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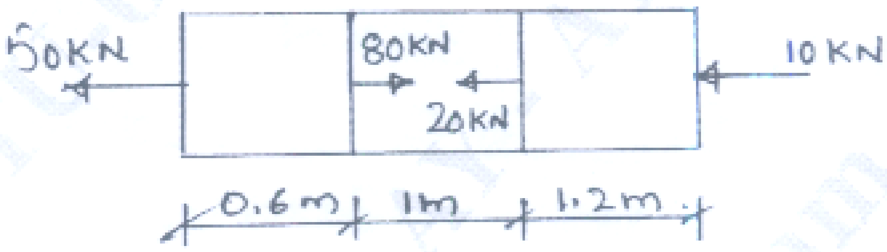
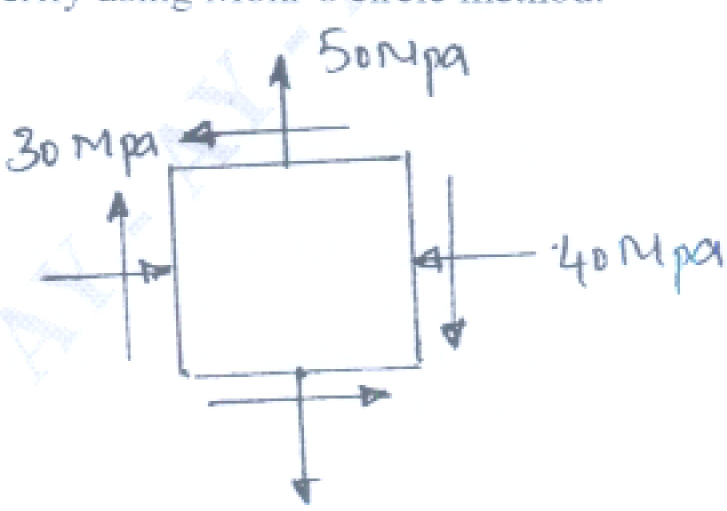
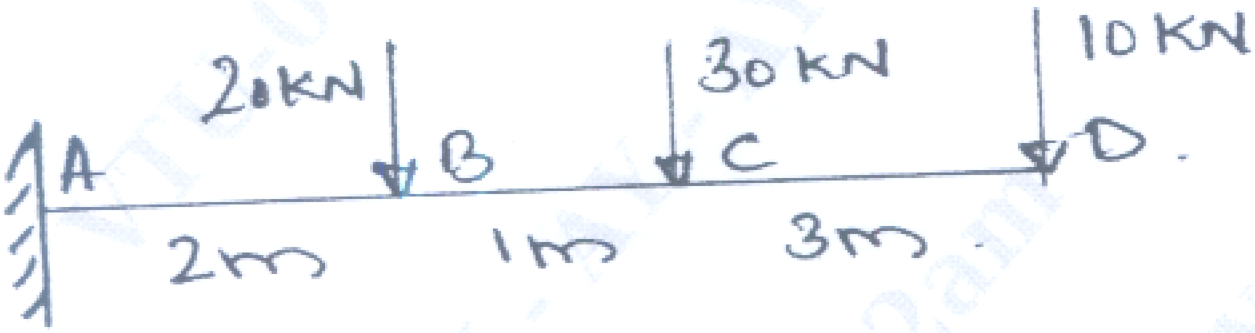
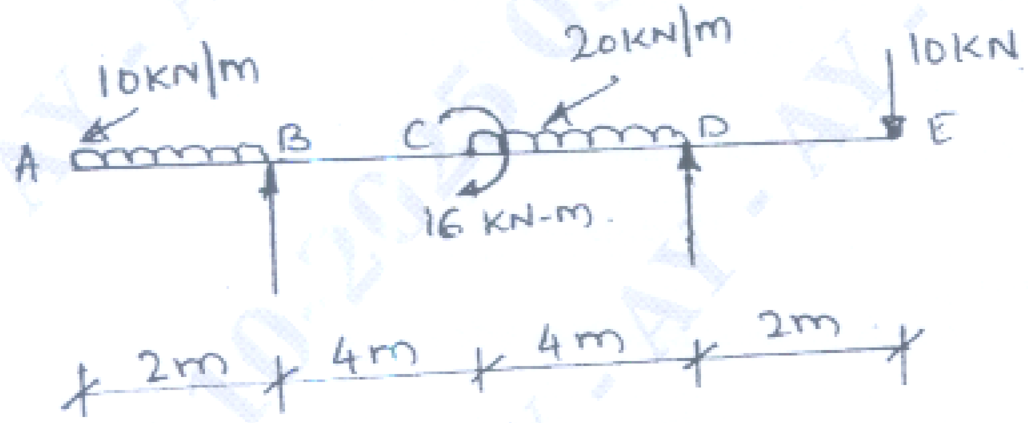
BME301

