R20 Regulation *Subject code: 3P7CA*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

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

B.Tech VII Semester Regular/Supplementary Examinations, December 2024

FINITE ELEMENT METHODS

(Mechanical Engineering)

Maximum Marks: 70 Date:10.01.2025 Duration: 3 hours

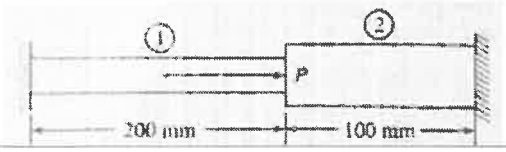
Note: **1.This question paper contains two parts A and B.**
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

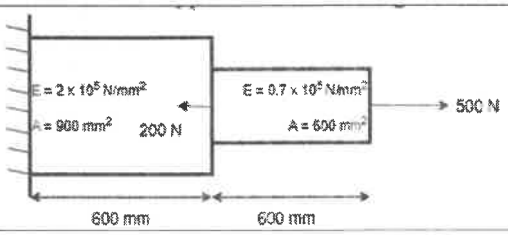
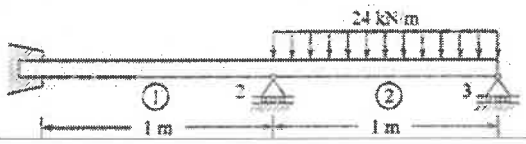
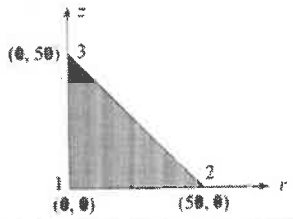
HEAT TRANSFER DATA BOOKS ARE ALLOWED

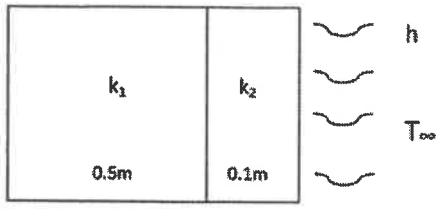
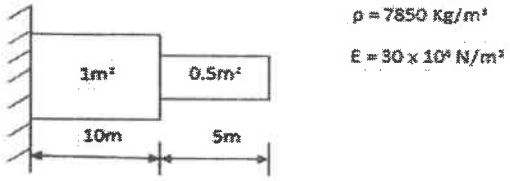
Part-A

	All the following questions carry equal marks (10X2M=20 Marks)	**CO**	**Bloom Tx**
1	Write the definition of FEM?	1	L3
2	Mention the material matrices for plane stress and plane strain conditions.	1	L3
3	Write the stiffness matrix of a truss element.	2	L3
4	What is a truss?	2	L3
5	Mention the shape functions of linear triangular element.	3	L4
6	Differentiate C.S.T and L.S.T. elements.	3	L3
7	What are lumped and consistent mass matrices? Mention them for 2-noded 1-D bar element.	4	L3
8	Write the governing equation for steady-state?	4	L4
9	Define Eigen value and Eigen vector?	5	L3
10	Write a short note on Dynamic Analysis?	5	L4

Part-B

	Answer All the following questions. **(5X10M=50Marks)**	**CO**	**Bloom Tx**
11	The structure consists of two bars. An axial load P = 200 KN is loaded as shown in the figure. Determine the following; a. Element Stiffness Matrix b. Global Stiffness Matrix c. Nodal Displacements Take A_1 = 1000 mm^2, E_1 = 200 GPa, A_2 = 2000mm^2, E_2 = 83 GPa [10M] 	1	L3
	OR		
12	Consider the stepped bar shown in figure below. Determine the nodal displacements, stress in each element and the reaction forces [10M]	1	L3

			
13	Derive the stiffness matrix for a plane truss element. [10M]	2	L3
	OR		
14	Write the Element Stiffness Matrices and Global Stiffness Matrix for the given beam element. Take E = 200GPa & I = 5 x 10^6 mm^4. [10M] 	2	L4
15	Evaluate the element stiffness matrix for a CST element with nodal coordinates; $X_1 = 1$, $X_2 = 5$, $X_3 = 3$ & $Y_1 = 2$, $Y_2 = 4$, $Y_3 = 6$. Assume plane stress condition, E = 200 GPa, $\mu = 0.25$ and thickness = 5mm. [10M]	3	L3
	OR		
16	For the axisymmetric element shown in Figure , determine the element stiffness matrix. Take E=200 GPa, and υ=0.3. [10M] 	3	L3
17	A fin of length 15cm has its cross section in the form a rectangle of width 6cm and thickness 2 cm. Its base left end is at 30°C.The surrounding temperature is 25°C, the convective heat transfer coefficient is 2000 w/m^2°C and conductivity of the fin material is 300 w/m°C. Determine the temperature distribution along the length of the fin by a) considering the convection over lateral surface only. b) Including convection over right end cross section along with the convection over lateral surface of the fin. [10M]	4	L4
	OR		
18	A wall of 0.5m thickness has thermal conductivity of 6 W/mK. The wall is insulated with a material of thickness 0.1m having an average thermal conductivity of 0.3 W/mK. The inner surface temperature is 1200°C and the outside of the insulation is exposed to atmospheric air at 30°C with heat transfer coefficient of 40W/m^2K. Calculate the nodal temperatures. [10M]	4	L3

			
19	Determine the Eigen values and Eigen Vectors for the stepped bar as shown in figure? [10M] 	5	L4
	OR		
20	Explain the importance of element mass matrix in FEM with suitable example. [10M]	5	L3