Hall Ticket No | | | | | | | | | | | Question Paper Code: BST005

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech II Semester End Examinations (Regular/ Supplementary) - July, 2018

Regulation: IARE–R16

FINITE ELEMENT METHOD

(Structural Engineering)

Time: 3 Hours **Max Marks: 70**

Answer ONE Question from each Unit
All Questions Carry Equal Marks
All parts of the question must be answered in one place only

UNIT – I

1. (a) Applying Rayleigh - Ritz method, develop the force displacement relation and evaluate the nodal displacements, support reactions and stresses in each element. **[7M]**

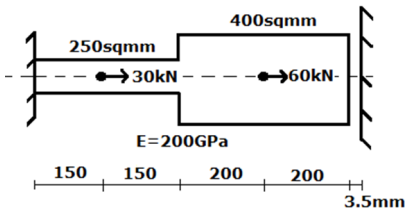

Figure 1

(b) Classify the different types of elements with sketches and outline the application of these elements. **[7M]**

2. (a) Analyze the tapering bar shown by using principle of minimum PE and determine the internal forces in all the elements. Use three elements. E = 200GPa Compare the solution with exact results and comment. Both ends are fixed. **[7M]**

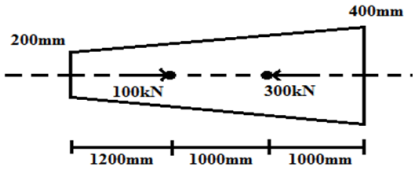

Figure 2

(b) write the basic stress - strain relations of a linear elastic materials in the finite element method. **[7M]**

UNIT – II

3. (a) Develop the shape functions for a two node beam element in cartesian coordinates and derive the consistent load vector for a two node beam element shown below. **[7M]**

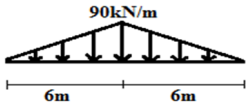

Figure 3

(b) Determine the shape functions for a Constant Strain Triangular (CST) element intermes of natural coordinate systems. Take 3 nodes. **[7M]**

4. (a) Discuss mesh refinement with higher order elements with suitable examples. **[7M]**

   (b) Illustrate with an example how numbering of nodes has to be carried out to minimize band width. **[7M]**

5. (a) Develop the shape functions for a triangular element with six nodes with isoparametric formulation. **[7M]**

   (b) Applying Lagrangian's polynomials develop the shape functions for an 8 -noded brick element. **[7M]**

UNIT – III

6. (a) Develop an expression for strain displacement matrix and outline the procedure for developing element stiffness matrix in plane stress linear rectangular element with isoparametric formulation. **[7M]**

   (b) Develop the strain displacement matrix for constant train triangle element with three nodes. **[7M]**

UNIT – IV

7. (a) Discuss the formulation of plate bending elements based on Kirchhoff's plate theory. **[7M]**

   (b) Discuss and write the basic relations in the thin plate theory with neat sketch. **[7M]**

8. (a) Discuss the formulation of plate bending elements based on Mindlin'splate theory. **[7M]**

   (b) Explain the displacementmodels for plate analysis interms of continuity element. **[7M]**

UNIT – V

9. (a) Explain modified Newton – Raphson method in nonlinear analysis. **[7M]**

   (b) Discuss convergence requirements in nonlinear analysis. **[7M]**

10. (a) Explain how plasticity is considered in uniaxial stress with respect to nonlinear analysis. **[7M]**

    (b) What are the different non linear problems in finite element analysis ans explain. **[7M]**

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