CBCS SCHEME

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BME301

Third 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 with necessary equations: (i) Stress (ii) Strain (iii) Young's modulus (iv) Poisson's ratio	04	L1	CO1
	b.	Explain with a neat sketch the stress-strain diagram for mild steel.	06	L2	CO1
	c.	Determine the overall change in length of the bar shown in the Fig.Q1(c) with following data : E = 100000 N/mm^2.	10	L3	CO1

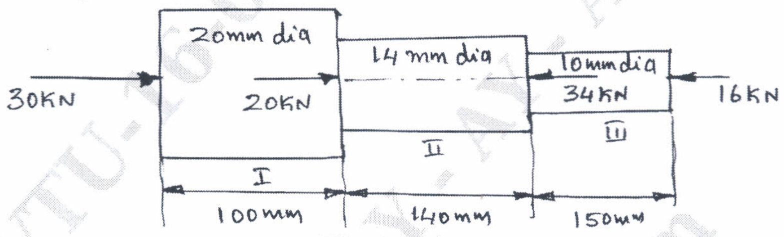

Fig.Q1(c)

OR

			M	L	C
Q.2	a.	Derive the relationship among Young's modulus, Bulk modulus and Poisson's ratio.	08	L2	CO1
	b.	An aluminium bar of 50 mm diameter is stressed in a testing machine, at certain instant the applied force is 100 KN while measured elongation of rod is 0.219 mm in a 300 mm gauge length and decrease in diameter is 0.01215 mm. Calculate elastic constants of the material.	12	L3	CO1

		Module – 2	M	L	C
Q.3	a.	Define Principal planes and principal stresses.	04	L1	CO2
	b.	A point in a strained material, the stresses on two planes at right angles to each other are 80 N/mm^2 (tensile) and 40 N/mm^2 (tensile) each of the above stresses is accompanied by a shear stress of 60 N/mm^2 as shown in Fig.Q3(b). Determine normal stress, shear stress and resultant stress on an oblique plane inclined at angle of 45° to the axis of minor tensile stress. Also find the major principal stress minor principal stress and their location, maximum shear stress and its location. Sketch the major and minor principal stress and also maximum shear stress planes with respect to x-axis.	16	L3	CO2

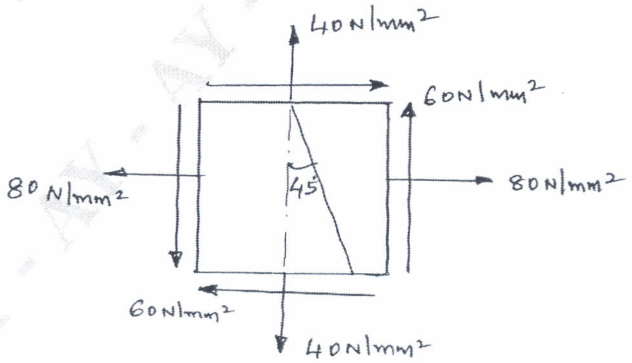

Fig.Q3(b)

		OR			
Q.4	**a.**	What are the differences between thin and thick cylinder.	**04**	**L1**	**CO2**
	b.	Derive an equation for longitudinal stress for thin cylinder.	**06**	**L2**	**CO2**
	c.	Find the thickness of metal necessary for a cylindrical shell of internal diameter 160 mm to withstand an internal fluid pressure of 8 N/mm^2. The maximum allowance or permissible or hoop stress in the section is not to exceed 35 N/mm^2.	**10**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Define a beam. What are the different types of beams?	**06**	**L1**	**CO3**
	b.	Draw the shear force and bending moment diagrams for the beam shown in Fig.Q5(b). Also find the point of contraflexture.	**14**	**L3**	**CO3**

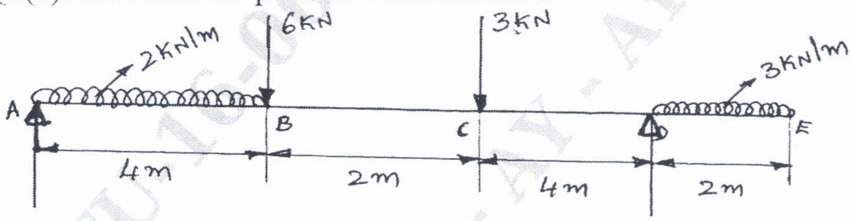

Fig.Q5(b)

