CBCS SCHEME

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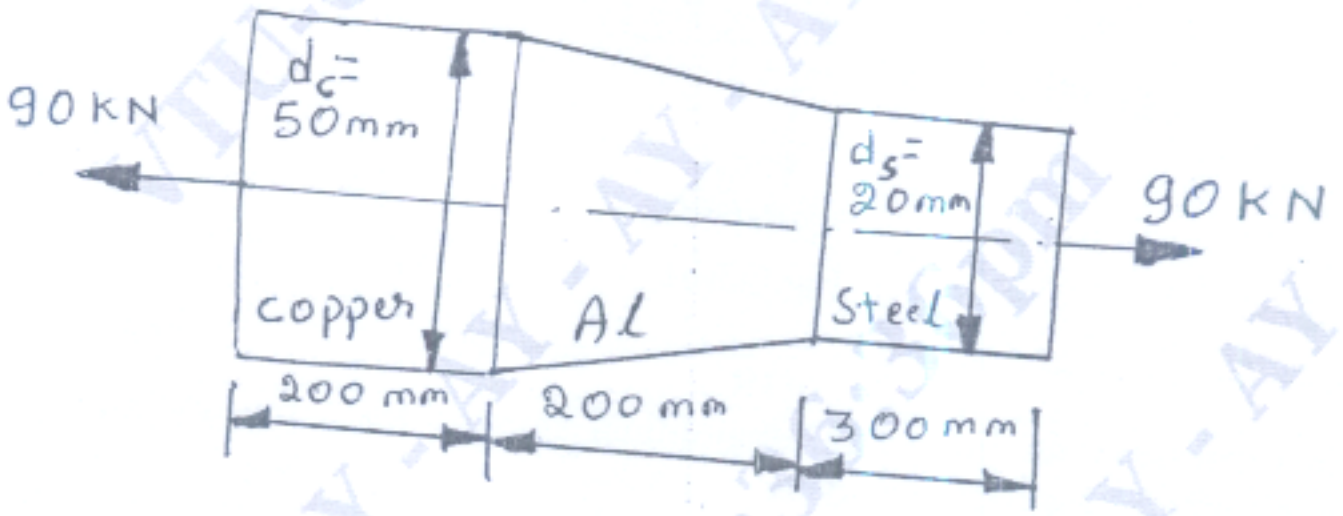
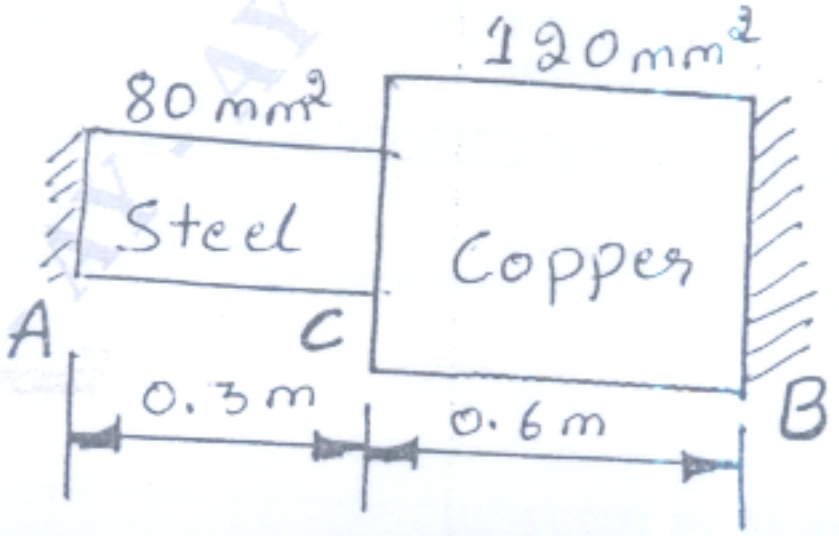
BME301

