Q. Code: 586540

Reg. No. | | | | | | | | | |

B.E. / B.TECH. DEGREE EXAMINATIONS, DEC 2019

Sixth Semester

ME16603 – FINITE ELEMENT ANALYSIS

(Common to AE & ME)

(Regulation 2016)

Time: Three Hours **Maximum : 100 Marks**

Answer **ALL** questions

PART A - (10 X 2 = 20 Marks)

		CO	RBT
1.	What do you mean by discretization?	1	U
2.	Name the weighted residual methods used in FEM.	1	U
3.	Give examples for essential and non-essential boundary conditions.	1	U
4.	Is beam element an isoparametric element? Justify?	3	U
5.	What is CST element?	2	U
6.	Define plane strain analysis.	2	U
7.	Write down the stress - strain relationship matrix for an axisymmetric triangular element.	2	U
8.	What are the ways in which a three-dimensional problem can be reduced to a two-dimensional approach.	2	U
9.	Write down the Jacobian matrix for four noded quadrilateral element.	3	U
10.	Differentiate Natural coordinates and Global coordinates.	3	U

PART B - (5 X16 = 80 Marks)

11. (a) The following differential equation is available for a physical phenomenon. **(16)** 1 AP

$$\frac{d^2y}{dx^2} + 50 = 0, 0 \le x \le 10$$

Trial function is $y = a_1 x(10 - x)$.

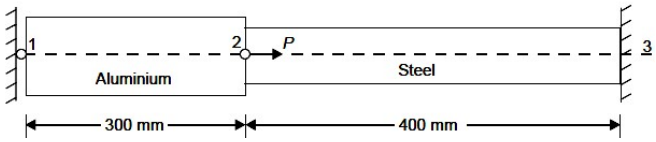
The boundary conditions are y(0)=0, y(10)=0. Find the value of the parameters a_1 by the following methods: (i) Point collocation, (ii)

Subdomain collocation, (iii) Least square method, (iv) Galerkin method.

(OR)

(b) Using Rayleigh – Ritz method, determine the expression for deflection and bending moments in a simply supported beam, subjected to uniformly distributed load 'w'/unit length over entire span of length 'l' and is subjected to a point load 'W' at its Centre. Find the deflection and moment at mid span. **(16) 1 AP**

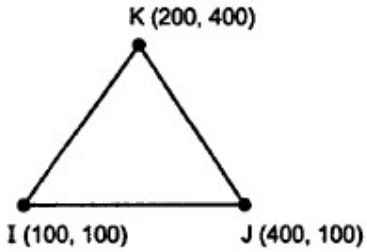
12. (a) Determine the nodal displacements at node 2, stresses in aluminium (A_1, E_1) and steel (A_2, E_2) and support reactions in the bar shown in Figure, due to applied force P = 400 kN. Given: A_1 = 2400 mm^2, A_2 = 1200 mm^2, l_1 = 300 mm, l_2 = 400 mm, $E_1 = 0.7 \times 10^5$ N/mm^2, $E_2 = 2 \times 10^5$ N/mm^2 **(16) 1 AP**



(OR)

(b) A cantilever beam of length L is made up of a material whose Young's Modulus and density are given by E and ρ. Estimate two natural frequencies of axial vibration of the bar using consistent mass matrix. **(16) 1 AP**

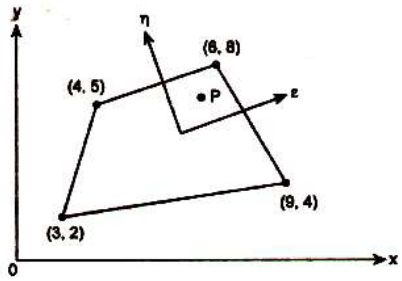
13. (a) For the constant strain triangular element shown in Figure, determine strain-displacement matrix. Take t = 20 mm and E = 2 x I0^5 N/mm^2. **(16) 2 AP**



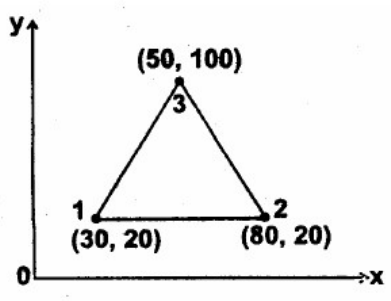
(OR)

(b) (i) Write short notes on iso parametric, sub parametric and super parametric elements. **(8)** **2** **AP**

(ii) Evaluate the cartesian co-ordinate of the point P which has local coordinates $\xi = 0.6$ and $\eta = 0.8$ as shown in Figure. **(8)** **2** **AN**

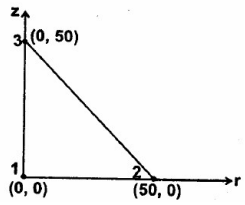


14. (a) For the plane stress element shown in figure. Evaluate the stiffness matrix. Assume E = 210 GPa, Poisson's ratio as 0.25 and element thickness t =10mm. The coordinates are given in millimeters. **(16)** **2** **AN**



(OR)

(b) For the axisymmetric element shown in figure, determine the stiffness matrix. Let E = 2.1×10^5 MPa and $\mu = 0.25$. The coordinates are in mm. **(16)** **2** **AP**



15. (a) Derive the shape function for 8- noded quadrilateral element **(16)** **3** **AN**

(OR)