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

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| **End Semester Examination – Nov/Dec – 2018** | | | |
| **Code :** | **10ME205** | **Duration :** | **3hrs** |
| **Sub. Name :** | **FINITE ELEMENT ANALYSIS** | **Max. marks :** | **100** |

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| **Q. No.** | **Questions** | **Marks** |
| **PART-A(10X1=10 MARKS)** | | |
| 1. | List out the three phases of finite element method. | 1 |
| 2. | Define the concept of potential energy. | 1 |
| 3. | Give stiffness matrix of a simple beam element. | 1 |
| 4. | Sum of all the shape functions is equal to \_\_\_\_\_\_\_\_\_\_\_. | 1 |
| 5. | Define Natural coordinate system. | 1 |
| 6. | Mention the function of Pascal triangle. | 1 |
| 7. | Write the interpolation polynomial for 1D cubic element. | 1 |
| 8. | Define Lagrange element. | 1 |
| 9. | State the second order differential equation for 1-D heat transfer. | 1 |
| 10. | What is the characteristic matrix of 1D potential flow element? | 1 |

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| **PART B(5 X 3= 15 MARKS)** | | |
| 11. | What is the concept of matrix algebra and in what way it is used in FEA? | 3 |
| 12. | List the characteristics of shape function. | 3 |
| 13. | Mention the various convergence requirements | 3 |
| 14. | What is higher order element? Mention its purpose. | 3 |
| 15. | State Darcy’s Law. | 3 |

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| **PART C(5 X 15= 75 MARKS)** | | | |
| 16. |  | Explain the step by step procedure involved in FEA. | 15 |
| (OR) | | | |
| 17. |  | For the differential equation, d2y/dx2 + 400x2 = 0; 0 <x <1 with boundary conditions y(0)= 0 and y(1) = 0. Find the solution of the problem using a two term trial function by using i. point collocation method, ii. Subdomain collocation method | 15 |
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| 18. |  | For the beam shown in the fig.1, calculate the deflection and slope at each end of an individual member. E = 20x106 N/cm2, Moment of Inertia I = 500cm4, L=1000 cm and P = 20 kN.    Fig. 1 | 15 |
| (OR) | | | |
| 19. | a. | List the properties of the stiffness matrix. | 3 |
| b. | Calculate the deflection and stress for the given tapered bar shown in the fig.2 by converting it as a stepped bar with two elements. Take E = 2x105 N/mm2    Fig. 2 | 12 |
| 20. |  | Derive the stiffness matrix and equations for a CST element. | 15 |
| (OR) | | | |
| 21. | a. | Differentiate linear triangular element and bilinear rectangular element with suitable diagram. | 3 |
|  | b. | A rectangular element with four nodes i(5, 3), j (8, 3), k (8, 5) and m(5, 5) is shown in fig.3. The nodal values are Ti= 420C, Tj= 540C , Tk= 560C and Tm= 460C. Find the temperature at the points P(6, 4) and Q (7, 4.5).  D:\Academics\FEA\FEA- 3.jpg  Fig.3 | 12 |
| 22. |  | Derive the shape function for a serendipity element. | 15 |
| (OR) | | | |
| 23. |  | Derive the shape functions for a 1D quadratic element using local coordinate system. | 15 |
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| 24. |  | For the smooth pipe of variable cross section shown in the fig.4, determine the potential at the junctions, velocities in each section of the pipe and the volumetric flow rate. The potential at the left end is p1=10m and that at the right end is p4=1m. Permeability coefficient k = 1m/s.  Fig.4 | 15 |
| (OR) | | | |
| 25. |  | A wall of an industrial oven consists of three different materials. The first layer is composed of 5 cm of insulating cement with a clay binder that has a thermal conductivity of 0.08 W/m K. The second layer is made from 15 cm of asbestos board with a thermal conductivity of 0.074 W/m K. The exterior consists of 10 cm common brick with a thermal conductivity of 0.72 W/mK. The inside (inlet) wall temperature of the oven is 200°C, and the outside air is 30°C with a convection coefficient of 40 W/m2K. Determine the temperature distribution along the composite wall. Consider area of the element as 1m2. | 15 |