's triangle for 2-D elements.

(e) What is the principle used in deriving element stiffness matrix?

(f) Write the strain displacement matrix for a 4-noded rectangular element.

(g) What are sub-parametric elements?

(h) Write the Jacobian matrix for a 2-D isoparametric element.

(i) Write the gauss point of second order gauss quadrature in 1-D gauss quadrature.

(j) Write the sample point of 3 x 3 gauss quadrature for 3-D problems.

PART – B

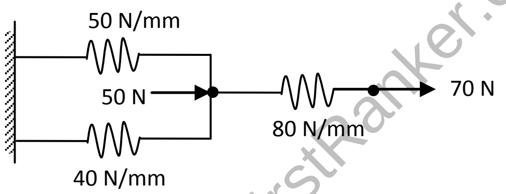
(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 Write and explain the various engineering applications of FEM. Also write the advantages.

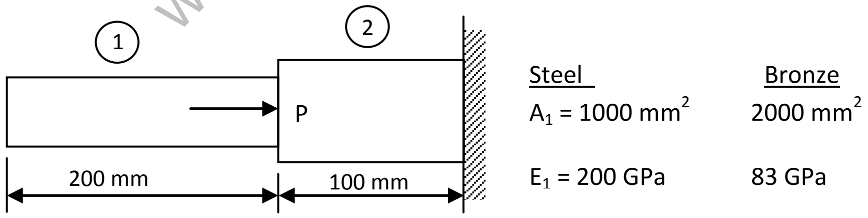
OR

3 Determine the displacements of nodes of the spring system shown in figure below.



UNIT – II

4 The structure consists of two bars. An axial load of P = 200 kN is loaded as shown in figure below. Determine the nodal displacements, stresses and reaction forces for the structure shown in figure below.



OR

5 For a plane stress triangular element the nodes are i(1, 2), j(4, 1) and k(3, 6) all in meters. Obtain the shape functions N_1, N_2 and N_3 at the point P(2, 3).

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UNIT – III

6 Derive the nodal load vectors for a CST element when both surface forces and body forces exist. And also derive the nodal load vectors when only gravity force exists.

OR

7 Derive the shape function matrix, strain displacement matrix and stiffness matrix for a 4-noded rectangular element.

UNIT – IV

8 Explain the formulation of 4-noded 2-D isoparametric quadrilateral element. Derive the strain displacement matrix and stiffness matrix.

OR

9 Explain:
(a) Lagrangian elements.
(b) Serendipity elements.

UNIT – V

10 (a) Evaluate $\int_1^4 \frac{dx}{x}$ using Gaussian three point formula.
(b) Evaluate $\int_{-1}^{+1} \phi(r)dr, if\ \phi = a_1 + a_2 r + a_3 r^2 + a_4 r^3$.

OR

11 (a) Explain static condensation.
(b) Explain the 2-D gauss quadrature in detail.

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