Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 17 – 12- 2025 **Time:** 01:00pm – 04:00pm

School: SOE	**Program:** B. TECH	
Course Code: MEC3005	**Course Name:** FINITE ELEMENT ANALYSIS	
Semester: V	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**24**	**24**	**26**	**26**	**-**

Instructions:

(i) Read all questions carefully and answer accordingly.
(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	Explain the concept of potential energy?	2 Marks	L2	CO1
2.	List different types of approximation methods?	2 Marks	L1	CO1
3.	List some the applications of finite element method?	2 Marks	L1	CO2
4.	In what ways global stiffness matrix is different from element stiffness matrix?	2 Marks	L2	CO2
5.	Discuss briefly about the effects of temperature on bar element?	2 Marks	L2	CO3
6.	Define boundary conditions? List few BCs?	2 Marks	L1	CO3
7.	Write short notes on simplex, complex and multiplex elements?	2 Marks	L1	CO3
8.	Explain the applications of beams and columns?	2 Marks	L2	CO4
9.	Stress induced in the truss element is given by?	2 Marks	L1	CO4
10.	What is the length *(l)* of the truss element for a simple truss?	2 Marks	L1	CO4

Part B

Answer the Questions. **Total Marks 80M**

<table>
<tr><td>11.</td><td>For the differential equation $(d^2y/dx^2) + 100x^2 = 0$, limiting $x = 0$ to 10 with the boundary conditions $y(0) = 0$; $y(10) = 0$, assuming the trial function as $y = a(x^2-10x)$. determine the solution of the problem using two term trail function by using 1) point collocation method 2) sub domain collocation method 3) least square method (4) Galerkin's method.</td><td>20 Marks</td><td>L3</td><td>CO1</td></tr>
<tr><td colspan="5">Or</td></tr>
<tr><td>12.</td><td>The physical phenomena are governed by the differential equation $(d^2y/dx^2) - 10x^2 = 5$ limiting x = 0 to 1. The boundary conditions are given by $W(0) = W(1) = 0$. By taking a two-term trial solution as $W(x) = C_1 f_1(x) + C_2 f_2(x)$ with $f_1(x) = x^2(x-1)$ and $f_2(x) = x^3(x-1)$, determine the solution of this problem using Galerkin Method.</td><td>20 Marks</td><td>L3</td><td>CO1</td></tr>
</table>

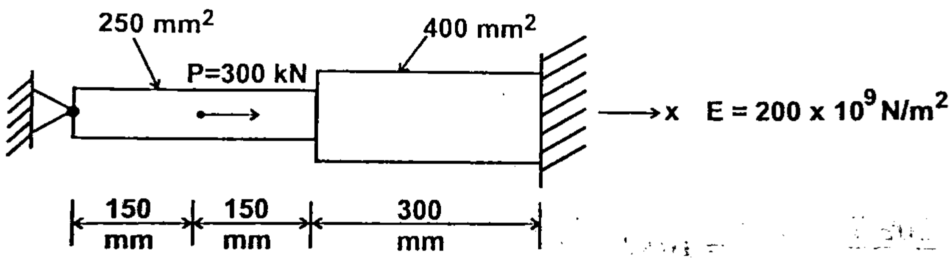
<table>
<tr><td>13.</td><td>A stepped bar is subjected to an axial load of 300kN as shown in Figure 1. Determine the nodal displacements, elemental stresses and support reactions.


