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



**End Semester Examination – Nov / Dec – 2019**

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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. | Distinguish between the types of elements. | CO1 | 5 |
| b. | The three bar assemblage is present as in figure. A force of 2500N is applied in the x direction at node 2. The length of each element is 750mm. Take E= 2 x 105 N/mm2 and A= 600 mm2 for elements 1 and 2. Take E= 2 x 105 N/mm2 and A= 1200mm2 for elements 3. Nodes 1 and 4 are fixed. Calculate (i) Global stiffness matrix,  (ii) Displacement of nodes 2 and 3 (iii) Reactions at nodes 1 and 4 | CO1 | 15 |
| **(OR)** | | | | |
| 2. | a. | The differential equation of a physical phenomenon is given by d2y/dx2 + 500x2 = 0; 0 <x < 1.  Using the trial function y = a1(x-x3) + a2(x-x5), calculate the value of the parameters of a1 and a2 using (i) Point Collocation (ii) Least Square. The boundary conditions are y(0) = 0 and y(1) = 0 | CO1 | 15 |
| b. | Summarize the properties of stiffness matrix. | CO1 | 5 |
|  |  |  |  |  |
| 3. | a. | Derive the shape function for the beam element. | CO1 | 15 |
| b. | Reiterate the properties of shape functions. | CO1 | 5 |
| **(OR)** | | | | |
| 4. |  | Find the deflection at the point load and the slopes at the ends for the steel shaft which is simply supported at the bearing A and B as in figure. Take E=200GPa | CO1 | 20 |
|  |  |  |  |  |
| 5. | a. | Distinguish between higher order element and lower order element. | CO2 | 5 |
| b. | Criticize on grid dependent study and how it affects accuracy and computational time. | CO2 | 5 |
| c. | Using Lagrange’s method, derive the shape functions for quadratic element. | CO2 | 10 |
| **(OR)** | | | | |
| 6. |  | Reframe the shape function of a cubic element. | CO2 | 20 |
|  |  |  |  |  |
| 7. |  | Derive the shape function for a triangular element and verify whether they satisfy the properties of stiffness matrix. | CO3 | 20 |
| **(OR)** | | | | |
| 8. |  | Devise the shape function for a nine noded rectangular element. | CO3 | 20 |
|  | | **Compulsory**: |  |  |
| 9. |  | A steel rod of diameter d= 2cm, length L= 5cm and thermal conductivity k= 50W/m°C, is exposed at one end to a constant temperature of 320°C. The other end is in ambient air of temperature 20°C with a convection coefficient of h= 100W/m2°C. Determine the temperature at the midpoint of the rod. | CO3 | 20 |