Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2022

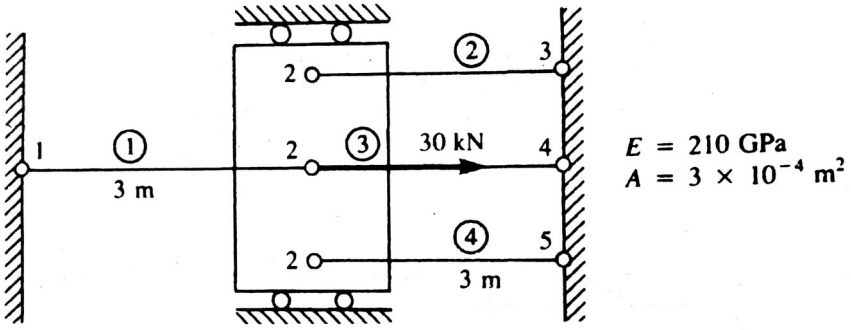
Course: Finite Element Analysis — **Semester : 6th**
Program: B.Tech Mechanical — **Time : 03 hrs.**
Course Code: MECH4023P — **Max. Marks: 100**

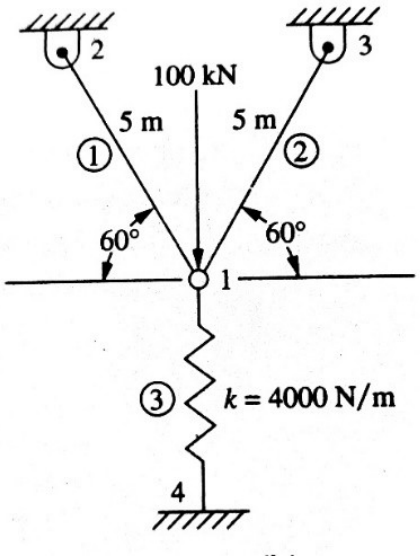
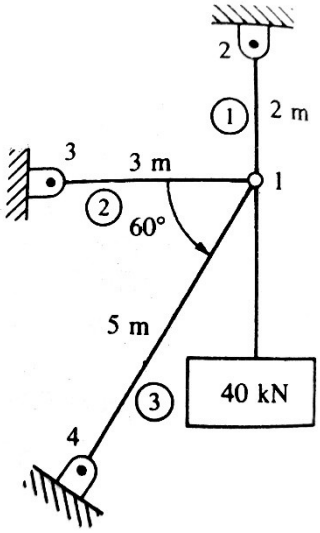
Instructions: Attempt all questions. Assume any data if required.

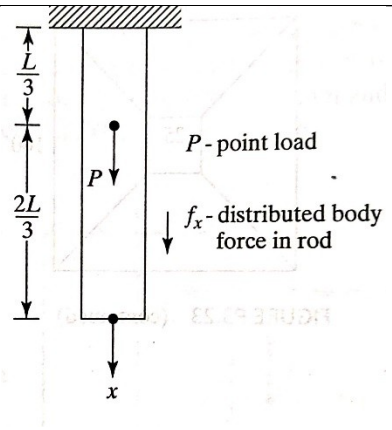
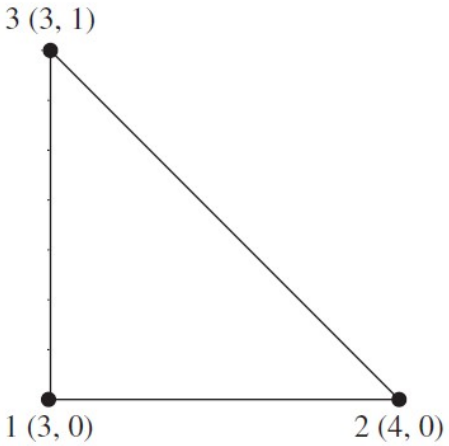
SECTION A
(5Qx4M=20Marks)

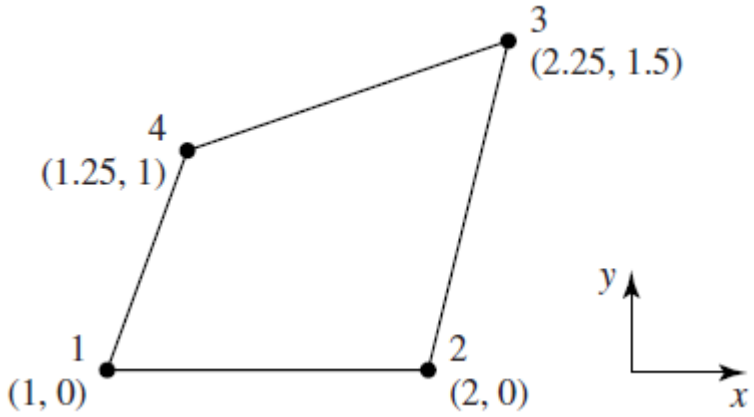
S. No.		Marks	CO
Q 1	Explain the difference between finite element and finite difference method.	4	CO1
Q 2	Explain the significance of shape function and its continuity requirement.	4	CO1
Q 3	Describe the penalty approach of applying boundary conditions.	4	CO1
Q 4	Explain Galerkin's approach in finite element method.	4	CO1
Q 5	Obtain the connectivity matrix for the discretized domain shown below,	4	CO1

SECTION B
(4Qx10M= 40 Marks)

Q 6	Foe the system shown in Figure, determine the nodal displacements. 	10	CO3
Q 7	For the plane truss, determine the individual elemental stiffness matrix of each element. Let E = 210 GPa and A = 5×10^{-4} m^2	10	CO3

	 **OR** For the plane truss, determine the individual elemental stiffness matrix of each element. Take P = 10 kN and L = 1 m. Let E = 210 GPa and A = 5×10^{-4} m^2  		
Q 8	A rod shown in figure is subjected to a body force f = 1 N/m^3. Take E = 1 N/m^2, A = 1 m^2 and L = 3 m = length of the rod. Point load applied is P = 1 N. Assuming a displacement field as $u = a_1 + a_2x$, use Rayleigh Ritz method to find the displacement field.	**10**	**CO3**

			
Q 9	Determine the sampling points and its weights in two-point formula of numerical integration and evaluate the integral, $\int_{-1}^{1}\int_{-1}^{1}(r^2+2rs+s^2)\,dr\,ds$	**10**	**CO1**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	Determine the **[B]** matrix in natural coordinates for the plate element shown in Figure. The coordinates are in units of meters. 	**20**	**CO2**
Q 11	Determine the inverse of the Jacobian matrix for the rectangular plate element shown in Figure. The coordinates are in the units of cm.	**20**	**CO2**



OR

Determine the inverse of the Jacobian matrix for the triangular plate element shown in Figure. The coordinates are in the units of cm.