Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2021

Course: Introduction to Solid Mechanics **Semester: IV**
Program: B. Tech (Civil Engineering) **Time 03 hrs.**
Course Code: CIVL2017 **Max. Marks: 100**

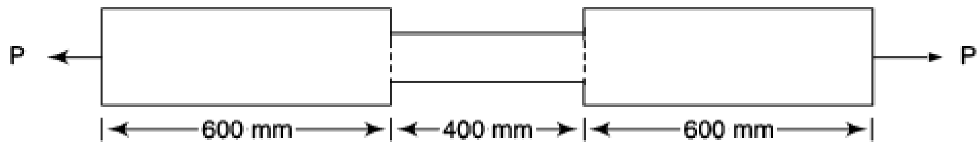
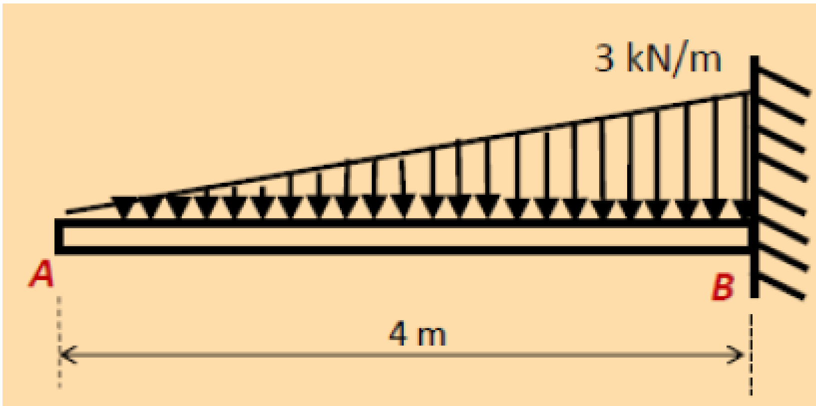
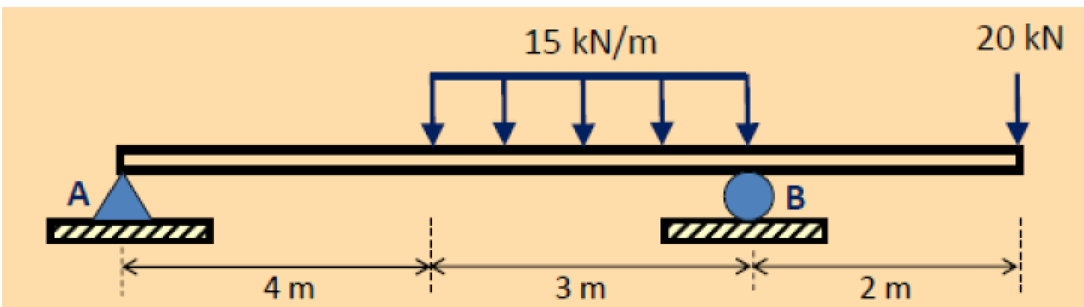
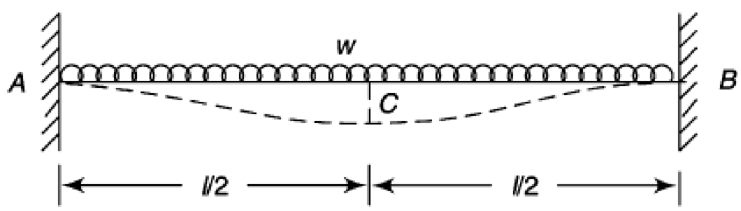
Instructions: Please write every equation and then solve the numerical. Draw relevant labelled figures and each steps followed to arrive at the solution. Please do not forget the units for your answers.

SECTION A

S. No.		**Marks**	**CO**
Q 1	Define (i) Crippling load, (ii) Hoop Stress, (iii) Strain Energy, (iv) Factor of Safety and (v) Slenderness Ratio.	**05**	**CO1**
Q 2	Explain (i) Modulus of Elasticity and (ii) Bulk Modulus. Consider the case if $E_s = 3E_a$ for a composite bar made of aluminum and steel strips each having a cross sectional area of 300 mm^2 and subjected to an axial load of 12 kN. Compute the stress in steel of this composite bar.	**05**	**CO1**
Q 3	Explain (i) Angle of Repose, (ii) Euler's formula, (iii) Indeterminate Beam (iv) Varignon's Theorem and (v) Torque	**05**	**CO1**
Q 4	Draw technically labelled shear force diagram and bending moment diagram for simply supported beam subjected to point load at the center of the beam, with relevant mathematical expressions.	**05**	**CO3**
Q 5	Enumerate any five methods to determine slope and deflection at a point of a beam.	**05**	**CO4**
Q 6	Prove that $U_b/U_c = (d_c/d_b)^2.E_c/E_b$ is the ratio of strain energies of two circular bars of equal length, and made of brass and copper subjected to same axial tensile load. Consider d = diameter, and E is young's modulus	**05**	**CO1**

SECTION B

Q 6	A shaft transmits 800 kW of power at 210 rpm. Determine the actual working stress and the diameter of the shaft if the shaft twists one degree on a length of 18 diameter and the shear stress is not to exceed 50 MPa. Consider G = 81 GPa.	**10**	**CO2**
Q 7	Consider a cylindrical shell of 800 mm internal diameter, 2 m length, and wall thickness of 10 mm, which is subjected to internal pressure of 1.5 MPa. Compute (i) maximum intensity of the induced shear stress, and (ii) the change in dimensions of the shell. E = 205 GPa and v = 0.3.	**10**	**CO2**
Q 8	A 140 MPa maximum stress is induced in a 1.6 m long bar by means of an axial pull as shown in the figure. The larger and smaller arear of cross-section are 240 mm2 and 120 mm2. Determine the strain energy stored in the bar.	**10**	**CO2**

			
Q 9	Draw the free body diagram, and compute the reaction forces for the beam shown below. Draw the SFD and BMD. 	**10**	**CO3**
Q 10	Draw the free body diagram, and compute the reaction forces for the beam shown below. 	**10**	**CO3**
	SECTION-C		
Q 11	Determine the maximum bending moment and the deflection of a beam of length 'l' and flexural rigidity EI. The beam is fixed horizontally at both ends and carries a uniformly distributed load w over the whole span. 	**20**	**CO4**