Hall Ticket No | | | | | | | | | | | Question Paper Code: BCCB11

INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

M.Tech II Semester End Examinations (Regular) - May, 2019

Regulation: IARE–R18

ADVANCED FINITE ELEMENT METHOD

Time: 3 Hours **(CAD/CAM)** **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 finite element methods. Deduce stiffness matrix of 3-noded bar element. **[7M]**

   (b) Evaluate the Work potential of a finite element for point load, Traction loads and body loads. **[7M]**

2. (a) Analyze the following integral equation using two point Gaussian Quadrature formula and compare with exact solution. Given for 2 x 2 rule, ζi=$\pm$0.57735, w_i=1.0.

   $I = \int_0^2 \int_0^2 (x^2 + xy^2)dxdy$ **[7M]**

   (b) The Figure 1 shows a four noded quadrilateral. The element displacement vector is given as q = $[0, 0, 020, 0, 0.15, 0.10, 0, 0.05]^T$. Find

   i) the x, y coordinates of a point P whose location in the master element is given by $\zeta = 0.5$, η= 0.5

   ii) u, v displacements of the point P. **[7M]**

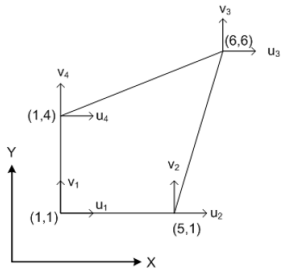

Figure 1

UNIT – II

3. (a) Discuss the conforming and non-conforming rectangular plate bending analysis. **[7M]**

   (b) List and sketch the various flat elements used in the analysis of shells mentioning the nodal degrees of freedom in each element. **[7M]**

4. (a) Explain the term Mindlin's C^o-continuity plate element and briefly explain stiffness matrix formulation for such elements. **[7M]**

(b) Analyze the equivalent load on a shell element when element is subjected **[7M]**
i) gravity load
ii) uniform vertical pressure
iii) uniform normal surface pressure.

UNIT – III

5. (a) List any four two dimensional elements Deduce the shape functions of four noded Tetrahedron element. **[7M]**
   (b) Define plane stress and plane strain. Determine the shape functions for a 8 node quadratic quadrilateral element(boundary noded). **[7M]**

6. (a) Differentiate linear and quadratic hexahedral elements. Deduce the shape functions of a linear hexahedron element. **[7M]**
   (b) Illustrate the load vector of tetrahedral element when subjected to body loads. **[7M]**

UNIT – IV

7. (a) Express the stresses and displacement near crack tip from the theories of linear elastic fracture mechanics. **[7M]**
   (b) Describe heat transfer analysis for composite wall. Analyze the strain in crack tip element. **[7M]**

8. (a) Define steady state heat transfer. Briefly explain the various methods of infinite domain. **[7M]**
   (b) Consider a brick wall of thickness L=30 cm, k=0.7 W/m0C. The inner surface is at 28^0C and the outer surface is exposed to cold air at -15^0C. The heat transfer coefficient associated with the outside surface is h=40 W/m^{20}C. Determine the steady state temperature distribution within the wall and also the heat flux through the wall. **[7M]**

UNIT – V

9. (a) Explain iterative procedure to handle material non-linear problems. **[7M]**
   (b) Determine the first natural frequency of longitudinal vibration of a bar fixed at one end using two linear elements. **[7M]**

10. (a) Explain incremental procedure for the analysis of geometrical non-linearity problems. **[7M]**
    (b) Find the natural frequencies in the vibration of two element simply supported beam having the parameters as length L= 2m, area of cross section A = 30cm^2, moment of inertia I=400 mm^2 density ρ = 7800 kg/m^3 and Young's modulus E = 200 GPa. **[7M]**

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