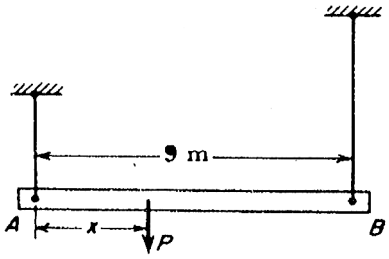
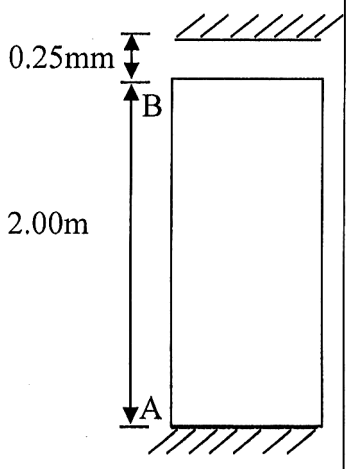
B. CONS.ENGG. 2nd YR 1ST. SEM. EXAM.-2023

SUBJECT Strength of Material

Time : 3 hours. **Full Marks : 100**

(50 marks for each Part)

Use Separate Answer scripts for each Part

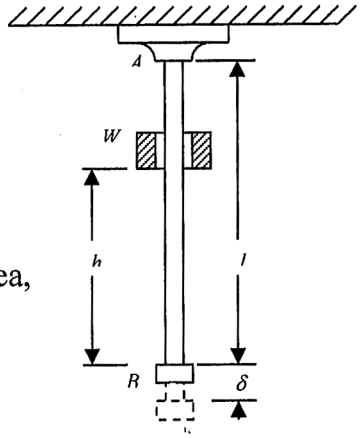
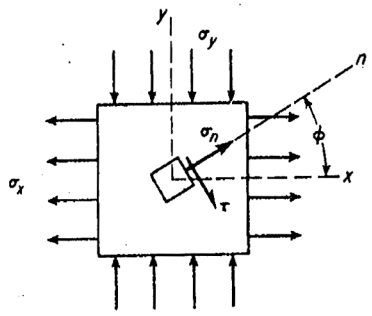
	No of Questions	Part I	Marks
CO1		**Answer any three from Q1, Q2, Q3, Q4 and Q5.**	
	Q1.	A rigid bar AB, 9m long, is suspended by two vertical rods at its ends and hangs in a horizontal position under its own weight as shown in Fig.A. The rod at A is brass, length 3m, cross-sectional area, 1000mm², modulus of elasticity 1 x 10^5 N/mm². The rod at B is steel, length 5m, cross-sectional area 445 mm², modulus of elasticity 2 x 10^5 N/mm². At what distance x from A may a vertical load P be applied if the bar is to remain horizontal after the load is applied ?  Fig.A	07
	Q2.	For a prismatic bar of length L, cross sectional area A, weight per unit volume is γ, which hangs vertically under its own weight, derive the expressions for (i) total elongation of the bar (ii) strain energy stored in the bar.	07
	Q3.	A copper bar AB of length 2.0m is placed in position at room temperature with a gap of 0.25mm between and A and a rigid restraint B (Ref Fig B). Calculate the axial compressive stress σ_c in the bar if temperature rise is 100^{0}C. Use α=18x10^{-6} per ^{0}C and E =1x10^5 N/mm².  Fig.B	07

Ref. No. Ex. EX/CON/PC/B/T/212/2023

B. CONS.ENGG. 2nd YR 1ST. SEM. EXAM.-2023

SUBJECT Strength of Material

Time : 3 hours. **Full Marks : 100**

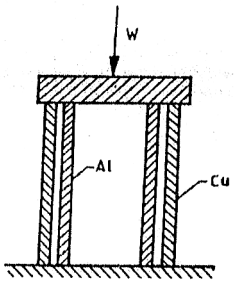
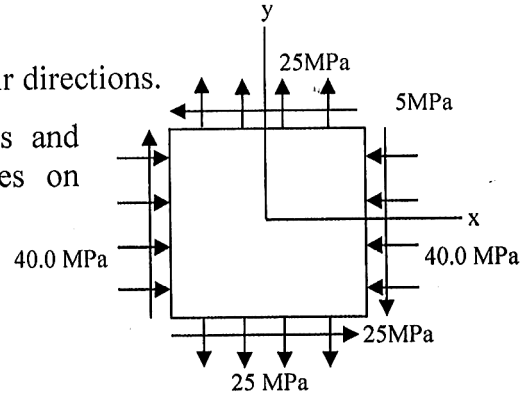
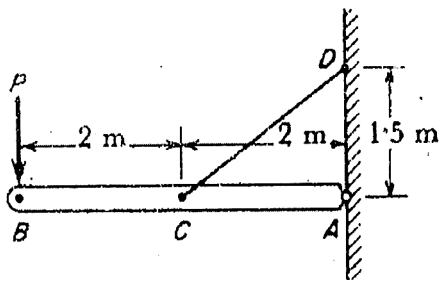
	No of Questions	Part I	Marks
	Q4.	A steel specimen of 15mm diameter extends by 0.081mm over a gauge length of 150mm when subjected to an axial load of 15 KN. The same specimen undergoes a twist of 0.307° over a length of 150mm for a twisting moment of 15N-m. Using the above data, determine the elastic modulus E, Poisson's ratio μ, shear modulus G and bulk modulus K.	07
	Q5.	Derive from the first principle the relation ship (Refer Fig. C) $\sigma = \sqrt{\frac{2E}{Al} \cdot \frac{Wv^2}{2g}}$ Where W = Weight of the falling body σ = Tensile stress, A = Cross sectional area, v = Velocity of the falling body E = Modulus of elasticity Also clearly state the assumptions.  **Fig. C**	07
CO2		**Answer Q6 and any two from Q7, Q8, Q9 and Q10.**	
	Q6.	State whether the following statements are True or False i) In case of biaxial stress, the maximum shear stress is τmax = ½ (σx - σy), where σx and σy are mutually perpendicular normal stress is in x and y direction. ii) In case of biaxial stress, the sum of complimentary normal stress is constant and equal to σx + σy.	02
	Q7.	Construct Mohr's circle for the case of biaxial stress σ_x = 35MPa and σ_y= (-)70MPa. For these principal stresses, construct Mohr's circle and find the value of ϕ defining the plane on which σ_n varishes. What is the magnitude of shear stress on this plane ?  	09