		OR			
Q.6	**a.**	Define the following : (i) Sagging bending moment (ii) Hogging bending moment (iii) Point of contraflexture	**06**	**L1**	**CO3**
	b.	Draw the bending moment and shear force diagram for the beam shown in Fig.Q6(b).	**14**	**L3**	**CO3**

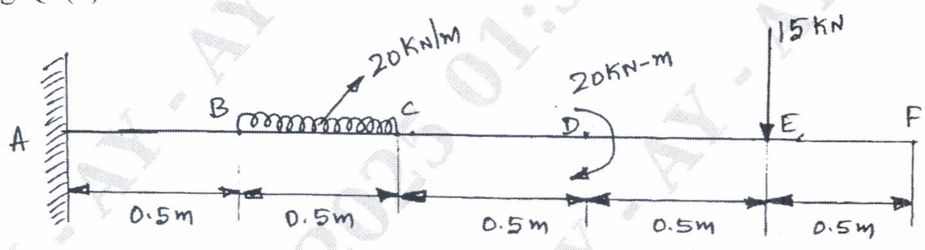

Fig.Q6(b)

		Module – 4			
Q.7	**a.**	Derive the bending equation in the form of $\frac{M}{I} = \frac{\sigma}{Y} = \frac{E}{R}$	**10**	**L2**	**CO4**
	b.	A simply supported beam of span 5 m has a cross section of 150 mm × 250 mm if the permissible stress is 10 N/mm^2, find (i) Max intensity of uniformly distributed load it can carry. (ii) Max concentrated load 'P' applied at 2 m from one end it can carry.	**10**	**L3**	**CO4**
		OR			
Q.8		A cast iron beam of I-section shown in Fig.Q8, is simply supported over a span of 6 m. If the limiting bending stress under tension and compression for the material are 32.5 MPa and 65 MPa respectively. Determine uniformly distributed load inclusive of self weight that the beam can carry.	**20**	**L4**	**CO4**

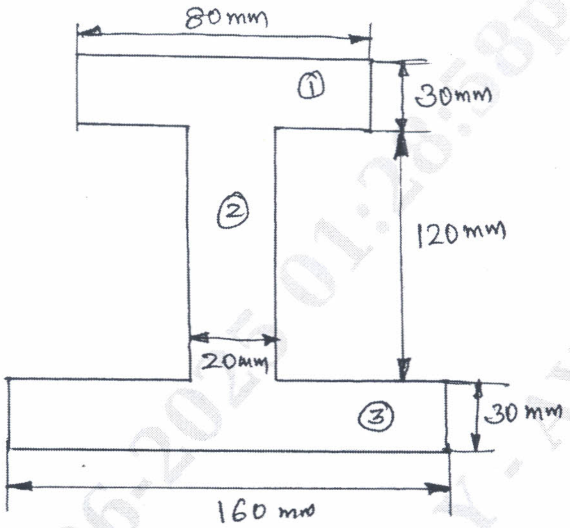

Fig.Q8

		Module – 5			
Q.9	**a.**	Derive torsion equation in the form of $\frac{T}{J}=\frac{\tau}{R}=\frac{G\theta}{L}$	**10**	**L2**	**CO5**
	b.	A solid shaft rotating at 1000 rpm transmits 50 KW. Maximum torque is 20% more than the mean torque. Material of the shaft has the allowable shear stress of 50 MPa and modulus of rigidity 80 GPa. Angle of twist in the shaft should not exceed 1° in one meter length. Determine the diameter of the shaft.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	Define the following : (i) Column (ii) Buckling load (iii) Slenderness ratio (iv) Radius of gyration	**08**	**L1**	**CO5**
	b.	Derive an expression for Euler buckling load when both ends of the column are fixed.	**12**	**L2**	**CO5**

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