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



**End Semester Examination – Nov/Dec – 2018**

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| **Code :** | **18CE3013** | **Duration :** | **3hrs** |
| **Sub. Name :** | **FINITE ELEMENT METHODS IN STRUCTURAL ENGINEERING** | **Max. marks :** | **100** |

**ANSWER ANY FIVE QUESTIONS (5 x 16 = 80 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Define Principle of Virtual work and give its application. | CO1 | 2 |
| b. | Define Initial value problem and boundary value problem and give examples. | CO1 | 2 |
| c. | Distinguish between strong formulation and weak formulation. | CO2 | 4 |
| d. | Explain the variational principle and develop the equation of an Euler beam and the associated boundary conditions from total potential energy expression. | CO2 | 8 |
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| 2. | a. | List the properties of a structural stiffness matrix. | CO2 | 2 |
| b. | List the properties of shape function. | CO2 | 2 |
| c. | Develop the shape functions for a 4 noded line element. | CO3 | 4 |
| d. | The members (A) and (B) of the truss given below are circular in cross section with diameters of 10 cm and 20 cm respectively. Determine the displacements at the node where load is acting. | CO4 | 8 |
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| 3. | a. | Develop the shape functions for a QST. | CO3 | 4 |
| b. | Develop the shape functions for a 9 noded Lagrangean element. | CO3 | 4 |
| c. | Explain Static condensation technique. | CO2 | 4 |
| d. | State the theorems of isoparametric element. | CO1 | 4 |
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| 4. | a. | Develop the stiffness matrix for a 8 noded brick element (ZIB8 ). | CO3 | 6 |
| b. | Compare axisymmetric stress analysis and plane stress / strain analysis in the context of finite element application. | CO3 | 4 |
| c. | Using two point Gaussian quadrature function, evaluate the integral | CO5 | 6 |
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| 5. | a. | Distinguish between Kirchhoff thin plate bending element and Reissners plate bending element. | CO5 | 2 |
| b. | Explain the concept of degenerated shall element. | CO5 | 4 |
| c | Define shear locking and membrane locking. | CO1 | 4 |
| d. | Briefly discuss finite strip method for analysis of bridge deck. | CO5 | 6 |
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| 6. | a. | Explain the convergence criteria for monotonic convergence of a displacement model. | CO2 | 5 |
| b. | Develop the shape functions of a 2 D beam element. | CO3 | 5 |
| c. | Develop the force displacement relations for a two dimensional truss element inclined at an angle “θ” with horizontal. Take E, A and L as elastic modulus, area and length of element respectively. | CO3 | 6 |
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| 7. | a. | Distinguish between sub, iso and super parametric elements. | CO2 | 2 |
| b | Develop the shape functions and hence the stiffness matrix for 8 noded serendipity element. | CO3 | 6 |
| 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 Tx1 at node 1 to Tx2 at node 2). Compute the nodal load vector.  1  Tx1  6    4  3  5  Tx2 2 | CO4 | 8 |
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| **COMPULSORY QUESTION (1 x 20 = 20 Marks)** | | | | |
| 8. | a. | Explain adoptive mesh generation techniques. | CO6 | 5 |
| b. | Discuss Automatic mesh generation technique. | CO6 | 5 |
| c. | Discuss the requirements for selection of commercial software for structural analysis. | CO6 | 5 |
| d. | Briefly explain the principles of modeling using software. | CO6 | 5 |