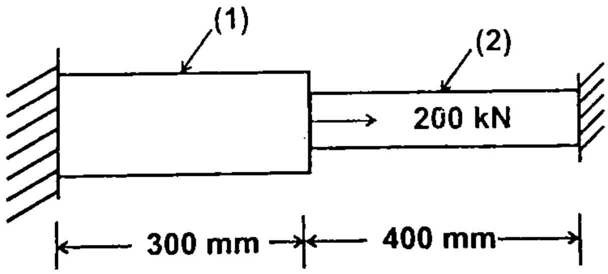
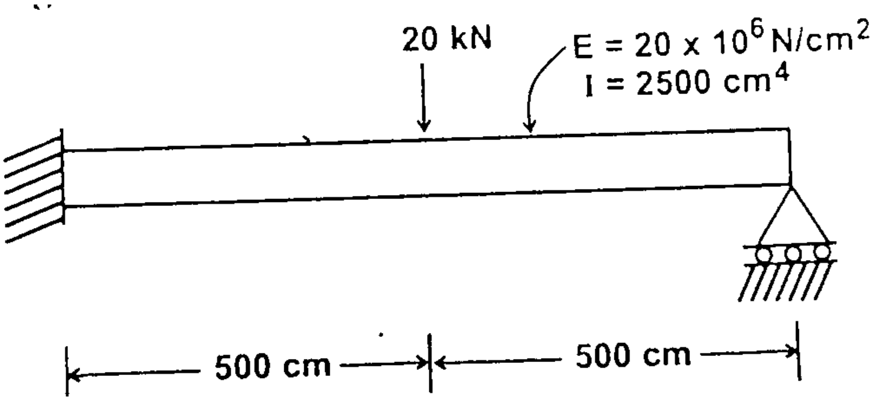
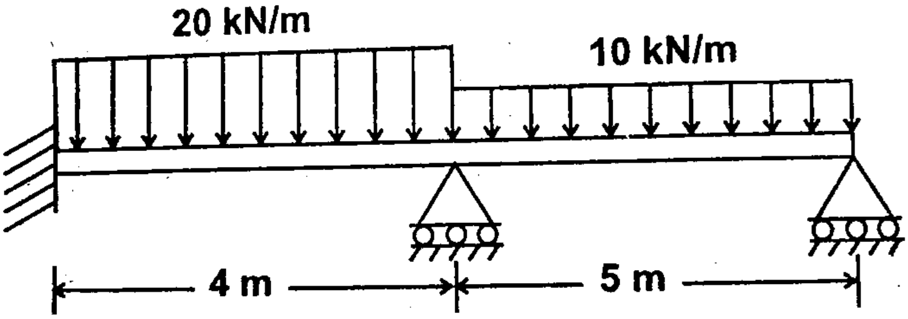
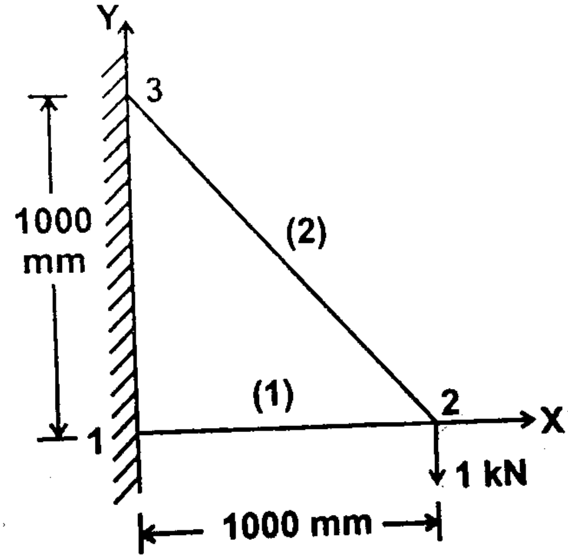
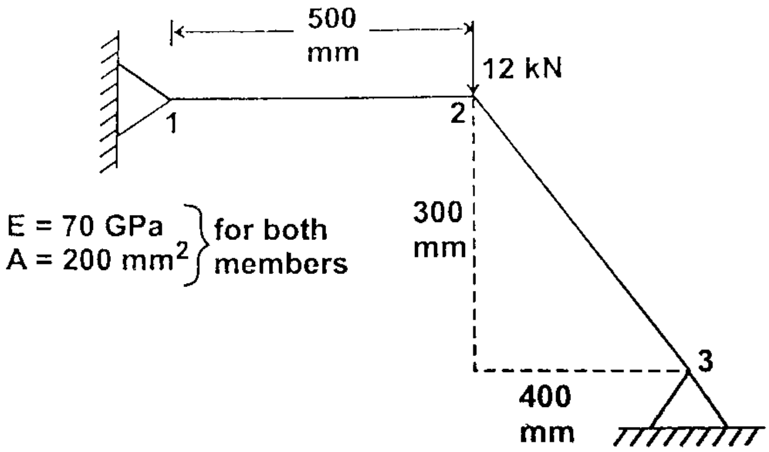
Figure 1</td><td>20 Marks</td><td>L3</td><td>CO2</td></tr>
<tr><td colspan="5">Or</td></tr>
<tr><td>14.</td><td>A stepped bar is subjected to an axial load of 200 kN at the place of change of cross section and material as shown in Figure 2. Determine (a) The nodal displacements (b) the reaction forces (c) the induced stress in each material.
(1) - Aluminium bar
$A_1 = 2400\ mm^2$
$A_2 = 600\ mm^2$
(2) - Steel bar
$E_1 = 70 \times 10^3\ N/mm^2$
$E_2 = 200 \times 10^3\ N/mm^2$


Figure 2</td><td>20 Marks</td><td>L3</td><td>CO2</td></tr>
</table>

15.	A beam fixed at one end and supported by a roller at the other end, has a 20 kN concentrated load applied at the Centre of the span as shown in Figure 3. Calculate the deflection under the load and construct the shear force and bending moment diagrams for the beam.  **Figure 3**	**20 Marks**	**L3**	**CO3**
Or				
16.	For a beam shown in Figure 4. Determine the slope at the hinged support points. E= 200GPa, I = 4×10^{-6} m^4. Use two beam elements.  **Figure 4**	**20 Marks**	**L3**	**CO3**

17.	A Truss structure is subjected to a load of 1kN as shown in Figure 5. Calculate the nodal displacements and forces if the element stiffness of the truss is 10 kN/mm.	**20 Marks**	**L3**	**CO4**

	 **Figure 5**			
	Or			
18.	For a two-bar truss as shown in Figure 6. Determine the displacements at node 2 and the stresses in both elements.  **Figure 6**	**20 Marks**	**L3**	**CO4**