Reg. No.												

Question Paper Code	11534

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV/DEC 2022

Sixth Semester

Mechanical Engineering

ME8692 - FINITE ELEMENT ANALYSIS

(Regulations 2017)

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

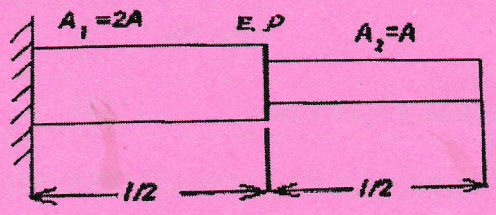
Answer ALL Questions

		Marks, K-Level, CO
1.	List the various weighted residual methods.	2,K1,CO1
2.	What do you mean by constitutive law?	2,K1,CO1
3.	Explain the stiffness matrix properties.	2,K2,CO2
4.	Illustrate the expression of longitudinal vibration of the bar element	2,K2,CO2
5.	Express the (B) matrix for CST element.	2,K2,CO3
6.	Express QST (Quadratic strain triangle) element.	2,K2,CO3
7.	Develop the Stiffness matrix for axisymmetric solid.	2,K3,CO4
8.	Distinguish between plate and shell elements.	2,K2,CO4
9.	List out the advantages of Gauss quadrature numerical integration for Isoparametric element.	2,K1,CO6
10.	Describe the Jacobian transformation for two-noded Isoparametric element.	2,K1,CO6

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

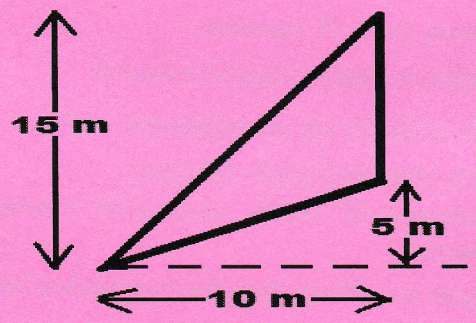
11.	a)	Estimate the differential equation for a physical problem expressed as d2y/dx2+50=0, 0≤x≤10 with boundary conditions as y(0)=0 and y(10)=0 using the trial function y=a1x(10-x) and find the value of the parameters a1 by the following methods listed below.(i) Point collocation method (ii) Sub domain collocation method (iii) Least squares method and (iv) Galerkin method.	13,K2,CO1
		OR	
	b)	Estimate the Eigen value and Eigen function of $y''-4\lambda y'+4\lambda^2 y=0$; with the boundary conditions are $y'(1)=0$, $y(2)=2$.	13,K2,CO1
12.	a)	Estimate the first two natural frequencies of longitudinal vibration of the stepped steel bar shown in fig. and plot the mode shapes. All the dimensions are in mm Take E=200GPa. And ρ=0.78kg/cc. A=4cm^2, length$l$=500mm.	13,K2,CO1



OR

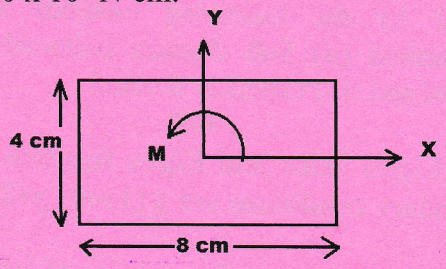
b) A metallic fin 20 mm wide and 4 mm thick is attached to a furnace whose wall temperature is 180°C. The length of the fin is 120 mm. if the thermal conductivity of the material of the fin is 350 W/m °C and convection coefficient is 9W/m^2°C, Estimate the temperature distribution assuming that the tip of the fin is open to the atmosphere and that the ambienttemperatureis25 °C. *13,K2,CO2*

13. a) For the triangular element shown in the figure determine the strain-displacement matrix [B] and constitutive matrix [D]. Assume plane stress conditions. Take μ=0.3, E=30 x 10^6 N/m^2 and thickness t= 0.1 m. And also calculate the element stiffness matrix for the triangular element. *13,K3,CO3*



OR

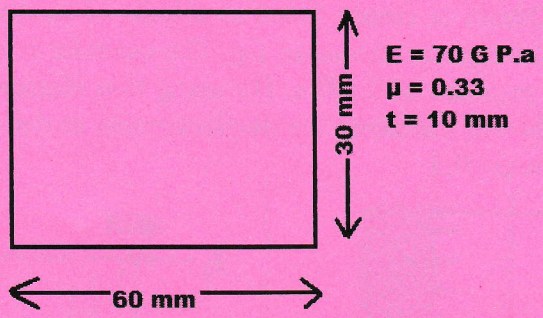
b) The figure below shows a shaft having rectangular cross section with 8cmx 4 cm sides. The material has shear modulus of 80 x 10^5 N/mm^2. Shaft length is 100 cm. The shaft is fixed at one end and subjected to torque T at the other end. Determine the total angle of twist, if the applied torque is 10 x 10^3 N-cm. *13,K3,CO3*



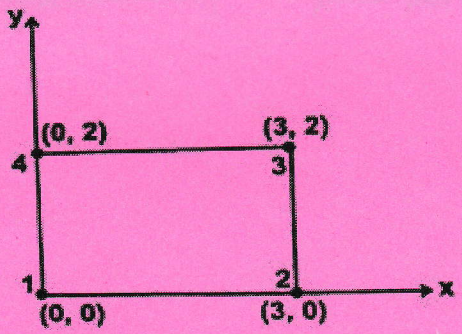
14. a) Develop Strain-Displacement matrix for axisymmetric triangular element *13,K3,CO4*

OR

b) Calculate the global stiffness matrix for the plate shown in fig. Taking two triangular elements. Assume plane stress conditions. *13,K3,CO4*

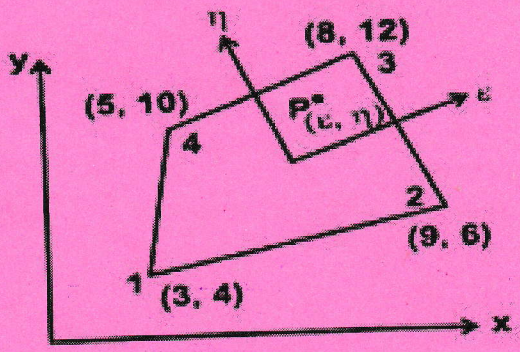


15. a) For a four noded rectangular element shown in fig. Calculate the following (a)Jacobian matrix (b)Strain-Displacement matrix (c)Element strain and (d) Element stress *13,K3,CO5*



OR

b) Calculate the Cartesian coordinates of the point P which has local coordinates ε= 0.8 and η= 0.6 as shown in figure *13,K3,CO5*



PART - C (1 × 15 = 15 Marks)

16. a) Develop the step by step procedure of solving FEA. *15,K3,CO6*

OR

b) A long hollow cylinder of inside diameter 100mm and outside diameter 120mm is firmly fitted in a hole of another rigid cylinder over its full length as shown in fig. The cylinder is then subjected to an internal pressure of 2 MPa. By using two elements on the 10mm length as shown, Calculate the displacements at the inner radius take E =210 GPa. μ =0.3 *15,K3,CO6*