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** |

(For Mechanical students)

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

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| Q. No. | Sub Div. | Questions | Course  Outcome | Marks |
| 1. | a. | Discuss in detail about the discretization process with suitable examples. | CO1 | 6 |
| b. | Using a three term polynomial trial function, determine the deflection at the center of a simply supported beam of span ‘l’ subjected to uniformly distributed load throughout its length as in figure. Use Rayleigh Ritz method.  Also, compare the deflection with the value obtained from a single term trigonometric trial function. | CO1 | 14 |
| (OR) | | | | |
| 2. | a. | Solve the differential equation for a physical problem expressed as d2y/dx2 + 100 = 0; 0 < x < 10 with boundary conditions y(0)= 0 and y(10) = 0 using i. galerkin method, ii. Least square method, iii. point collocation method, iv. Sub-domain method. | CO1 | 20 |
| 3. | a. | 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 |
| (OR) | | | | |
| 4. | a. | A stepped bar is subjected to an axial load of 200 kN at the place of change of cross section and material as in the figure. Find i. Nodal displacement, ii. Reaction forces, iii. Induced stresses in each material.  FEA- 1 | CO1 | 20 |
| 5. | a. | Write the different convergence criteria. | CO1 | 3 |
| b. | Differentiate between linear triangular element and bilinear rectangular element with an example. | CO1 | 3 |
| c. | The nodal displacements at the nodal points of a triangular element along x and y are given as  u1= 0.001, u2= 0.003, u3= **-**0.002,, v1= **-**0.004, v2= 0.002 and v3= 0.005. Find the displacements u,v at point (2,5). | CO1 | 14 |
| (OR) | | | | |
| 6. | a. | What is shape function? List their properties | CO1 | 4 |
| b. | Derive the Shape function for a bilinear rectangular element using local coordinate system. | CO1 | 16 |
| 7. | a. | Define Lagrange element. | CO1 | 2 |
|  | b. | Derive the shape function for 1-D Quadratic element using local coordinate system. | CO1 | 18 |
| (OR) | | | | |
| 8. | a. | Write the Shape function for the 1-D cubic element and check for unity. | CO1 | 4 |
|  | b. | Determine the shape functions of a eight noded rectangular element. | CO1 | 16 |
|  | | **Compulsory:** |  |  |
| 9. | a. | Give the governing differential equation for a steady state heat transfer from a 1D fin. | CO1 | 2 |
|  | b. | State Darcy law. What does the negative sign indicate? | CO1 | 2 |
|  | c. | A wall of cylindrical oven consists of 3 different layers of materials. First layer is composed of 5 cm of insulating material with thermal conductivity 0.08 W/mk. The second layer is made of 15 cm thickness of asbestos with thermal conductivity 0.04 W/mk. The outer layer consists of 10 cm thick brick wall with thermal conductivity 0.72 W/mK. The inside wall temperature of oven is 250°C and outer layer is 30 °C with convective heat transfer coefficient 40 W/m2K. Determine the temperature distribution along the composite wall. (Convective heat loss occurs at the right end)  D:\Academics\FEA\FEA- 4.jpg | CO1 | 16 |

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