CBCS SCHEME

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18CV751

Seventh Semester B.E. Degree Examination, Dec.2023/Jan.2024
Finite Element Method

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Explain the steps involved in finite element method of structural analysis. **(10 Marks)**

b. Explain the terms plain stress and plain strain. Also give constitutive laws for these cases. **(10 Marks)**

OR

2 a. Derive the general stiffness relation F = K.q from the principle of minimum potential energy. **(10 Marks)**

b. Explain the steps involved in Rayleigh Ritz method for determining the deflection of a beam. **(10 Marks)**

Module-2

3 a. What are the types of discontinuities that are encountered in discretization of the structure? **(10 Marks)**

b. Discuss "two dimensional Lagrangian and Serendipity family of elements" with sketches. **(10 Marks)**

OR

4 a. Using Lagrangian method obtain the shape functions for:
(i) Two noded bar element
(ii) Three noded bar element **(10 Marks)**

b. What are convergence and compatibility requirements of a good displacement model? **(10 Marks)**

Module-3

5 a. Selecting interpolation function for a CST element in its natural coordinates, find the strain matrix. **(10 Marks)**

b. Develop the shape function for the seven noded rectangular element shown in Fig.Q5(b)(i) by degrading technique given that for eight noded element shown in Fig.Q5(b)(ii).

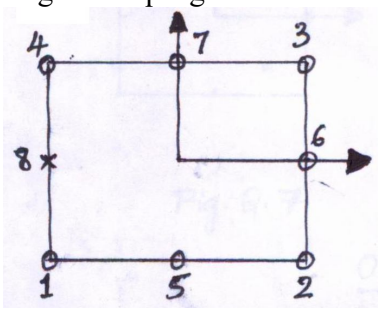

Fig.Q5(b)(i)

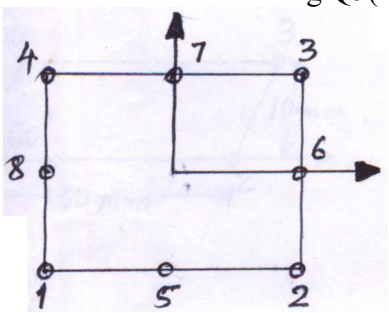

Fig.Q5(b)(ii) **(10 Marks)**

OR

6 a. Derive the strain displacement matrix of axisymmetric bodies with triangular elements. **(10 Marks)**

b. Determine the shape function for Linear Strain Triangular (LST) element. Use natural coordinate system. **(10 Marks)**

Module-4

7 Assemble Jacobian matrix and strain displacement matrix corresponding to the Gauss point (0.57735, 0.57735) for the element shown in Fig.Q7. Then indicate how do you proceed to assemble element stiffness matrix.

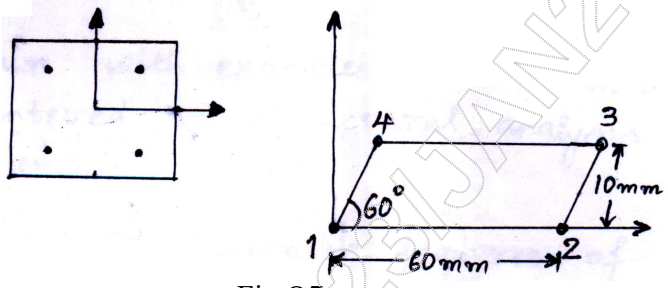

Fig.Q7 **(20 Marks)**

OR

8 a. Determine the Cartesian coordinate of the point P($\xi = 0.8, \eta = 0.9$) as shown in Fig.Q8(a).

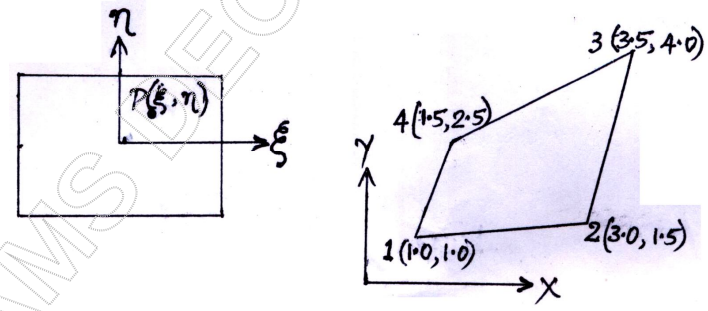

Fig.Q8(a) **(10 Marks)**

b. Briefly explain Gaussian quadrature rules for one dimensional problems. **(10 Marks)**

Module-5

9 a. Explain the methods used for analysis of material non-linearity problems. **(10 Marks)**

b. Explain the structure of a finite element analysis program. **(10 Marks)**

OR

10 a. Explain with examples, various non-linearities encountered in structural analysis problems. **(10 Marks)**

b. List out the desirable features of FEA packages. **(10 Marks)**

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