**Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_**

****

**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

**Supplementary Examination – June – 2017**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Code :** | **14CE3006** | **Duration :** | **3hrs** |
| **Sub. Name :** | **FINITE ELEMENT METHODS IN ENGINEERING** | **Max. marks :** | **100** |

(For Structural Engineering)

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Develop the shape function of four noded bar element using Lagrangean interpolation functions. Nodes are equally spaced. | CO1 | 3 |
| b. | Consider the bar shown in figure. P=200kN .Determine (i) nodal displacements (ii) stress in each material and (iii) reaction forces | CO1 | 6 |
| c. | Explain the convergence criteria for monotonic convergence of a displacement model. | CO1 | 5 |
| d. | A simply supported beam is subjected to udl over entire span. Determine the bending moment and deflection at the mid-span using Rayleigh Ritz method and compare with exact solution. Use a two term trial function, | CO1 | 6 |
| (OR) | | | | |
| 2. | a. | Explain the advantages and disadvantages of Finite Element Method. | CO1 | 3 |
| b. | Explain the variational principle and hence develop the Euler equation of a beam and the associated boundary conditions from the expression for total potential energy. | CO1 | 4 |
| c. | The following differential equation is available for a physical problem  d2 y + 500 x2 = 0 ; 0 ≤ x ≤ 1  dx2  By using the trial function y = a (x – x3) + b (x – x5), calculate the values of “ a” and ” b” by Galerkin’s method of weighted residual. | CO1 | 6 |
| d. | The composite bar shown below is subjected to axial forces indicated at 200C. Determine the nodal displacements and the stresses in each material when the temperature of the bar is raised to 800C.   |  |  |  |  | | --- | --- | --- | --- | |  | Part 1-2 | Part 2-3 | Part3-44 | | Material | Bronze | Aluminium | Steel | | Area of cross section- mm 2 | 2400 | 1200 | 600 | | Youngs modulus- GPa | 83 | 70 | 200 | | Coefficient of linear expansion / Degree C | 18.9X10-6 | 23.0X10-6 | 11.7X10-6 | | CO1 | 7 |
| 3. | a. | Distinguish between Sub, Iso and Super parametric elements and  bring out the importance of Jacobian determinant in ensuring  uniqueness of mapping. | CO1 | 4 |
|  | b. | Develop the shape functions for LST in area coordinates. | CO1 | 4 |
|  | c. | A six noded triangular element in plane stress condition is subjected to a uniformly varying surface traction along x direction on the side 1 – 4 – 2. ( from Tx1at node 1 to Tx2 at node 2). Compute the nodal load vector. | CO1 | 6 |
|  | d. | Develop the shape shape functions for a 2D beam element and hence the stiffness matrix. | CO1 | 6 |
| (OR) | | | | |
| 4. | a. | Develop the shape functions and heance stiffness matric for a 4 noded serendipity element. | CO1 | 5 |
|  | b. | Develop the shape functions for a 9 noded Lagrangean element using Lagrangean interpolation. | CO1 | 5 |
|  | c. | Develop the stiffness matrix and consistent load vector due to self weight for a isoparametric quadrilateral. | CO1 | 5 |
|  | d. | Determine the shape functions for a 4 noded planar triangular element shown. Node number 4 is at nthe middle of edge 1-2. | CO1 | 5 |
|  |  |  |  |  |
| 5. | a. | Evaluate the following integral using appropriate Gauss quadrature | CO1 | 6 |
|  | b. | Develop the shape functions in volume coordinates for a 4 noded tetrahendran element and hence the stiffness matrix | CO1 | 7 |
|  | c. | Develop the shape functions for a 8 noded brick element ( ZIB 8 element) and hence the stiffness matrix. | CO1 | 7 |
| (OR) | | | | |
| 6. | a. | Develop the Gauss Points and Weights for 1 Point and 2 Points Gauss Quadrature. | CO1 | 5 |
|  | b. | Develop the shape functions for a linear 10 noded tetrahedron element | CO1 | 5 |
|  | c. | Explain the finite element procedure for axisymmetric stress analysis using 3 noded triangular Element | CO1 | 10 |
|  |  |  |  |  |
| 7. | a. | Discuss in detail the 4 different approaches used to generate shell elements. | CO1 | 5 |
|  | b. | Develop the stiffness matrix for 4 noded bilinear degenerated quadratic  shell element. | CO1 | 8 |
|  | c. | Develop the stiffness matrix for 4 noded 12 DOF Melosh plate bending element. | CO1 | 7 |
| (OR) | | | | |
| 8. | a. | Distinguish between C0, C1 and C2 plate bending elements. | CO1 | 5 |
|  | b. | Prove that a 16 dof rectangular plate bending element is a conforming element. | CO1 | 5 |
|  | c. | Explain Dynamic condensation technique. | CO1 | 5 |
|  | d. | Explain Finite Strip method. | CO1 | 5 |
|  | | **Compulsory**: |  |  |
| 9. | a. | Write short notes on discritization errors. | CO2 | 5 |
|  | b. | Discuss the basic modules of various adaptive mesh generation techniques. | CO2 | 5 |
|  | c. | Explain in detail about the pre-processing, solution phase and post processing with respect to an engineering structure. | CO2 | 5 |
|  | d. | Write short notes on finite element for fracture analysis. | CO2 | 5 |

**ALL THE BEST**