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



**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

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

**End Semester Examination – April/May – 2017**

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

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

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Mention the different stages of Finite element analysis according to computer implementation. | CO1 | 2 |
| b. | Differentiate Finite Difference Method and Finite Volume method. Write the various steps involved in the FVM. | CO1 | 4 |
| c. | 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    Predict the solution using Rayleigh Ritz method with one term solution as y = ax(1-x3). | CO1 | 14 |
| (OR) | | | | |
| 2. | a. | List the applications of FEA in different engineering fields with examples. | CO1 | 4 |
| b. | For the differential equation d2y/dx2+ 400x2 = 0; 0<x<1 with boundary conditions y(0)=0 and y(1) = 0. Solve the problem using a two term polynomial trial function by using i. point collocation method, ii. Sub-domain method. | CO1 | 16 |
| 3. |  | An axial load of 300 kN is applied at 20° C to the rod as shown in figure. The temperature is raised to 60°C. Determine i. Nodal displacements, ii. Stresses in each material, iii. Support reactions. | CO1 | 20 |
| (OR) | | | | |
| 4. | a. | State the Shape function for a 1D Beam element. | CO1 | 20 |
| 5. | a. | Write the different convergence criteria. | CO1 | 3 |
| b. | Differentiate between linear triangular element and bilinear rectangular element with neat example. | CO1 | 3 |
| c. | Determine three points on the 50°C contour line for the rectangular element shown in the figure. The nodal values are  Φi= 42°C, Φj = 54°C, Φk = 56°C and Φm = 46°C. Use local coordinate system.  D:\Academics\FEA\FEA- 3.jpg | CO1 | 14 |
| (OR) | | | | |
| 6. | a. | Define shape function? List their properties. | CO1 | 4 |
| b. | Derive the Shape function for a 2D triangular element. | CO1 | 16 |
| 7. | a. | Define Serendipity element. | CO1 | 2 |
|  | b. | Derive the shape function for 1-D Quadratic element using local coordinate system. | CO1 | 18 |
| (OR) | | | | |
| 8. | a. | Describe higher order elements and why they are needed? List their advantages. | CO1 | 4 |
|  | b. | Determine the shape functions of a nine noded rectangular element. | CO1 | 16 |
|  | | **Compulsory:** |  |  |
| 9. |  | For the smooth pipe of variable cross section as shown in the figure, determine the potential at the junctions, velocities in each section of the pipe and the volumetric flow rate.  The potential at the left end is p1=10m and that at the right end is p4=1m. Permeability coefficient k=1m/s. | CO1 | 20 |

ALL THE BEST