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define the following : i) Ductility ii) Brittleness iii) Toughness iv) Resilience.	4	L1	CO1
	b.	Derive an expression for the extension of a member subjected to a tensile load P.	6	L2	CO1
	c.	Find the elongation in bar loaded as shown in Fig.Q1(c) take modulus of elasticity for steel E_s = 200 GPa, for copper E_C = 100 GPa and for aluminum E_A = 70 GPa.  Fig.Q1(c)	10	L3	CO1
		OR			
Q.2	a.	Define the following : i) Steady load ii) Impact load iii) Sudden load iv) Shock load.	4	L1	CO2
	b.	A stepped bar shown in Fig.Q2(b) is fixed at its two ends rigidly. The bar is free from stresses when its temperature is 30°C. When the temperature of the bar is increased to 90°C determine : i. Stresses induced in steel and copper portions ii. Displacement in the junction at point C. Take : E_C = 100 GPa, $\alpha_C = 1.8 \times 10^{-5}$ /°C E_S = 200 GPa, $\alpha_S = 1.2 \times 10^{-5}$ /°C  Fig.Q2(b)	16	L3	CO1

Module – 2

Q.3	a.	Define principle planes and principal stresses.	4	L1	CO2
	b.	The state of stress at a point in a strained material is as shown in Fig.Q3(b). Determine : i. Principle stresses and their planes ii. Maximum shear stress and planes of maximum shear stress iii. Normal stress and tangential stress on plane XY Solve by Mohr's circle method.	16	L3	CO2

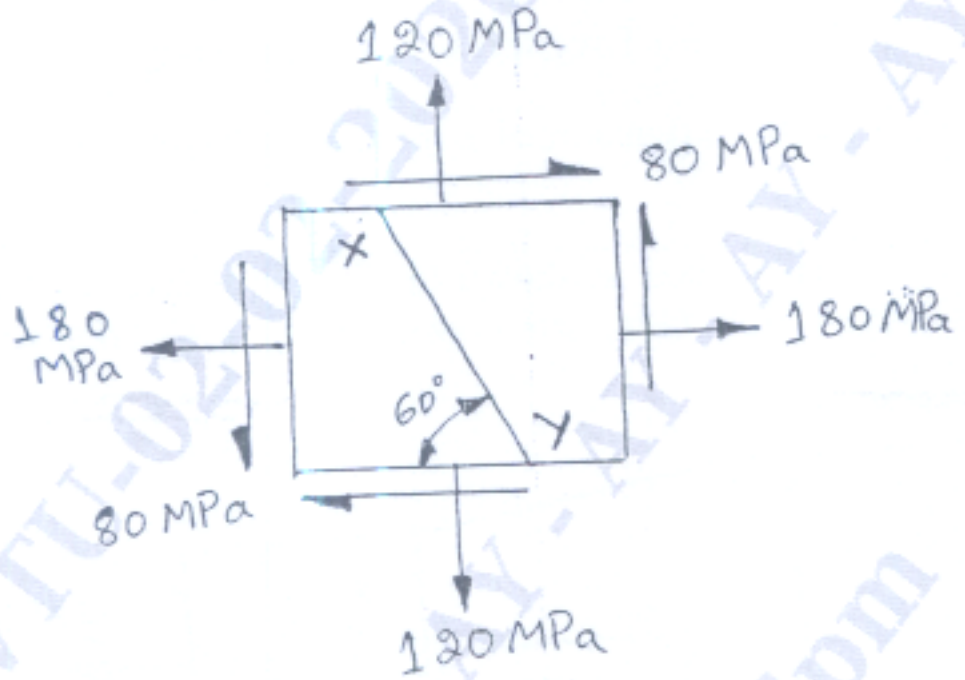


Fig.Q3(b)

OR

Q.4	a.	Obtain expression for hoop and longitudinal stresses for a thin cylinder stating clearly the assumptions made.	8	L2	CO2
	b.	A thick walled cylindrical pressure vessel has inner radius of 150 mm and outer radius of 185 mm. Draw a sketch showing the radius pressure and hoop stress distribution in the section of the cylinder wall, when an internal pressure of 10 MPa is applied.	12	L3	CO2

Module – 3

Q.5	a.	Define the following : i) SFD ii) BMD.	4	L1	CO3
	b.	Draw the SFD and BMD for the simply supported beam as shown in Fig.Q5(b).	16	L3	CO3

