Reg. No.												

Question Paper Code	11972

10 JUL 2023

M.E. / M.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023

Second Semester

M.E. - CAD/CAM

20PCDPC202 – ADVANCED FINITE ELEMENT ANALYSIS

(Regulations 2020)

Duration: 3 Hours

Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

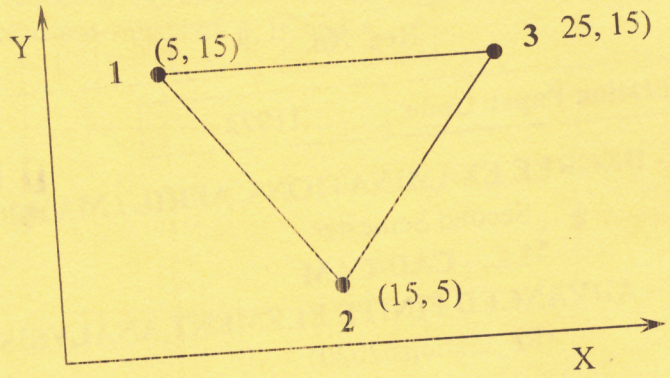
Answer ALL Questions

		Marks, K-Level,CO
1.	What is meant by finite element analysis?	2,K1,CO1
2.	Compare structural and nonstructural problems.	2,K1,CO1
3.	What is the purpose of Isoparameteric elements?	2,K1,CO2
4.	Distinguish between shell and plate elements.	2,K2,CO2
5.	List the properties of mass matrix.	2,K1,CO3
6.	Define time dependent one dimensional bar analysis.	2,K1,CO3
7.	Write the one-dimensional heat equation for a conductive heat transfer.	2,K1,CO4
8.	Define transient thermal analysis.	2,K1,CO4
9.	Classify nonlinear analysis.	2,K2,CO5
10.	Name few FEA software packages.	2,K1,CO5

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a)	Solve the differential equation for a physical problem expressed as $\frac{d^2y}{dx^2}+100=0,\ 0 \le x \le 10$ with boundary conditions as y(0)=0 and y(10)=0 using a. Least Squares Method and b. Galarkin's Method.	13,K3,CO1
		OR	
	b)	Consider a plane wall with uniformly distributed heat source. Obtain the finite element formulation for the above case based on the stationary of a functional.	13,K3,CO1
12.	a)	For the plane strain element shown in figure, the nodal displacement the nodal displacement is: u1 = 0.005mm; v1 = 0.002 mm; u2 = 0.0 mm; v2 = 0.0 mm; u3 = 0.005 mm; v3= 0.0 mm. Assume the value of E and Poisson ratio.	13,K3,CO2



Determine the Elemental Stress and Elemental Strain.

OR

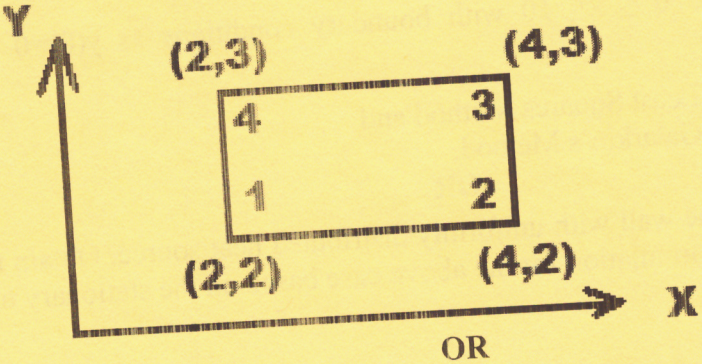
b) For the axisymmetric triangular element of nodes (0,0), (60,0) and (30,50) with the nodal displacements (u,v) are (0.05,0.03), (0.02,0.02) and (0,0) respectively. Determine the element stresses if E=210Gpa and v=0.25. *13,K3,CO2*

13. a) Explain the procedure involved in deriving the finite element equations of a dynamic problem with an example. *13,K3,CO*

OR

b) Explain the methods of obtaining natural frequencies of longitudinal vibration of a stepped bar has a cross sectional bar of area A for length L and 2A for length L. Idealizing the bar with two elements. Take A = $100mm^2$ and L = 250 mm. *13,K3,C*

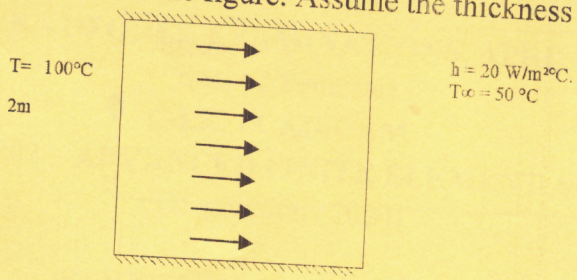
14. a) For a 4-noded rectangular element shown in fig. Infer the temperature at the point (2.5, 2.5). The nodal values of the temperatures are T_1= 100°C, T_2= 60°C and T_3= 50°C and T_4= 90°C. *13,K3,C*



OR

b) For the two-dimensional body shown in Figure, determine the temperature distribution . The temperature at the left side of the body is maintained at 100°C. The edges on the top and bottom of the body are *13,K*

insulated. There is heat convection from the right side with convection coefficient h = 20 W/m²°C.The free stream temperature is T∞ = 50 °C. The coefficient of thermal conductivity are $k_x = k_y = 25$ W/m²°C.The dimensions are shown in the figure. Assume the thickness is 1 m.



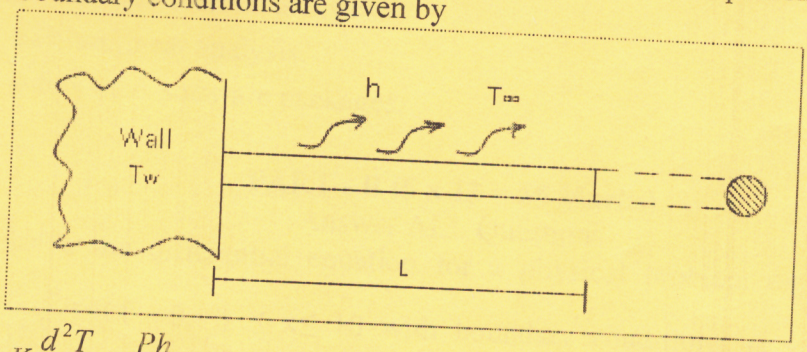
15. a) Elaborate the solution procedures for nonlinear problems. *13,K2,CO5*

OR

b) Write a detailed note on material nonlinearity and geometric non-linearity *13,K2,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Consider a 1mm diameter, 30 mm long Aluminum pin fin as shown in Figure is used to enhance the heat transfer from a surface wall maintained at 300°C. The governing differential equation and the boundary conditions are given by *15,K3,CO1*



$$K\frac{d^2T}{dx^2} = \frac{Ph}{A}(T - T_\infty)$$

$T(0) = Tw = 300°C$

$$\frac{dT}{dx}(L) = 0$$

(Insulated tip)

Let, = K= 200/W/m°C for aluminum, h = 20 W/m² °C, T_∞=30°C. Estimate the temperature distribution in the fin using the Galerkin weighted residual method.

OR

b) Consider a cantilever beam as shown in figure . Determine the natural frequency of vibration of cantilever beam of length L, assuming constant values of ρ, E, and A. *15,K3,CO3*