Reg. No.												

Question Paper Code	12191

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

Sixth Semester

Mechanical Engineering

ME8692 - FINITE ELEMENT ANALYSIS

(Regulations 2017)

Duration: 3 Hours Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks, K-Level, CO
1.	Why polynomial type interpolation functions are mostly used in FEM?	*2,K2,CO1*
2.	List the various weighted residual methods.	*2.K1,CO1*
3.	Define shape function.	*2,K1,CO2*
4.	Differentiate global and local coordinates.	*2,K2,C02*
5.	List out the difference between CST and LST elements.	*2,K1,CO3*
6.	Assess the required conditions for a problem assumed to be axisymmetric.	*2,K1,CO3*
7.	Write down the Stiffness Matrix for 1D Heat conduction element.	*2,K1,CO4*
8.	What is meant by Longitudinal vibration?	*2,K2,CO4*
9.	Differentiate between Isoparametric, super parametric and sub-parametric elements.	*2,K2,CO5*
10.	Define Sub-parametric element.	*2,K1,CO5*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11. a) Solve the differential equation for a physical problem expressed as $\mathbf{d^2y/dx^2 + 50 = 0,\ 0 \le x \le 10}$ with boundary conditions as y(0)=0 and y(10)=0 using (i) Point collocation method (ii) Sub domain collocation method (iii) Least square method and (iv) Galerkin method. *13,K3,CO1*

OR

b) Determine the deflection at the centre of a simply supported beam subjected to uniformly distributed load over the entire span of length l as shown in figure -1. Use Rayleigh Ritz method. *13,K3,CO1*

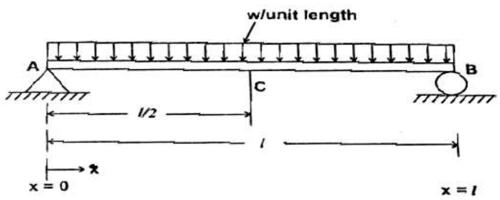

Figure-1

12. a) Derive the stiffness Matrix for one dimensional Linear bar element. *13,K2,CO2*

OR

b) Consider a bar as shown in figure-2 an axial load of 200 kN is applied at a point P. Take $A_1 = 2400$ mm^2, $E_1 = 70 \times 10^9$ N/mm^2 $A_2 = 600$ mm^2 and $E_2 = 200 \times 10^9$ N/mm^2. Calculate the following (i) the nodal displacement at point,P (ii) Stress in each element (iii) Reaction force. *13,K3,CO2*

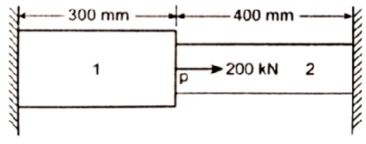

Figure-2

13. a) For the plane stress CST element as shown in the figure -3 nodal displacements are $u_1 = 2$ mm, $u_2 = 1$ mm, $u_3 = 2.5$ mm, $v_1 = 1$ mm, $v_2 = 1.5$ mm, $v_3 = 0.5$ mm. Determine the element stresses. Assume E = 200 GPa, v = 0.3, t = 10 mm. All coordinates are in mm. *13,K3,C03*

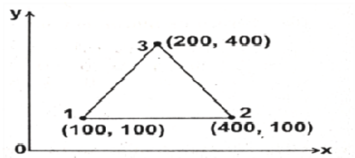

Figure-3

OR

b) The nodal coordinates for an axisymmetric triangular element are given in figure-4. Evaluate the strain-displacement matrix. *13,K3,CO3*

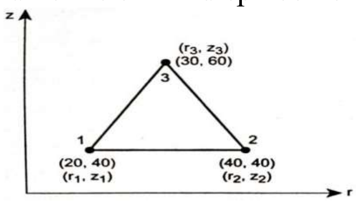

Figure-4

14. a) Derive the expression of Stiffness Matrix for heat transfer in 1D element with conduction, convection and internal Heat generation. *13,K3,CO4*

OR

b) Compute the element matrices and vectors for the element shown in figure-5. When the edges 2-3 and 1-3 experience convection heat loss. *13,K3,CO4*

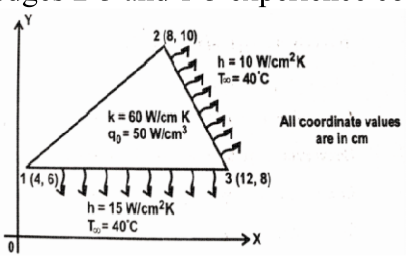

Figure-5

15. a) Develop the shape function for 4 noded isoparametric quadrilateral element. *13,K3,CO5*

OR

b) Evaluate the integral, *13,K3,CO5*

$$I = \int_{-1}^{1} Cos\ \frac{\pi x}{2} dx$$

by applying 3 point Gaussian quadrature and compare with exact solution.

PART - C (1 × 15 = 15 Marks)

16. a) Solve the following simultaneous equations using Gaussian elimination method. *15,K3,CO6*

$4x_1 - 2x_2 + x_3 - 3x_4 = 5$
$x_1 + 5x_2 + 2x_3 = 9$
$2x_1 + x_2 - 4x_3 + x_4 = 6$
$-3x_1 - 4x_2 - 2x_4 = -7$

OR

b) Develop Strain-Displacement matrix for axisymmetric triangular Element. *15,K3,CO6*