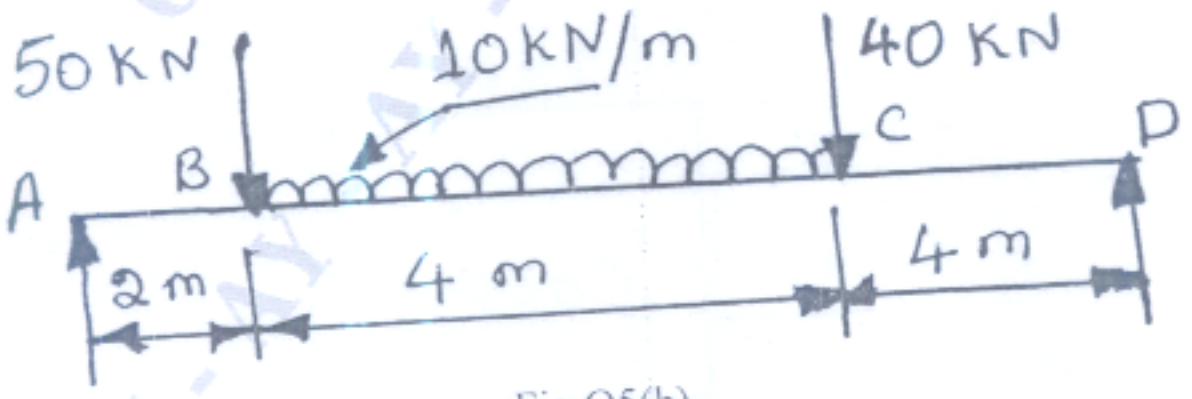


Fig.Q5(b)

		OR			
Q.6	a.	Draw the SFD and BMD of cantilever of length L carrying UDL = W/meter.	6	L2	CO3
	b.	Draw the SFD and BMD for the overhanging beam shown in Fig.Q6(b).	14	L3	CO3

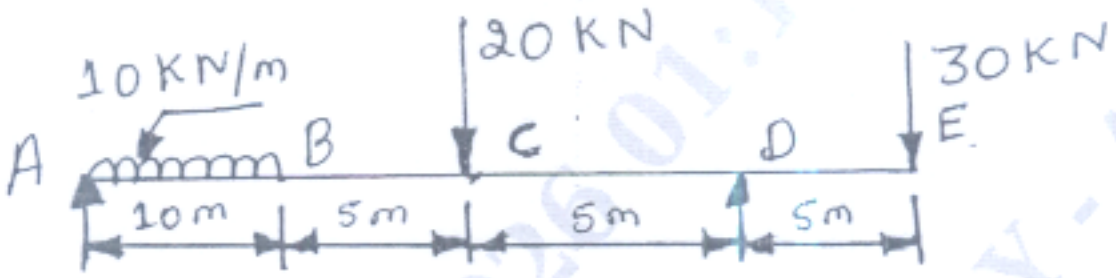


Fig.Q6(b)

		Module – 4			
Q.7	a.	Derive an expression for the bending and radius of curvature for a straight beam subjected to pure bending.	10	L2	CO4
	b.	A beam having T section with its flanges of (180 mm × 10 mm) and web of (220 mm × 10 mm) is subjected to sagging bending moment 15 KN –m. Determine the maximum tensile stress and maximum compressive stresses, and their locations in the section . Draw a sketch showing bending stress distribution.	10	L3	CO4
		OR			
Q.8		An I – section beam 350 mm × 200 mm has a web thickness of 12.5 mm and a flange thickness of 25 mm. It carries a sharing force of 200 KN at a section. Sketch the shear stress discretion across the section.	20	L4	CO4
		Module – 5			
Q.9	a.	Derive torsion equation with usual notation. State the assumption in the theory of pure torsion.	10	L2	CO5
	b.	A hollow circular steel shaft has to transmit 60 KW at 210 rpm such that the maximum shear stress does not exceed 60 MPa. If the ratio of internal to external diameter is equal to 0.75 and the value of rigidity modulus is 84 GPa, find the dimensions of the shaft and angle of twist in length of 3 m.	10	L3	CO5
		OR			
Q.10	a.	Derive an expression for the critical load in a column subjected to compressive load, when both end is fixed.	10	L2	CO5
	b.	A 2.5 meter long column with hollow circular section is hinged at both ends. External diameter is 140 mm and thickness of wall is 20 mm. Taking E = 80 GPa. $\alpha = \frac{1}{1600}$ and σ_c = 550 MPA, Compare the buckling loads obtained using : i. Euler's formula ii.Rankine's formula Also find the length of column for which both formulae given same load.	10	L3	CO5

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