Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

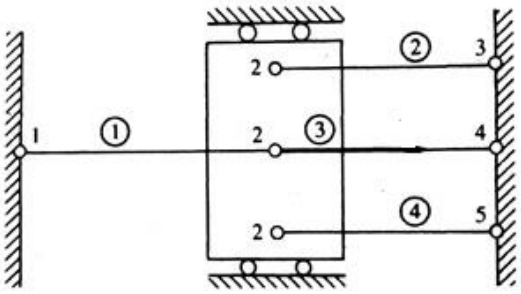
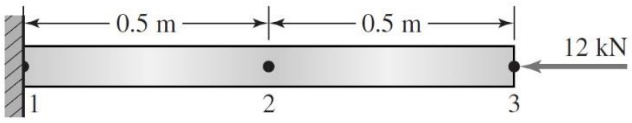
End Semester Examination, May 2021

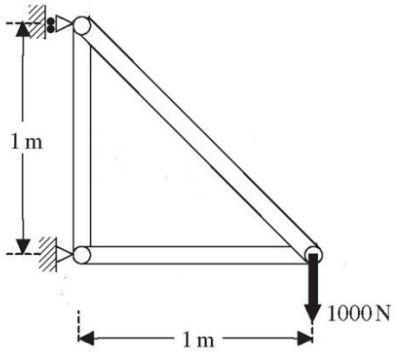
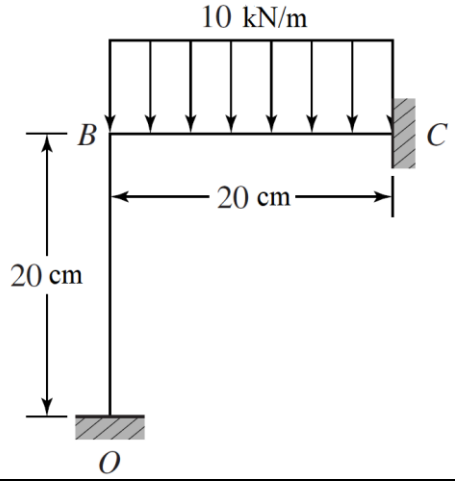
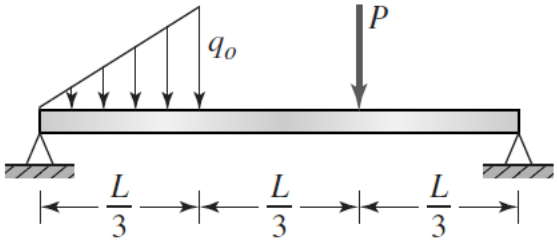
Programme Name: B.Tech Mech | **Semester : 6th**
Course Name : Finite element analysis | **Time : 03 hrs**
Course Code : MECH4023P | **Max. Marks : 100**
Nos. of page(s) : 03

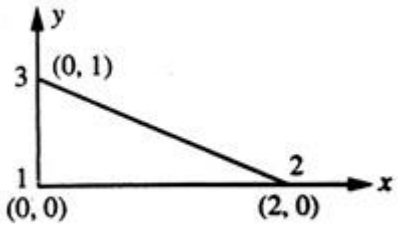
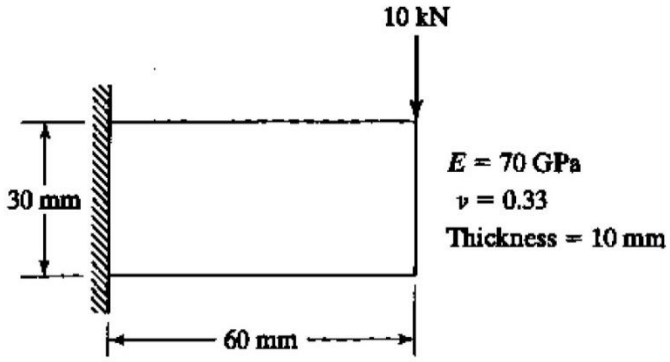
SECTION A

S. No.		Marks	CO
Q 1	Describe the steps in finite element analysis.	5	CO1
Q 2	Explain the principle of minimum total potential energy.	5	CO1
Q 3	State the importance of shape functions.	5	CO1
Q 4	Explain C^0 and C^1 continuity.	5	CO1
Q 5	Describe constant strain, linear strain and cubic strain triangles.	5	CO1
Q 6	Explain the connectivity matrix.	5	CO1

SECTION B

Q 7	Determine the global stiffness matrix for the system shown in Figure. All elements have same length, area and material properties. 	10	CO2
Q 8	A steel rod subjected to compression is modeled by two bar elements, as shown in Figure. Determine the nodal displacements and the axial stress in each element.  $E = 207$ GPa $A = 500$ mm^2	10	CO2

Q 9	A plane truss is loaded and supported as shown in Figure. Determine the displacements at the ends using finite element method. Take, E = 200 GPa and A = 200 mm^2  	**10**	**CO2**
Q 10	For the frame shown in Figure, determine the global stiffness matrix and load vector and apply the boundary conditions using the elimination approach. Take *E* = 200 GPa and Area = 2×2 cm^2  	**10**	**CO3**
Q 11	Construct the global load vector corresponding to the beam element shown in Figure.  	**10**	**CO3**
SECTION-C			
Q 12	Determine the stiffness matrix for the element shown in Figure. The coordinates are in units of meters. Assume plane stress condition. Let *E* = 200 GPa, *v* = 0.25 and	**20**	**CO3**

	thickness t = 0.05 m.  		
	OR		
	A rectangular plate is loaded and supported as shown in Figure. Find the stiffness matrix and force vector and apply the boundary conditions. Use a four noded quadrilateral element.  	**20**	**CO3**