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

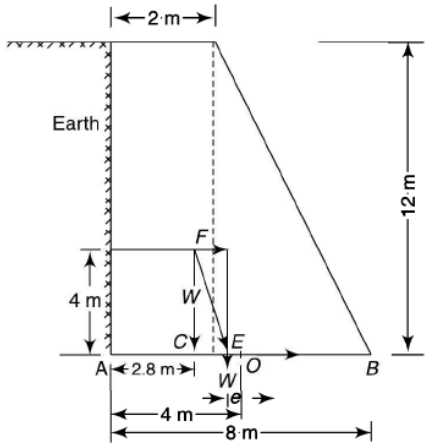
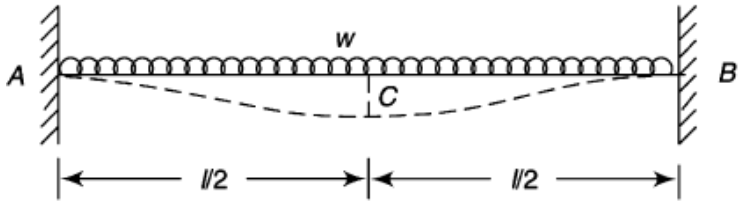
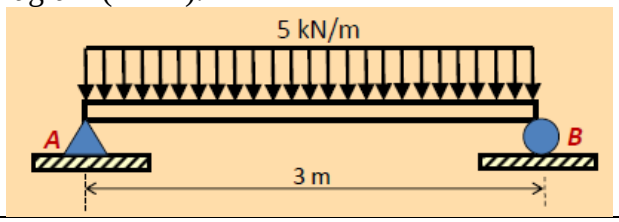
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, July 2020

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) Tension, (ii) Compression, (iii) Shear Stress and (iv) Factor of Safety.	**04**	**CO1**
Q 2	Explain (i) Modulus of Elasticity and (ii) Composite Bar. 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.	**04**	**CO1**
Q 3	Explain (i) Angle of Repose, (ii) Rankine's formula, (iii) Determinate Beam and (iv) Varignon's Theorem	**04**	**CO1**
Q 4	Draw technically labelled shear force diagram and bending moment diagram for cantilever subjected to uniformly distributed loading, with relevant mathematical expressions.	**04**	**CO1**
Q 5	Enumerate any four methods to determine slope and deflection at a point of a beam.	**04**	**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	Define strain energy and resilience. Determine the proof resilience for a 1.5 m long steel bar having 800 mm^2 cross-sectional area, an elastic limit of 180 MPa, and E = 205 GPa.	**10**	**CO2**
Q 9	A 12 m high masonry retaining wall of trapezoidal section has a width of 2 m at the top and 8 m at the bottom as shown in figure below. The retaining surface is vertical and the wall retains earth which is level up to the top. Determine the maximum and minimum stresses at the base. The densities of the earth and the masonry are 14 kN/m^3 and 25 kN/m^3 respectively and the angle of repose of the earth is 30^o.	**10**	**CO3**

			
	OR		
Q 9	Discuss the relationship between load, shear and bending moment with relevant mathematical relationships and diagrams.	**10**	**CO3**
	SECTION-C		
Q 10	Discuss Factor of Safety keeping in mind the holistic design philosophy for a structural engineer and the associated project costs.	**20**	**CO4**
	OR		
Q 10	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. (10 marks)  Explain the various methods that can be used for computing the slope and deflection in a member. Why are there so many methods available and how are they applicable in different cases. (10 marks)	**20**	**CO4**
Q 11	Calculate the shear force and bending moment for the beam subjected to a uniformly distributed load as shown in the figure, then draw the shear force diagram (SFD) and bending moment diagram (BMD). 	**20**	**CO3**