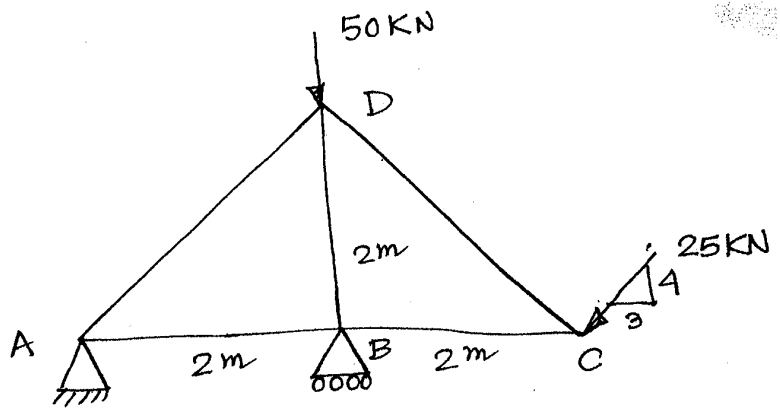
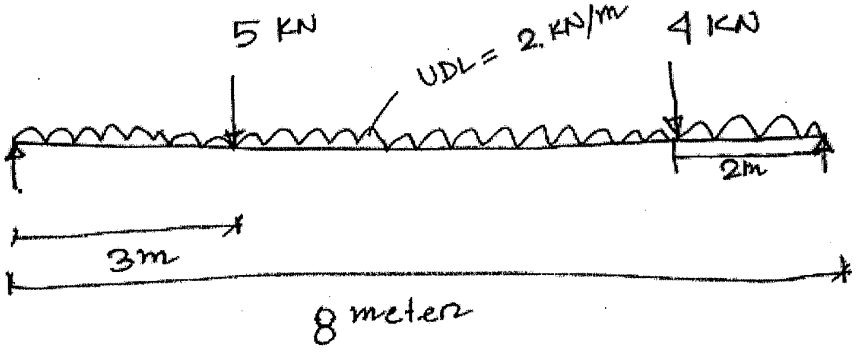
Ref. No. Ex. /CON/PC/B/T/212/2024(S)

B. CONST. ENGG. 2nd YR 1ST. SEM. SUPPLEMENTARY EXAM.-2024

SUBJECT: Strength of Material

Time : 3 hours. **(50 Marks for each Part)** **Full Marks : 100**

Instructions: **Use Separate Answer Scripts for Each Part**
Answer All Questions

No. of Questions	Part I (50 Marks)	Marks
Q1.	 Solve the above-mentioned truss structure and find forces of all members (compression & tension) by method of joint.	25
Q2.	 Find Shear force diagram of above-mentioned beam.	15
Q3.	Derive the relation between Bending Moment (M) and Shear force (F) of a beam member.	10

[Turn over

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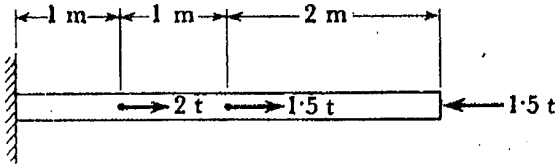
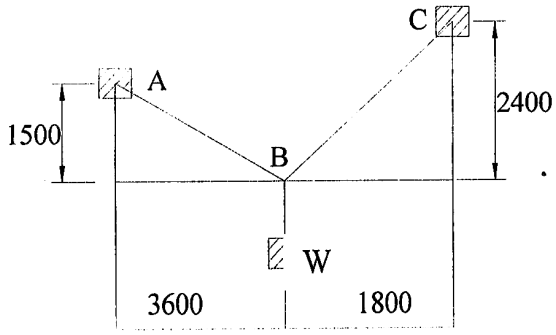
SUBJECT: Strength of Material

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

Use Separate Answer scripts for each Part

	No of Questions	Part II (50 Marks)	Marks
CO1		**Answer any three from Q1, Q2, Q3 and Q4.**	
	Q1.	A steel bar 2.5cm diameter is rigidly attached to two parallel support which are 5m apart. Find the pull exerted by the bar on the support when the temperature is increased by 100^0C (a) if the support do not yield (b) if yielding of supports is 0.25cm $\alpha = 12 \times 10^{-6}$ per ^{0}C, $E_s = 2.1 \times 10^5$ MPa	07
	Q2.	i) Draw the stress-strain diagram of structural steel and mark the relevant points. ii) Define (i) Proportional limit, (ii) Elastic limit, (iii) Modulus of resilience. iii) Explain what do you understand by ductile and brittle material.	07
	Q3.	A prismatic steel bar having cross-sectional area A=3sq cm is subjected to axial loading as shown in Fig.A Neglecting localized irregularities in stress distribution near the points of application of the loads, find the net increases λ in the length of the bar. Assume $E=2(10)^6$ kg/cm^2  FIG. A	07
	Q4.	A weight W is hung by two steel wires as shown in the figure. The cross sectional area of wire AB is 200mm^2 and that of BC is 400mm^2. If the allowable tensile stress of the wire material is 100MPa, calculate the value of W that can be safely supported by the wires?  	07

