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

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech II Semester End Examinations (Regular) - July, 2017

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) Explain the concept of FEM briefly and outline the procedure. **[6M]**
   (b) Find out deflection at centre of a simply supported beam of length (L) subjected to a concentrated load W. Use Rayleigh Ritz method. Take EI is constant. **[8M]**
2. (a) Derive the equations of equilibrium in case of a three dimensional stress system. **[7M]**
   (b) State and explain the principle of minimum potential energy. **[7M]**

UNIT – II

3. (a) State and explain the convergence requirements of polynomial shape functions. **[7M]**
   (b) Derive the expression for shape function for a two noded bar element taking natural coordinate as varying from -1 to 1. **[7M]**
4. The thin plate of uniform thickness 20 mm, is as shown in Figure 1. In addition to the self-weight, the plate is subjected to a point load of 400N at mid-depth. The Young's modulus E = $2 \times 10^5 N/mm^2$ and unit weight $\rho = 0.8 \times 10^{-4} N/mm^2$. Analyse the plate after modelling it with two elements and find the stresses in each element. Determine the support reactions also. **[14M]**

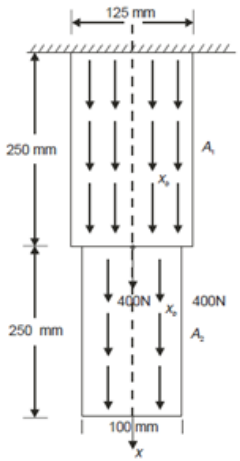

Figure 1

UNIT – III

5. (a) Explain the terms isoparametric, subparametric and superparametric elements. **[9M]**

   (b) Write short notes on serendipity elements with necessary figure. **[5M]**

6. Assemble Jacobian matrix and strain displacement matrix corresponding to the Gauss point (0.57735, 0.57735) for the element shown in Figure 2. Then indicate how you proceed to assemble element stiffness matrix. **[14M]**

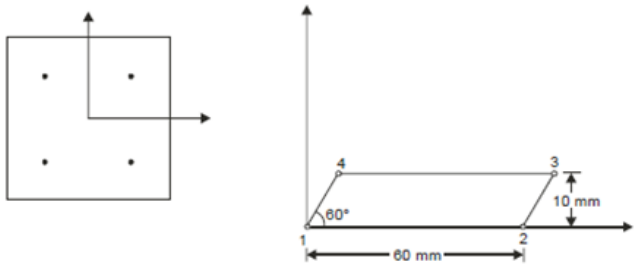

Figure 2

UNIT – IV

7. Describe briefly about basic theory of plate bending with neat sketch and derive flexural rigidity equation. **[14M]**

8. Explain the term Mindlin's C0-continuity plate element and briefly explain stiffness matrix formulation for such elements. **[14M]**

UNIT – V

9. Explain the different types of non-linearities encountered in structural analysis. **[14M]**

10. Explain mid-point Runge-Kutta incremental scheme and discuss its advantages and disadvantages over the incremental procedure. **[14M]**

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