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

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

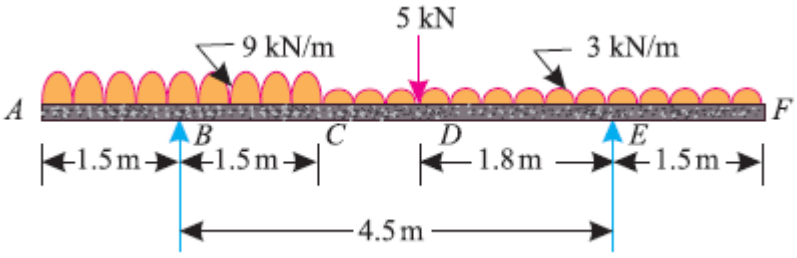
Course: Strength of materials — **Semester: IV**
Program: B.Tech Mechanical — **Time : 03 hrs.**
Course Code: MECH 2012 — **Max. Marks: 100**

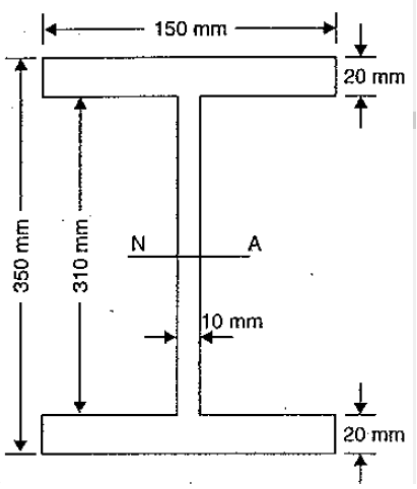
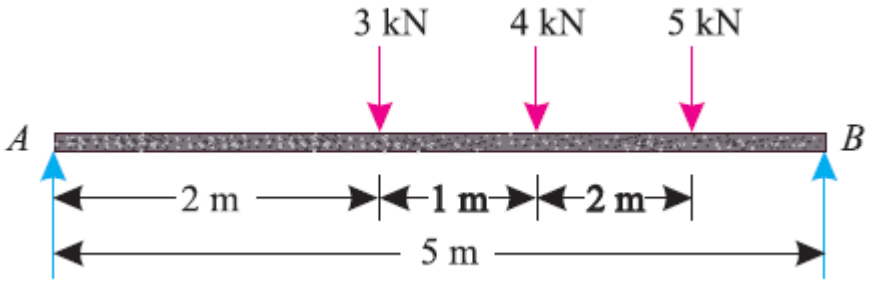
Instructions: Attempt all the questions. Assume suitable data if missing.

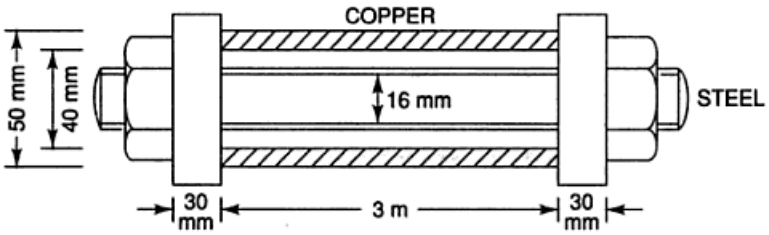
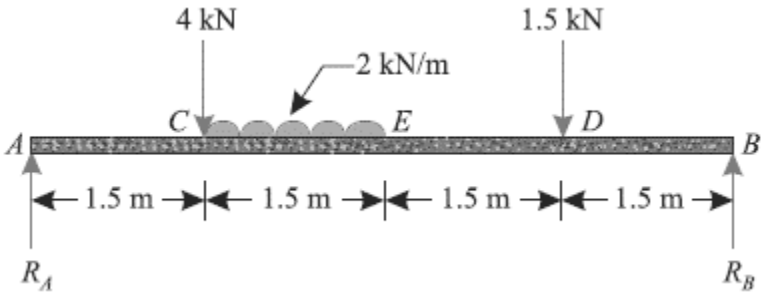
SECTION A
(5Qx4M=20Marks)

Q No		Marks	CO
Q 1	Discuss in brief the following: a) Creep b) Endurance limit c) Polar modulus d) flexural rigidity	**4**	**CO1**
Q 2	Derive an expression of elongation in a cylindrical rod due to self-weight. Take the usual notations.	**4**	**CO2**
Q 3	Explain the compound bars. Also, discuss the equilibrium and compatibility equations for it.	**4**	**CO2**
Q 4	Differentiate thin cylinder with thick cylinder on the basis of dimensional attributes and stresses developed.	**4**	**CO1**
Q 5	Discuss the analysis of shaft in series and parallel, subjected to pure torsional moments.	**4**	**CO1**

SECTION B
(4Qx10M= 40 Marks)

Q 6	Starting thereon all the important values of shear force and bending moment, construct the shear force and bending moment diagrams for the beam loaded as shown in figure. State the position of points of inflexion on the beam. 	**10**	**CO3**
Q 7	A thin cylinder tube 80 mm internal diameter and 5 mm thick, is closed at the ends and is subjected to an internal pressure of 6 N/mm^2. A torque of 2009600 N-mm is also applied to the tube. Find the hoop stress, longitudinal stress; maximum and minimum principal stresses and maximum shear stress.	**10**	**CO2**

Q 8	Two shafts of the same material and same lengths are subjected to the same torque. If the first shaft is of a solid circular section, the second shaft is of hollow circular section, whose internal diameter is 2/3 of the outside diameter and the maximum shear stress developed in each shaft is the same, compare the weights of the shafts.	**10**	**CO4**
Q 9	An- I section beam 350 mm x 150 mm has a web thickness of 10 mm and a flange thickness of 20 mm. If the shear force acting on the section is 40 kN, find the maximum shear stress developed in the I-section. Also draw the shear stress distribution across the section.  OR A simply supported beam of a square cross-section of the dimensions 250 mm x 250 mm is loaded as shown in figure. Find the maximum bending stresses developed in the beam.  	**10**	**CO3**
	SECTION-C **(2Qx20M=40 Marks)**		
Q 10	A steel rod of 16 mm diameter and 3 m length passes through a copper tube of 50 mm external and 40 mm internal diameter and of the same length. The tube is closed at each end with the help of 30 mm thick steel plates, which are tightened by nuts till the length of copper tube is reduced by 0.6 mm. The temperature of the whole assembly is then raised by 56 ^{0}C. Determine the stress in the steel and copper before and after the rise of temperature. Assume that the thickness of steel plates at the ends do not change during tightening of nuts. E_s=210 GPa; E_c = 100 GPa; α_s =12 x 10-6/^{0}C; α_c =17 x 10-6/^{0}C;	**20**	**CO3**

	 OR At a point in a bracket, the stress on two mutually perpendicular planes are 100 N/mm^2 (tensile) and 50 N/mm^2 (tensile). The shear stress across the planes is 80 N/mm^2. Find using Mohr stress circle or otherwise calculate: a. Magnitude and direction of the resultant stress on plane making an angle of 20^0 with the plane of the first stress. b. Maximum shear stress and location of its plane. c. Principal stresses and the location of principal planes.		
Q 11	A beam is loaded as shown in figure below. Compute; a. Deflection at point E and D. b. The maximum deflection c. Slop at end A and B 	**20**	**CO4**