CBCS SCHEME - Make-Up Exam

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BCV301

Third Semester B.E/B.Tech. Degree Examination, June/July 2025
Strength 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.
3. Missing data, if any, may be suitably assumed.

		Module – 1	M	L	C
1	a.	Drive the expression of circular tapering bar subjected to an axial load P.	6	L1	CO1
	b.	Define the following terms : i) Modulus of rigidity ii) Modulus of elasticity iii) Bulk modulus iv) Volumetric strain.	4	L1	CO1
	c.	A 1.5 m long steel bar is having uniform diameter of 40 mm for a length of 1m. In the next 0.5 m its diameter gradually reduces from 40 mm to 20 mm as shown in Fig.Q1(c). Determine the elongation of this bar when subjected to an axial tensile load of 160 kN, given E = 200 GN/m^2.	10	L3	CO1

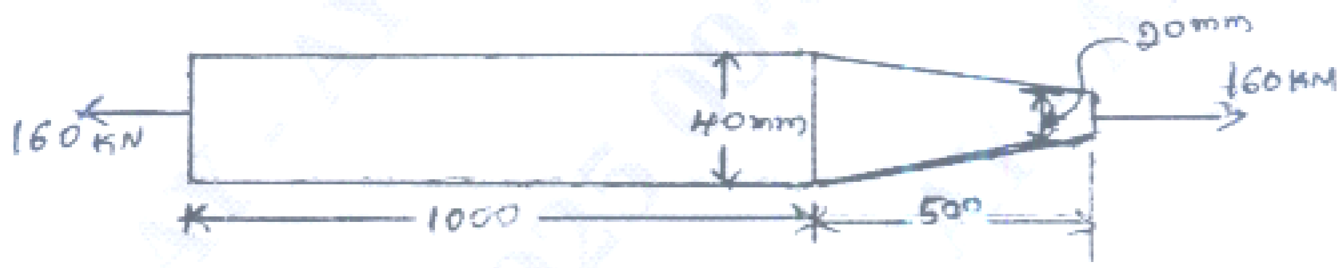
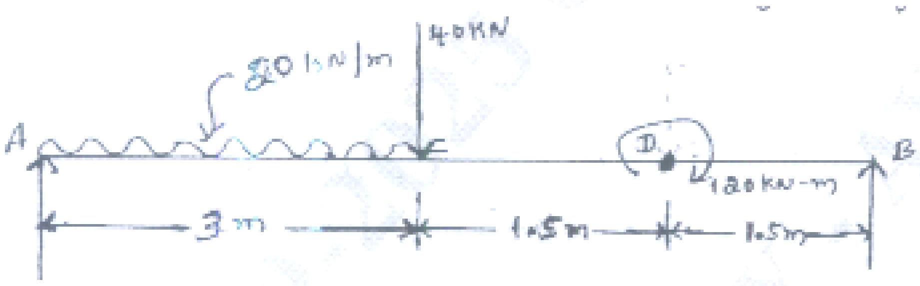
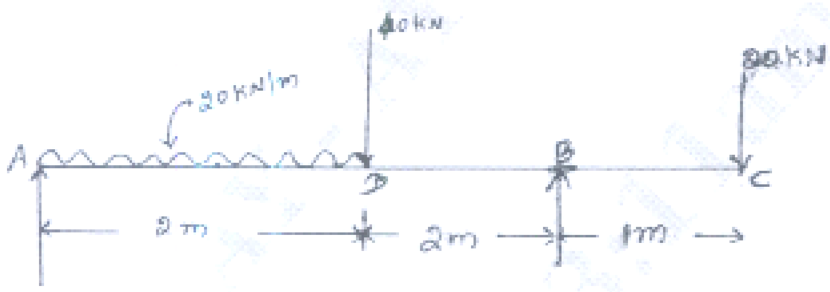


Fig.Q1(c)

		OR			
2	a.	Derive the relationship between modulus of elasticity. Module of rigidity and Poisson's ratio.	6	L3	CO1
	b.	A 18 mm diameter steel rod passes centrally through a copper tube of 26 mm, diameter (internal) and 38 mm diameter (External). The rod is 2.6 m long and is closed, at each ends by rigid plates of negligible thickness. The nuts are tightened lightly on the protecting parts of the rod. If the temperature of assembly is raised by 80°C. Calculate thermal stresses induced in copper and steel. Take α_{cu} = 17.5 × 10^{-6}/°C, α_s = 12 × 10^{-6}/°C, E_{st} = 210 GPa, E_{cu} = 1.05 × 10^5 N/mm^2.	10	L2	CO1
	c.	Define the principle of superposition and thermal stress.	4	L1	CO1

