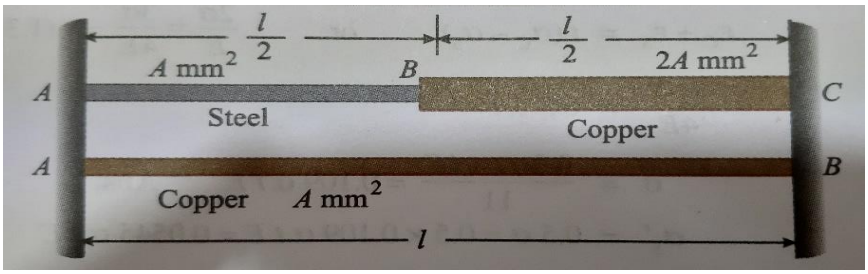
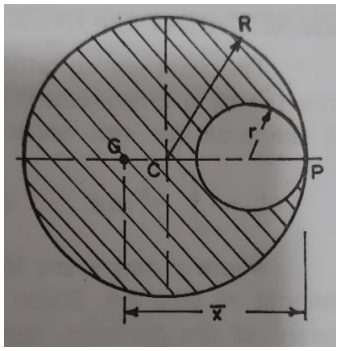
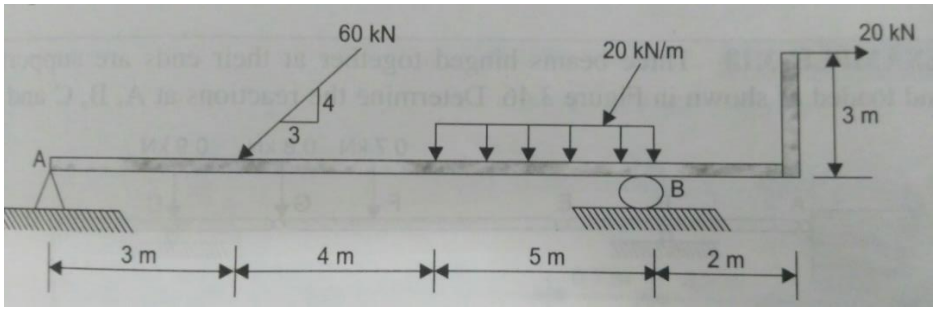
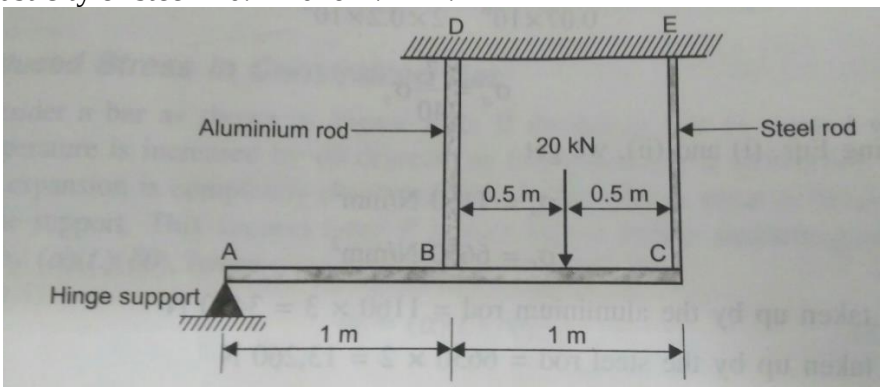
Name: **Enrolment No:**	UPES UNIVERSITY WITH A PURPOSE

