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INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech II Semester End Examinations (Supplementary) - January, 2019

Regulation: IARE-R16

FINITE ELEMENT METHOD (STE)

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) Explain the steps involved in finite element method and von mises stress. [7M]
- (b) Obtain strain displacement relationship for an axi-symmetric element. [7M]
2. (a) Explain the term Axi-Symmetric problems and give constitutive law for such problems. [7M]
- (b) Explain the terms 'Plane stress' and 'Plane strain' problems. Give constitutive laws for these cases. [7M]

UNIT – II

3. (a) Derive the general equation for determining the stiffness of an element with usual notations in the form. [7M]

$$[k]_e = \int \int \int [B]^T [D] [B] dV$$

- (b) Obtain an expression for strain displacement matrix for a rectangular element shown in Figure 1. 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. [14M]

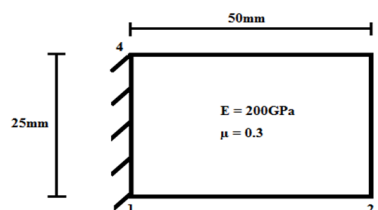


Figure 1

4. (a) Derive shape functions and their derivatives for two noded line element [7M]
- (b) Derive expressions for natural coordinates in a CST element. Show that they are nothing but area coordinates. [7M]

UNIT – III

5. (a) Explain the isoparametric elements and their advantages. [7M]

- (b) Using Lagrange polynomial find shape functions for Two noded bar element. Sketch the shape function. [7M]
6. (a) Derive Jacobian matrix four noded isoparametric element [7M]
(b) Obtain strain displacement relation matrix for two dimensional triangular element. [7M]

UNIT – IV

7. (a) What are the assumptions in thin plate theory? Write the relation between forces and stresses action on a thin plate. [7M]
(b) Evaluate J,B and sigma matrix, assume plane stress condition for 4 noded rectangular element. [7M]
8. (a) Describe briefly about Mindlin's theory of plates? List out the assumptions [7M]
(b) Write the steps involved in obtaining Jacobian matrix and strain displacement relation matrix for 4 noded shell element. [7M]

UNIT – V

9. (a) Explain iterative procedure and modified iterative procedure for the analysis of material non-linearity problems. [7M]
(b) What are the basic methods for non linear analysis and explain? [7M]
10. (a) Explain incremental procedure to handle geometric non-linear problems. [7M]
(b) Explain about non linear applications to special structures. [7M]

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