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

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

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| **Code :** | **18ME3018** | **Duration :** | **3hrs** |
| **Sub. Name :** | **FINITE ELEMENT METHODS IN 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. | | Obtain the system stiffness matrix for the linear spring system below. Also find the force in spring ‘3’. | CO3 | 10 |
| b. | | Use the Rayleigh-Ritz method to solve the beam deflection problem given by the variational principle    with the boundary conditions y(0) = 0 = y(L). The exact solution of this minimization problem is | CO3 | 06 |
|  |  | |  |  |  |
| 2. | a. | | Solve the differential equation    with the boundary conditions y(0) = 0, y(2) = 5 using point collocation method. The exact solution of the problem is | CO2 | 10 |
| b. | | Solve the differential equation    with the boundary conditions y(0) = 0, y(2) = 5 using Galerkin method. | CO2 | 06 |
|  |  | |  |  |  |
| 3. |  | The mesh for a problem contains an eight-node quadratic serendipity rectangle adjacent to a six-node quadratic triangle as shown in the figure. Show that the coordinates computed from each element satisfy continuity along the edge 3-7-11. | | CO1 | 16 |
|  |  |  | |  |  |
| 4. | a. | Solve by direct stiffness matrix of the following four-spring system:    With spring constant k = 200 kN/m and the displacement δ = 20 mm. | | CO3 | 10 |
| b. | Explain adaptive mesh refinement procedure of finite element method. | | CO1 | 06 |
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| 5. |  | For the triangle in figure, the interior point P at (2,2) divides it into three areas, A1 , A2 , A3 as shown in figure. Deteremine A1/A , A2/A, A3/A. | | CO5 | 16 |
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| 6. |  | The structure in the figure is subjected to an increase in temperature, . Determine the displacements, stresses and support reactions. Solve this problem by hand calculation, using the elimination method for handling boundary conditions. | | CO5 | 16 |
|  |  |  | |  |  |
| 7. |  | Find the natural frequency of longitudinal vibration of the unconstrained stepped bar as shown in figure. | |  | 16 |
| **COMPULSORY QUESTION (1 x 20 = 20 Marks)** | | | | | |
| 8. | a. | | Explain three methods to solve eigen values problems by using matrix method. | CO1 | 8 |
| b. | | Explain the procedure of weighted residual method using finite element method. | CO2 | 8 |
| c. | | Define shape function related to FEM. | CO1 | 4 |