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

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**End Semester Examination – Nov/Dec – 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. | List the advantages and disadvantages of finite element method. | CO1 | | 5 |
| b. | Explain variational principle in the development of finite element model. | CO1 | | 5 |
| c. | Discuss the various weighted residual methods with respect to the following differential equation available for a physical phenomenon. 0 ≤ x ≤ 1  By using the trial function y = a (x – x3) + b (x – x5), calculate the values of the parameters “a” and “b” by the any two weighted residual methods. | CO1 | | 10 |
| (OR) | | | | | |
| 2. | a. | Distinguish between boundary value problems and Initial value problems with examples, | CO1 | | 5 |
| b. | Distinguish between strong formulation and weak formulation in the context of finite element model, | CO1 | | 5 |
| c. | Explain the basic philosophy of finite element method and explain the Step by step Finite Element Analysis procedure by taking a simple truss problem, | CO1 | | 10 |
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| 3. | a. | Develop the shape functions for four noded axial element using natural Coordinates. | CO1 | | 5 |
| b. | Develop the shape functions for Linear Strain Triangle element using area coordinates. | CO1 | | 5 |
| c. | Explain the convergence criteria for monotonic convergence of a displacement model. | CO1 | | 10 |
| (OR) | | | | | |
| 4. | a. | Explain the Principle of Minimum Potential. | | CO1 | 5 |
| b | Explain area coordinates. | | CO1 | 5 |
| b. | Prove that a three noded plane stress / strain triangular element is a Constant Strain Triangle element and hence derive the stiffness matrix. | | CO1 | 10 |
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| 5. | a. | Distinguish between Sub, Iso and Super parametric elements. | | CO1 | 5 |
| b. | Develop the shape functions for the nine noded Langarangean rectangular element. | | CO1 | 5 |
| c | Develop the shape functions and stiffness matrix for Eight-Noded quadrilateral element of serendipity family. | | CO1 | 10 |
| (OR) | | | | | |
| 6. | a. | Develop the shape functions and stiffness matrix for four noded tetrahedran element. | | CO1 | 10 |
| b. | Develop the stiffness matrix and consistent load vector for a eight noded hexahedral element. | | CO1 | 10 |
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| 7. | a. | Discuss the development of triangular plate bending elements, | | CO1 | 8 |
|  | b. | Distinguish between C0, C1 and C2 plate bending elements. | | CO1 | 4 |
|  | c. | Explain the finite strip method for analyzing a folded late structure. | | CO1 | 8 |
| (OR) | | | | | |
| 8 | a. | Discuss in detail the four different approaches used to generate shell elements. | CO1 | | 8 |
|  | b. | Explain the concept of degenerated shell element. | CO1 | | 4 |
|  | c. | Develop the stiffness matrix for four noded bilinear degenerated quadratic shell element. | CO1 | | 8 |
|  | | |  | |  |
| **Compulsory:** | | |  | |  |
| 9 | a | Develop the consistent mass matrix for a bar element. | CO1 | | 5 |
| b. | Explain “h”, “p”, “r” and “hp” methods of adoptive mesh refinement techniques. | CO1 | | 5 |
| c. | Calculate the temperature distribution in the fin, as shown in Figure, using the finite element method. The fin is rectangular in shape, 8 cm long, 0.4 cm wide and 1 cm thick. Assume that convection heat loss occurs from the right end of the fin. (The fin is to be divided uniformly into four elements with a total of five nodes. Each element is with a length of I = 2 cm.)  [A one-dimensional fin of a rectangular cross-section.](http://what-when-how.com/wp-content/uploads/2012/06/tmp556b55_thumb2.png) | CO1 | | 10 |

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