Hall Ticket No | | | | | | | | | | |

Question Paper Code: BST005

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech II Semester End Examinations (Supplementary) - January, 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) Outline the steps involved in finite element analysis for solving a complex problem. **[7M]**
   (b) Applying Rayleigh - Ritz method, develop an expression for maximum deflection in a fixed beam subjected to a central concentrated load using a polynomial with four terms. **[7M]**

2. (a) Discuss the merits and demerits of finite element analysis **[7M]**
   (b) Obtain an expression for Euler's critical for a column with one end fixed and other end hinged using Rayleigh - Ritz method adopting a polynomial of five terms. **[7M]**

UNIT – II

3. (a) Explain the term 'geometric isotropy / geometric Invariance'. Why polynomial shape functions should satisfy these requirement? How do you check a polynomial for this requirement? **[7M]**
   (b) Obtain an expression for strain displacement matrix for a rectangular element. Assuming plane stress condition with displacement matrix as [0, 0, 0.051, 0.076, 0.0152, 0.081, 0, 0] T, determine the stresses at the centre of the rectangle shown in Figure 1. **[7M]**

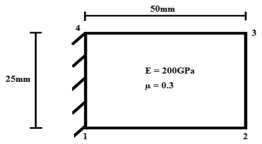

Figure 1

4. (a) Illustrate the application of internal nodes and higher order elements with examples. **[7M]**
   (b) Discuss the convergence requirements to be satisfied by an element. **[7M]**

UNIT – III

5. (a) Derive the strain displacement matrix of a linear triangular element using isoparametric formulation. Determine the joint displacements for the bracket shown in Figure 2. **[7M]**

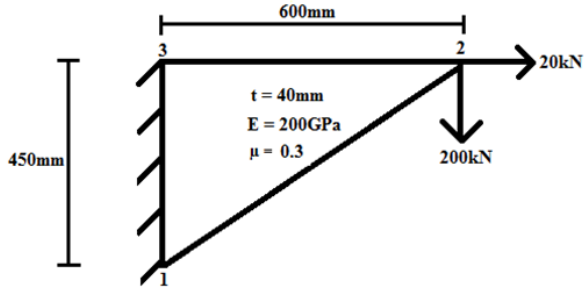

Figure 2

(b) Using Lagrange polynomial find shape functions for Two noded bar element. Sketch the shape function. **[7M]**

6. (a) Develop the strain displacement matrix of an axisymmetry solid using triangular element with isoparametric formulation. **[7M]**

(b) Derive Jacobian matrix four noded isoparametric element **[7M]**

UNIT – IV

7. (a) Discuss the different aspects involved in developing plate bending elements. **[7M]**

(b) What are the assumptions in thin plate theory? Write the relation between forces and stresses action on a thin plate.

8. (a) Discuss the development of various types of shell elements with sketches. **[7M]**

(b) Describe briefly about mindlin's theory of plates? List out the assumptions. **[7M]**

UNIT – V

9. (a) Explain the different types of non-linearities encountered in structural analysis. **[7M]**

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

10. (a) Discuss the difficulties involved in modelling nonlinear problems. **[7M]**

(b) Explain incremental procedure to handle geometric non-linear problems. **[7M]**

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