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



**End Semester Examination – Nov/Dec – 2017**

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

(for mech only)

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

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Discuss in detail about Finite Element Method and Boundary Element Method. Write the various steps involved. | CO1 | 6 |
| b. | The following differential equation is available for a physical phenomenon. d2y/dx2 + 300x2 = 0; 0<x<1 with the boundary condition y(0)= y(1)= 0. The functional corresponding to this problem to be extremised is given by  Find the solution using Rayleigh Ritz method with one term solution as y = ax(1-x3). | CO1 | 14 |
| (OR) | | | | |
| 2. |  | Find the deflection at the centre of a simply supported beam of span length L subjected to a uniformly distributed load throughout its length as shown in the figure using Galerkin’s method, Sub domain method, Collocation method, Least square method and compare with the exact solution.  Fig.1 | CO1 | 20 |
|  |  |  |  |  |
| 3. |  | |  | | --- | | An axial load of 300 kN is applied at 20° C to the rod as shown in fig.2. The temperature is raised to 60°C. Determine i. Nodal displacements, ii. Stresses in each material, iii. Support reactions. |     Fig.2 | CO1 | 20 |
| (OR) | | | | |
| 4. |  | A cantilever beam with a span of 50mm and cross-section 10mm x 10 mm is subjected to a point load of 100 N. Find the deflection and slope at the free end. Compare the FEA solution with the exact solution. | CO1 | 20 |
|  |  |  |  |  |
| 5. | a. | List their properties of the shape function. | CO1 | 3 |
| b. | Write the different convergence criteria. | CO1 | 3 |
| c. | Determine three points on the 50°C contour line for the rectangular element shown in the fig.3. The nodal values are Φi= 42°C, Φj = 54°C, Φk = 56°C and Φm = 46°C. Use local coordinate system.    Fig.3 | CO1 | 14 |
| (OR) | | | | |
| 6. | a. | Differentiate between linear triangular element and bilinear rectangular element with an example. | CO1 | 4 |
| b. | Derive the Shape function for a 2D triangular element | CO1 | 16 |
|  |  |  |  |  |
| 7. | a. | Write the Shape function for the 1-D cubic element and check for unity | CO1 | 4 |
|  | b. | Determine the shape functions of a nine noded rectangular element. | CO1 | 16 |
| (OR) | | | | |
| 8. | a. | What is higher order elements and why they are needed? | CO1 | 2 |
|  | b. | Derive the shape function for 1-D Quadratic element using local coordinate system. | CO1 | 18 |
|  |  |  |  |  |
|  | | **Compulsory:** |  |  |
| 9. | a. | Give the governing differential equation for a steady state heat transfer from a 1D fin. | CO1 | 2 |
|  | b. | Define Potential flow. | CO1 | 2 |
|  | c. | A long bar or rectangular cross section, having thermal conductivity of 1.5 W/m °C is subjected to the boundary conditions shown in the figure. Two opposite sides are maintained at a uniform temperature of 180°C; one side is insulated, and the remaining side is subjected to a convection process with T∞=25°C and h=50 W/m2°C. Determine the temperature distribution in the bar.    Fig.4 | CO1 | 16 |

ALL THE BEST