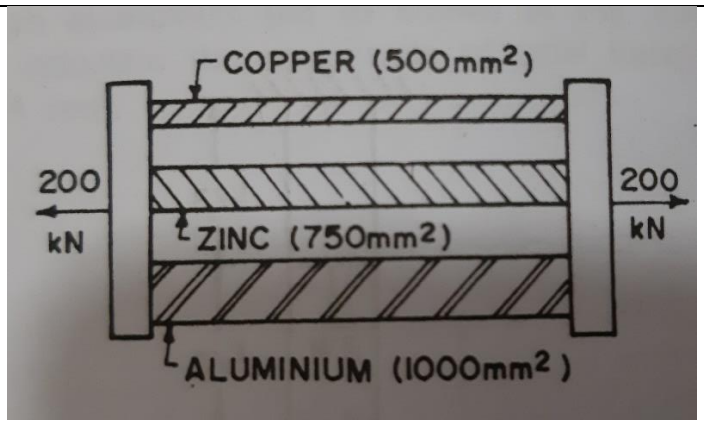
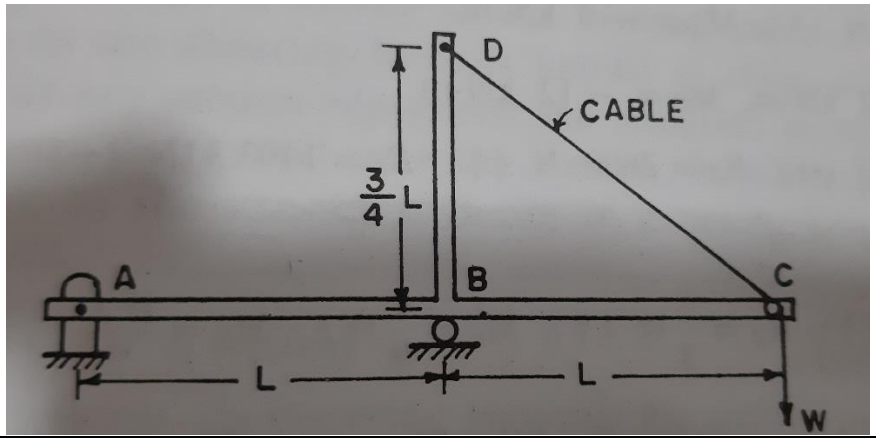
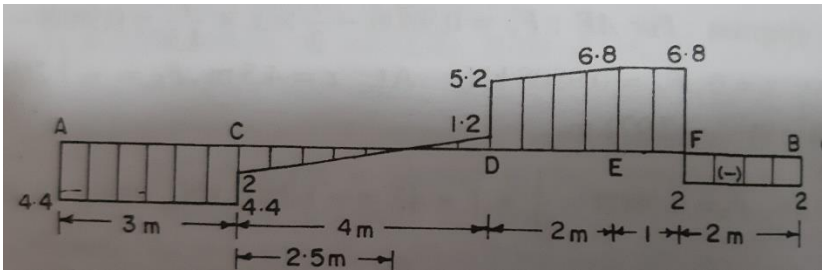
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, July 2020

Programme Name: B. Tech. FSE — **Semester : IV**
Course Name : Strength of Materials — **Time : 03 hrs.**
Course Code : MECH 2018 — **Max. Marks: 100**
Nos. of page(s) :

SECTION A

S. No.		Marks	CO
Q 1	A composite bar is made up by connecting a steel member and a copper member, rigidly fixed at their ends as shown in fig.  The cross-sectional area of the steel member is A mm^2 for half of the length and 2A mm^2 for another half of the length, while that for the copper member is A mm^2. The coefficient of expansion for the steel and copper are α and 1.3α, while elastic modulii are E and 0.5E respectively. Determine the stresses induced in both the members when the composite bar is subjected to a rise of temperature of t degrees.	**5**	**CO1**
Q 2	A piece of material is subjected to tensile stress of 70 N/mm^2 and 50 N/mm^2 at right angles to each other. Find fully the stresses on a plane the normal of which makes an angle of 35 degree with large tensile stress.	**5**	**CO2**
Q 3	A circular sheet of metal has radius R. if a hole of radius r is made as shown in figure, determine the position of centroid of the remaining part.  	**5**	**CO3**

Q 4	Two elastic bars of the same material and length, one of circular section of diameter d and the other of square section of side d, absorb the same amount of energy delivered by axial forces. Compare the stresses in two bars.	**5**	**CO3**
	SECTION B		
Q 5	Determine the SF and BM at every point of the overhang beam as shown in figure. 	**10**	**CO4**
Q 6	A timber beam of rectangular section is to support a load of 20 kN over a span of 4 m. If the depth of the section is to be twice the breath, and the stress in the timber is not to exceed 60 N/mm^2, find the dimensions of the cross-section.	**10**	**CO3**
Q 7	As shown in figure, a rigid bar ABC hinged at A and suspended at two points B and C by two equal bars BD and CE made of aluminum and steel respectively. The bar carries a load of 20 kN midway between B and C. The cross sectional area of the aluminum bar is 3 mm^2 and that of steel bar is 2 mm^2. Determine the load taken by two bars. Assume modulus of elasticity of aluminum = 0.07*10^6 N/mm^2 and modulus of elasticity of steel = 0.2*10^6 N/mm^2. 	**10**	**CO4**
Q 8	Three bars, made of copper, zinc and aluminum are of equal length and have cross-section 0f 500, 750 and 1000 sq. mm respectively. The are rigidly connected at their ends, as shown in figure. If this compound member is subjected to a longitudinal pull of 200 kN, estimate the proportion of load carried by each rod and the induced stresses. Take E_c = 1.3*10^5 N/mm^2 , E_z = 1*10^5 N/mm^2, E_a = 0.8*10^5 N/mm^2	**10**	**CO4**

			
SECTION-C			
Q 9	Construct S.F and B. M diagrams for the beam ABC, loaded as shown in figure. The cable passes over a small frictionless pulley in C, and supports a weight W. 	**20**	**CO5**
Q 10	The S. F. diagram for a beam AB, hinged at both the ends is shown in figure. Determine the loading on the beam and draw the B. M. diagram, indicating principal values. 	**20**	**CO5**