Thrid Semester B.E./B.Tech. Degree Examination, June/July 2025
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) Stress ii) Strain iii) Possion's ratio iv) Volumetric strain v) Bulk Modulus	5	L1	CO1
	b.	With a neat diagram, explain the salient points in stress- strain curve of mild steel material.	5	L2	CO1
	c.	A brass bar having cross sectional area of 1000 mm^2 is subjected to axial forces as shown in Fig Q1(c). Find the total elongation of the bar. Take E = 100 GPa.  Fig Q1(c)	10	L1/3	CO1
		OR			
Q.2	a.	Establish the relationship between Young's Modulus and Modulus of Rigidity.	10	L2	CO1
	b.	A steel rod of 30 mm diameter is enclosed centrally in a hollow copper tube of external diameter 50 mm and internal diameter 40 mm. The composite bar is subjected to axial pull of 45 kN, if the length of the each bar is equal to 190 mm. Find : i) Stress in rod and hollow tube ii) Load carried by each member iii) Deformation	10	L1/3	CO1
		Module – 2			
Q.3	a.	Define the following : i) Plane stress ii) Principle plane and Principle stress.	5	L1	CO2
	b.	An element is subjected to state of stress as shown in Fig Q3(b). Determine principle stresses and its direction Max. shear stress and its direction. Also verify using Mohr's circle method.  Fig Q3(b)	15	L3	CO2

		OR			
Q.4	**a.**	Derive an expression for stresses in thin cylinder.	**10**	**L2**	**CO2**
	b.	A cylindrical pressure vessel has inner and outer radii of 200 mm and 250 mm respectively. The material of the cylinder has allowable stress of 75 MPa. Determine the maximum internal pressure that can be applied and draw a sketch of radial pressure and circumferential stress distribution.	**10**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	List the different types of Beams and Loads.	**5**	**L1**	**CO3**
	b.	Derive the relationship between load intensity, shear force and bending moment.	**5**	**L2**	**CO3**
	c.	Draw the shear force and bending moment diagram for the beam shown in Fig Q5(c).  Fig Q5(c)	**10**	**L3**	**CO3**
		OR			
Q.6		For the beam shown in Fig Q6. Draw the shear force and bending moment diagram. Locate the point of contra – flexure if any.  Fig Q6	**20**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	List the assumptions made in theory of pure bending.	**5**	**L1**	**CO4**
	b.	Establish the relation between Bending stress and Radius of curvature.	**5**	**L2**	**CO4**
	c.	A 2 cm long beam with rectangular section (100 mm × 50 mm) is simply supported at its ends and is subjected to point load 10 kN at its midspan. Draw a sketch showing bending stress distribution along with depth of the section under maximum bending moment.	**10**	**L3**	**CO4**

OR					
Q.8	**a.**	Show that the maximum shear stress in rectangular section is 1.5 times average shear stress.	**10**	**L2**	**CO4**
	b.	An 'I' section of a beam has equal flanges of each (120 mm × 10 mm) and web of size (200 mm × 10 mm) when the section is subjected to a shear force of 50 kN. Draw a sketch showing shear stress distribution.	**10**	**L3**	**CO4**
Module – 5					
Q.9	**a.**	Derive Torsion Equation with usual notation.	**10**	**L2**	**CO5**
	b.	A shaft transmits 180 kW at 240 rpm. The allowable shear stress is 72 MPa. Find the diameter of solid shaft. Also, find the diameter of the hollow shaft if, the inside diameter is 0.6 times the outside diameter. What is the percentage of saving in material if, both shaft are made of same material and same length.	**10**	**L3**	**CO5**
OR					
Q.10	**a.**	Derive Euler's Equation for long column having both ends hinged.	**10**	**L2**	**CO5**
	b.	A 2 m long column has a square cross section of side 40 mm. Taking FoS as 4. Find the safe load for the following condition. i) Both ends hinged ii) One end fix other end free iii) Both ends fixed iv) One end fix other end hinged	**10**	**L3**	**CO5**

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