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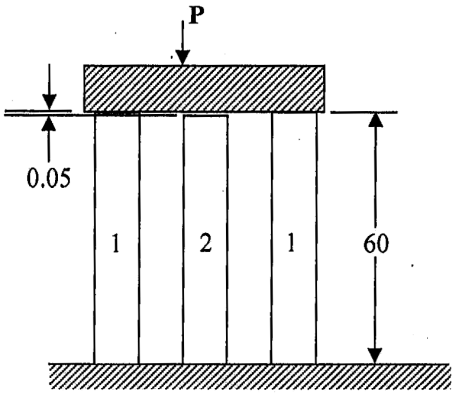
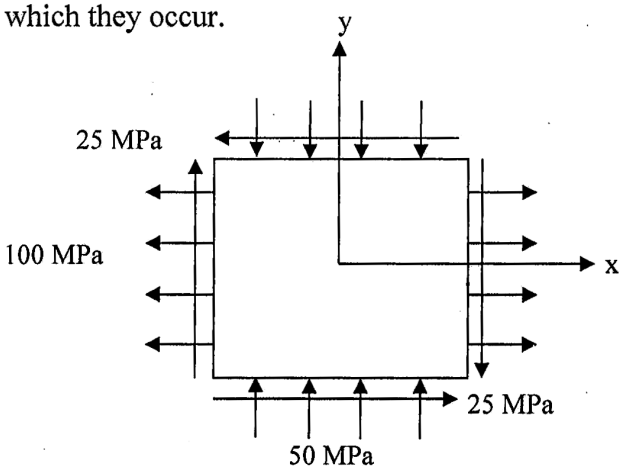
SUBJECT: Strength of Material

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

	No of Questions	Part II	Marks
CO2		**Answer any two from Q5, Q6, Q7 and Q8.**	
	Q5.	A rigid steel plate is supported by three concrete posts each having a 10cm x 10cm square cross section as shown in Fig. B. By accident the middle post is 0.05cm shorter than the other two before load P is applied. Find the safe value of load P if the working stress for the concrete in compression is 200 kg/cm² and the modulus of elasticity $E_c = 12(10)^4$ kg/cm².  Fig. B	09
	Q6.	A plane element is subjected to stresses as shown in Fig. C. 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.  **Fig. C**	09

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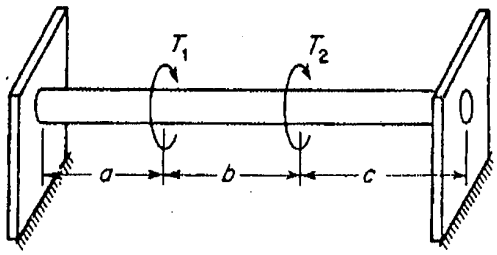
SUBJECT: Strength of Material

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

	No of Questions	Part II	Marks
	Q7.	A rectangular block having dimensions a, b, c in the x, y, z direction respectively, is subjected to biaxial stresses σ_x and σ_y of such magnitudes that the unit strains in the x, y, z directions are ε_x, ε_y and ε_z. show that if these strains are small, the unit volume change of the block will be $\Delta V/V = \varepsilon_x + \varepsilon_y + \varepsilon_z$.	09
	Q8.	Construct Mohr's circle for the case of biaxial stress of a thin plate where σ_x = 350kg/cm^2 and σ_v = -700kg/cm^2. Find the value of ϕ defining the plane on which σ_x vanished. What is the magnitude of the shear stress on this plane ?	09
CO4		**Answer Q11 and any one from Q9 and Q10.**	
	Q9.	A Prismatic shaft of diameter d has built-in ends and is subjected to the action of externally applied twisting moments T_1 and T_2 as shown in Fig.D. Find the internal torques T_a, T_b, T_c in the three portions a, b, c of the shaft. The following numerical data are given a =750mm, b=1250mm, c=1000mm, T_1=1200 N-m and T_2=2400 N-m  Fig.D	09
	Q10.	A hollow aluminum tube used in a roof structure has an outside diameter of 100 mm and an inside diameter of 80 mm. The tube is 2.50m long. Assume G = 28 GPa a) If the tube is twisted in pure torsion by torques acting at the ends, what is the angle of twist when the maximum shear stress is 50 MPa? b) What diameter is required for a solid shaft to resist the same torque with the same maximum stress?	09
	Q11.	A hollow circular shaft has an outer diameter of 100mm and a wall thickness of 25mm. The allowable shear stress in the shaft is 125MPa. The maximum torque the shaft can transmit is a) 46kN-m b) 24.5kN-m c) 23kN-m d) 11.5kN-m	02