Ref. No. Ex. EX/CON/PC/B/T/212/2023

B. CONS.ENGG. 2nd YR 1ST. SEM. EXAM.-2023

SUBJECT Strength of Material

Time : 3 hours. **Full Marks : 100**

	No of Questions	Part I	Marks
	Q8.	Two coaxial cylinders, one made of copper and the other aluminum, support a load W transmitted through a rigid plate (Fig. D). The copper tube has an internal diameter of 15 cm and is 1.5cm thick, while the aluminum cylinder is of 12cm external dia and is 2cm thick. The tubes are 30cm long. Determine the maximum safe load W that can be carried without material yielding. Take E_{cu} = 100 GPa and E_{AL} = 70 GPa. The yield point stress values for copper and aluminum are 260 MPa and 140 MPa respectively.  **Fig. D**	09
	Q9.	A plane element is subjected to stresses as shown in Fig. Draw Mohr's Circle and determine a) The principal stress and their directions. b) The maximum shear stress and the direction of the planes on which they occur. 	09
	Q10.	A rigid bar AB is hinged to a vertical wall and supported horizontally by a tie-bar CD. The tie-bar has cross-sectional area A=0.5 sq cm and its allowable stress in tension is σ_W = 150 MPa. Find the safe value of the magnitude of the load P and the corresponding vertical deflection Δ_B of point B. The tie-bar has modulus of elasticity E=2 x 10^5 N/mm². 	09

Ref. No. Ex. EX/CON/PC/B/T/212/2023

B. CONS.ENGG. 2nd YR 1ST. SEM. EXAM.-2023

SUBJECT Strength of Material

Time : 3 hours. **Full Marks : 100**

	No of Questions	Part I	Marks
CO4		**Answer Q11 and any one from Q12a and Q12b.**	
	Q11.	State whether the following statements are True or False i) Shear stress due to torsion applied to a circular bar is maximum at the centre of cross section of the bar.	01
	Q12a.	A solid shaft transmits 300 kW at 100 rpm. If the shear stress is not to exceed 80 N/mm^2, what should be the diameter of shaft? If this shaft is to be replaced by a hollow shaft whose internal diameter shall be 0.6 times the outer diameter, determine the size and percentage saving in weight, maximum stress being same.	08
	Q12b.	A hollow steel tube (outside diameter, d_o and inside diameter d_i) is to be used as a torque dynamometer. It is desired to attain an angle of twist of 1° per 0.30m of length per 10 N-m of torque without exceeding an allowable shear stress τ_w = 42 MPa. What are the required values of d_0 and d_i?	08

Ref. No. :- Ex/CON/PC/B/T/212/2023

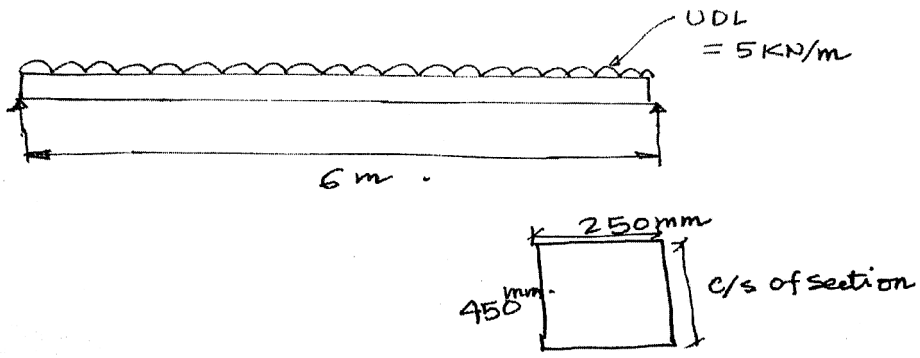
B. CONS. ENGG. 2ND YR 1ST SEMESTER EXAM-2023

STRENGTH OF METERIALS

Time : Three hours **Full Marks :100**

PART II

Instructions: **Use Separate Answer Scripts For Each Group/Part Etc.**
Answer All Questions

No. of Questions	Part -II	Marks
Q1.	Prove that maximum shearing stress due to bending in case of a rectangular beam cross section is 50 percent greater than the average of shearing stress acting on the beam section.	10
Q2.	Derive the relation between Bending Moment (M) and Shear force (F) of a beam member.	15
Q3.	 Draw bending moment and shear force diagram of this beam member of length 6 meter in length and supported at both end as pin supported joint. This beam is loaded with UDL of 5KN/Meter. Cross section of the beam is width is 250 mm and depth 450 mm. Finally also check the tensile bending stress at bottom most fiber.	25