CBCS SCHEME

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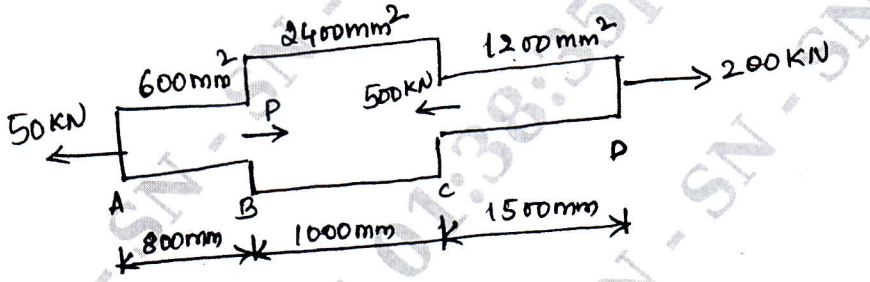
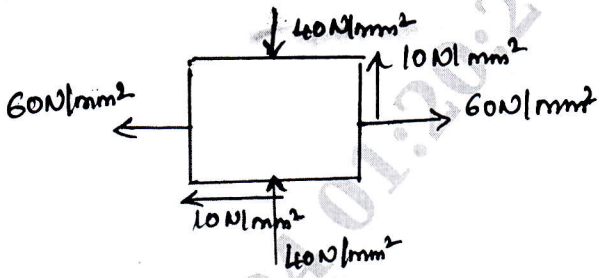
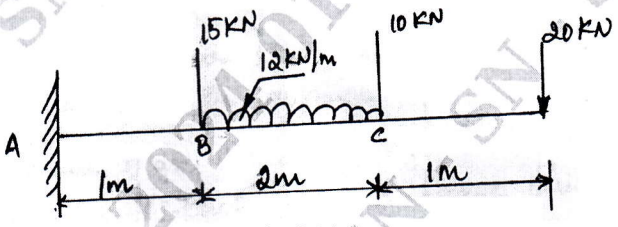
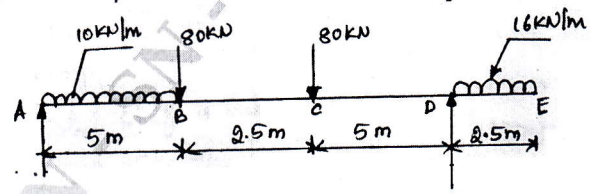
BMR401

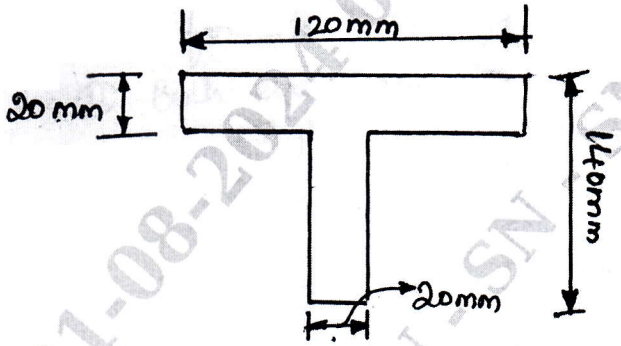
Fourth Semester B.E./B.Tech. Degree Examination, June/July 2024
Mechanics of Materials

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.	Explain the following : i) Elasticity ii) Ductility iii) Hooks law iv) Poisons Ratio v) Hardness vi) Young modulus of elasticity.	6	L2	CO1
	b.	Explain the salient points on a stress strain diagram for a ductile material (Mild steel)	6	L2	CO1
	c.	A member ABCD is subjected to point load a shown in Fig. Q1(c) calculate: i) Force 'P' necessary for equilibrium ii) Total elongation of the bar. Take E = 210GN/m^2.  Fig Q1(c)	8	L3	CO1
		OR			
Q.2	a.	Derive the equation for the elongation of a circular bear with uniformly tapering section under axial load 'P'.	6	L2	CO1
	b.	Derive a relation between Young's modulus and rigidity modulus.	6	L2	CO1
	c.	A steel rod of 4m long and 20mm diameter is subjected to an axial tensile load of 40kN. Determine the change in length, diameter and volume of rod. Take E = 2×10^5 N/mm^2 and Poison's ratio is 0.25.	8	L3	CO1
		Module – 2			
Q.3	a.	Find the expression for normal and tangential stress for the member subjected to direct stress on two mutually perpendicular directions.	10	L3	CO1

	b.	The state of stress at appoint in a material is as shown in Fig Q3(b). Determine : i) Direction of principal plans ii) Magnitude of principal stresses iii) Magnitude of maximum shear stress and its direction  Fig Q3(b)	10	L3	CO1
		OR			
Q.4	a.	What is thick cylinders? Derive expression of radia and hoop stress using Lames equation.	10	L3	CO1
	b.	A pipe of 500mm internal diameter and 75mm thick filled with a fluid at a pressure of 6N/mm^2. Find the maximum and minimum hoop stress across the cross section and also sketch the radial and hoop stress distribution across the section.	10	L3	CO1
		Module – 3			
Q.5	a.	Explain the sign convention for shear force and bending moment for a beam.	4	L2	CO2
	b.	Derive a relation for load, force and bending moment when beam under UDL.	6	L2	CO2
	c.	Determine the shear force and bending moment at point A, B, C, D of a beam shown in Fig Q5(c), Also sketch shear force and bending moment diagram.  Fig Q5(c)	10	L4	CO2
		OR			
Q.6	a.	Sketch and explain the types of loads acting on beams.	6	L2	CO2
	b.	Draw shear force and bending moment diagram for the beam shown in Fig Q6(b). Locate the point of contra flexure if any.  Fig Q6(b)	14	L4	CO2

		Module – 4			
Q.7	**a.**	What are the assumptions made in simple bending? Establish relationship between bending stress, moment and radius of curvature as $\frac{M}{I}=\frac{\sigma}{Y}=\frac{E}{R}$.	**12**	**L3**	**CO3**
	b.	A simply supported beam has a length of 4m carries uniformly distributed load of 8kN/m. over its entire span. The beam cross section is T-section as show in Fig Q7(b). Calculate the maximum tensile and compressive stress in the section.  Fig Q7(b)	**8**	**L4**	**CO3**
		OR			
Q.8	**a.**	Prove that in a rectangular cross section, maximum shear stress at the neutral surface is 1.5 times the average shear.	**12**	**L3**	**CO3**
	b.	A beam of an I section 200mm × 300mm has web thickness 10mm and flange thickness of 10mm. If carries a hearing force of 10kN at a section. Sketch the shear stress distribution across the section.	**8**	**L4**	**CO3**
		Module – 5			
Q.9	**a.**	Derive the torsion equation. What are the assumptions made in torsion equation?	**12**	**L3**	**CO4**
	b.	A solid shaft is subjected to a maximum torque of 25kN-m. Find a suitable diameter of solid shaft, if the allowable shear stress and the angle of twist are limited to 80N/mm^2 and 1° respectively for a length of shaft 20 times the diameter of shaft. Assume rigidity modulus G = 80kN/mm^2.	**8**	**L4**	**CO4**
		OR			
Q.10	**a.**	Derive the expression for Euler's crippling load for a column when both ends are fixed.	**12**	**L3**	**CO4**
	b.	A solid round bar of 60mm diameter and 2.5m is used as a strut. Find the safe compressive load for the strut. If i) both ends are hinged ii) both ends are fixed. Take Young's modulus E = 2 × 10^{5}N/mm^2 and FOS = 3.	**8**	**L4**	**CO4**

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