Karunya University
(Karunya Institute of Technology and Sciences)
(Declared as Deemed to be University under Sec.3 of the UGC Act, 1965)

End Semester Examinations - 2015-16 Even Semester - May 2016

14CE3006 Finite Element Methods in Engineering

Set A

Time : 3 hrs
Total Marks: 100

1. A. Explain Strong formulation and weak formulation in the context of finite element model. (05)

   B. Derive the force displacement relations for a two dimensional truss element inclined at an angle "q" with horizontal.Take E, A and L as elastic modulus, area and length of element respectively. (15)

OR

2. A . Using the variational principle, derive the Euler equation of a beam and bring out the associated natural and essential boundary conditions. (10)

   B. Explain the Finite element analysis procedure by taking a simple truss problem. (10)

3. A Prove that a 3 noded plane stress / strain triangular element is a Constant Strain Triangle element and hence derive the stiffness for plane strain problem . (10)

   B. Derive the shape functions for QST using Area Coordinates. (05)

   C. Distinguish between Sub, Iso and Super Parametric Elements and explain the three main theorems of isoparametric elements. (05)

OR

4. A Explain the principle of virtual work for deriving finite element equations for a 6 noded plane stress triangular element. (08)

   B Derive the shape functions for the 9 noded rectangular element of Langarangean family (06)

   C. Explain uniquesness of mapping and the significance of the Jacobian determinant ((06)

5. A. Develop the shape functions for a linear 10 noded tetrahedron Element using volume coordinates and hence derive its stiffness matrix. (10)

   B . Evaluate the following definite integral using 3 Point Gauss Quadrature and compare with closed form solutions (10)

$$I = \int_{-1}^{1} \cos \frac{\pi x}{2} \, dx$$

OR

6. A Draw neat sketches of Real and Parent elements of linear hexahedron (ZIB8) element

and derive its shape functions and stiffness matrix (10)

B. Explain the finite element for axisymmetric stress analysis using 3 noded planar triangular element and hence derive the stiffness matrix (10)

7. A. Develop the stiffness matrix for 4 Noded 12 DOF Mindlin plate bending element. (15)

B. Prove that a 16 dof rectangular plate bending element is a Fully Conforming element. (05)

OR

8. A Derive the stiffness matrix for 2D beam element (05)

B Develop the stiffness matrix for a Four Noded Bilinear Degenerated Shell Element. (15)

9. A. Describe the singularity element used for finite element analysis in fracture mechanics (05)

B. Explain the various sources of nonlinearities encountered in structural analysis (05)

C. Explain component mode synthesis (05)

D. Write a brief note on automatic mesh generation technique. (05

Wishing you All the Best
