R20 Regulation *Subject code:3P7CA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A+' Grade)

B.Tech VII Semester Regular Examinations, November2023

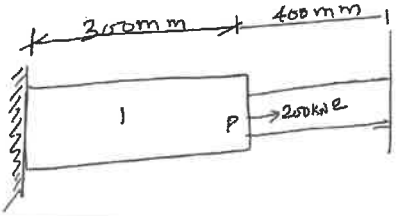
Finite Element Methods

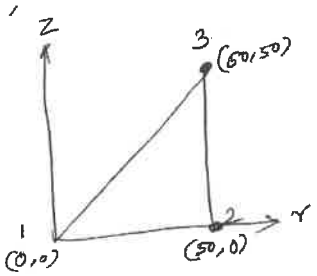
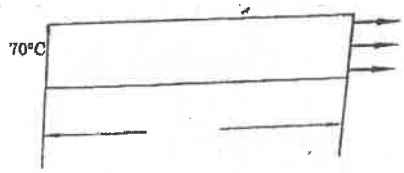
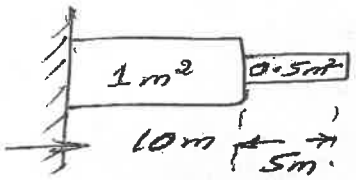
(Mechanical Engineering)

Maximum Marks: 70 Date:11.12.2023 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Note: Allow the HT and FEM Databook

	Part-A	
All the following questions carry equal marks	(10x2M=20 Marks)	
1	Name any four FEA software.	L1
2	State the properties of stiffness matrix.	L2
3	Write down the expression of stiffness matrix for a truss element.	L1
4	State the principle of minimum potential energy.	L2
5	Give the displacement function equation for CST element.	L1
6	What is axisymmetric element?	L1
7	Define steady state heat transfer.	L1
8	Write the equation for steady state heat transfer in a thin plate.	L2
9	What is discretization in FEM?	L1
10	Give the uses of NASTRAN.	L2
	Part-B	
Answer All the following questions.	(5X10M=50Marks)	
11	The following differential equation is available for a physical phenomenon: $\frac{d2y}{dx2} - 10x^2 = 5$; $0 \le x \le 1$, the boundary conditions are: y (0) = 0 and y (1) = 0. Solve approximate solution of the above differential equation. [10]	L3
	OR	
12	For a one-dimensional bar element, derive the shape functions and the stiffness matrix. [10]	L3
13	Consider the bar element shown in figure. An axial load of 200 kN is applied at point P. Take A_1= 2400 mm^2; E_1= 70 × 10^9 N/m^2; A_2= 600 mm^2; E_2= 200 × 10^9 N/m^2. Calculate the following (a) the nodal displacement at Point P (b) Stress in each material and (c) Reaction force. [10] 	L4
	OR	
14	Derive the stiffness matrix for two dimensional truss elements. [10]	L3

15	For the element shown in figure, determine the stiffness matrix. Take E=200 GPa, and ν= 0.25. [10] 	L3
	OR	
16	Derive stress strain relationship for axisymmetric element, also derive element stiffness matrix for the same element. [10]	L3
17	Calculate the temperature distribution in a stainless steel fin shown in figure. The region can be discretized into three elements of equal size. The length of fin = 9 cm, T_a = 25°C and h = 0.0025 W/cm²/°C. [10] 	L3
	OR	
18	Derive the conductance matrix for three noded triangular element whose nodal coordinates are known. The element is to be used for two dimensional heat transfer in a plate fin. [10]	L3
19	Determine the Eigen values and Eigen Vectors for the stepped bar shown in figure. [10] 	L3
	OR	
20	Give a detailed account of the concept of meshing and meshing algorithms. [10]	L3