			Marks	Level	CO
		Module – 2			
3	a.	What are the different types of beams? Explain with neat sketches.	6	L1	CO2
	b.	Define : i) SFD ii) BMD iii) Hogging bending moment iv) Sagging bending moment.	4	L1	CO2
	c.	For the simply supported beam shown in Fig.Q3(c). Draw SFD and BMD, also find the point of zero shear and its corresponding bending moment.  Fig.Q3(c)	10	L3	CO2
		OR			
4	a.	Derive the relationship between load, shear force and bending moment.	6	L2	CO2
	b.	Draw BMD and SFD for the overhanging beam shown in Fig.Q4(b). Clearly indicate the portion of contra flexure.  Fig.Q4(b)	14	L3	CO2
		Module – 3			
5	a.	Derive bending equation with usual notation.	6	L3	CO3
	b.	What are the assumptions of simple bending?	4	L1	CO3
	c.	A circular pipe of external diameter 70 mm and thickness 8 mm is used as a simple supported beam over an effective span of 2.5 m. Find the maximum concentrated loads that can be applied at the centre of the span, if the permissible stress in the tube is 150 N/mm^2.	10	L3	CO3
		OR			
6	a.	List the assumptions made in pure torsion.	4	L1	CO3
	b.	Calculate the maximum intensity of shear stress induced and the angle of twist produced in degrees in solid shaft of 100 mm diameter, 10 m long, transmitting 112.5 KW at 150rpm. Take G = 82 kN/mm^2.	6	L2	CO3
	c.	A solid shaft is required to transmit 330 KW at 120 rpm. The shear stress of the material must not exceed 80 MN/m^2. i) Find the diameter required ii) If the shaft is replaced by a hollow one with a diameter ratio of 3 : 5 and the maximum shear stress remaining unchanged, calculate the percentage saving in weight that could be obtained.	10	L3	CO3

Module – 4

7	a.	A simply supported beam of 5 m span is subjected to a counteracted load of 50 KN at 3 m from left support, calculate : i) The position and the value of maximum deflection ii) The slope at mid-span iii) Deflection at the load point Take EI = 15 MN m^2.	10	L3	CO4
	b.	Define deflection and curvature.	4	L1	CO4
	c.	Derive moment – curvature equation.	6	L2	CO4
		OR			
8	a.	Derive an equation for Euler's buckling load for a long column whose ends are hinged.	6	L3	CO4
	b.	State the limitations of Euler's theory.	4	L1	CO4
	c.	A hollow cast from iron column whose outside diameter is 200 mm and thickness of 20 mm is 4.5 m long and is fixed at both ends. Calculate the safe load by Rankine's formula using a factor of safety of 2.5. Find the ratio of Euler's to Rankine's loads. Take $E = 1 \times 10^5$ N/mm^2 and Rankine constant = $\frac{1}{1600}$ for both ends pinned case. Take σ_c = 550 N/mm^2.	10	L3	CO4

Module – 5

9	a.	Differentiate between thin cylinders and thick cylinders.	4	L1	CO5
	b.	Differentiate between Hoop stress and longitudinal stress.	6	L2	CO5
	c.	The state of at a point on a strained material is 120 MPa and is as shown in Fig.Q9(c). Determine : i) The direction of principal planes ii) The magnitude of principal stresses iii) The magnitude of maximum shear stress and its directions. Sketch the stresses and planes.	10	L3	CO4

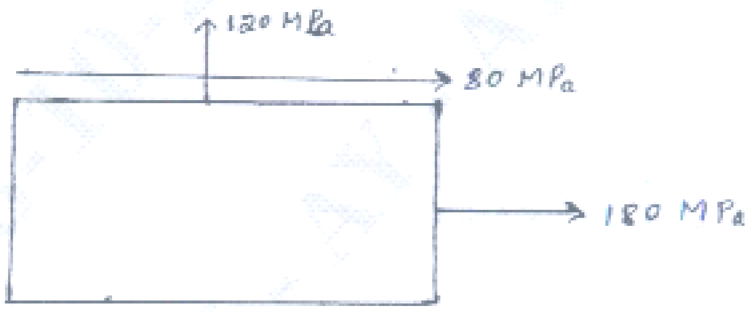


Fig.Q9(c)

OR

10	a.	Define : i) Principal stress ii) Principal plane.	4	L1	CO5
	b.	Derive Lame's equation with usual notation.	6	L3	CO5
	c.	Determine the maximum and minimum hoop stress across the section of a pipe of 400 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 80 N/mm^2. Also sketch the radial pressure distribution and hoop stress distribution.	10	L3	CO5