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



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

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| **Code :** | **15AE3009** | **Duration :** | **3hrs** |
| **Sub. Name :** | **FINITE ELEMENT ANALYSIS IN AEROSPACE APPLICATION** | **Max. Marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. |  | The following differential equation is available for a physical phenomenon.  Trial function is y = a1x (10 – x)  Boundary conditions are y (0) = 0  y(10) = 0  Find the value of parameter a1 by the following methods   1. Point Collocation 2. Subdomain Collocation 3. Least Squares 4. Galerkin method. | CO1 | 5  5  5  5 |
| (OR) | | | | |
| 2. |  | A simply supported beam subjected to uniformly distributed load over entire span. Determine the Bending moment and deflection at midspan by using Rayleigh – Ritz method and compare with exact solutions. | CO2 | 20 |
| 3. |  | Derive the Shape function and Element Stiffness Matrix for Triangular element in global coordinate system. | CO1 | 20 |
| (OR) | | | | |
| 4. | a. | Write the properties of the Shape function. | CO1 | 5 |
| b. | Derive the shape function of nine node quadratic quadrilateral element in Natural coordinate system. | CO2 | 15 |
|  |  |  |  |  |
| 5. |  | Derive the shape function of one dimensional Linear Quadratic element in Global coordinate system. | CO1 | 20 |
| (OR) | | | | |
| 6. |  | Consider a three bar as shown in figure. It is given that E = 2 X 105 N/mm2. Calculate   1. Nodal Displacements. 2. Stress in each member. 3. Reactions at the support.   Take Area of first element, second element and third element as 2000mm2, 2500mm2 and 2500mm2 respectively. | CO2 | 20 |
| 7. |  | Determine the stiffness matrix for the constraint strain triangle (CST) element shown in figure. The coordinates are given in millimeters. Assume plane stress conditions. Take E = 210 GPa, v = 0.25 and t = 10 mm. | CO2 | 20 |
| (OR) | | | | |
| 8. |  | For the plane stress element shown in figure, the nodal displacements are  U1 = 2.0 mm v1 = 1.0 mm  U2 = 0.5 mm v2 = 0.0 mm  U3 = 3.0 mm v3 = 1.0 mm    Determine the element stresses σx,σy, τxy, σ1 and σ2 and the principal angle θP. Let E = 2.10 X 105 N/mm2, v = 0.25 and t = 10 mm. All co-ordinates are in millimeters. | CO2 | 20 |
|  | | **Compulsory:** |  |  |
| 9. |  | For the two dimensional sandy soil region shown in figure, determine the potential distribution and velocity gradient. The potential (fluid head) on the left side is a constant 10.0 m, and that on the right side is 0.0 m. The upper and lower edges are impermeable. The permeabilities are kx = ky = 25 X 10 – 5 m/s. Assume unit thickness. | CO2 | 20 |