CBCS SCHEME

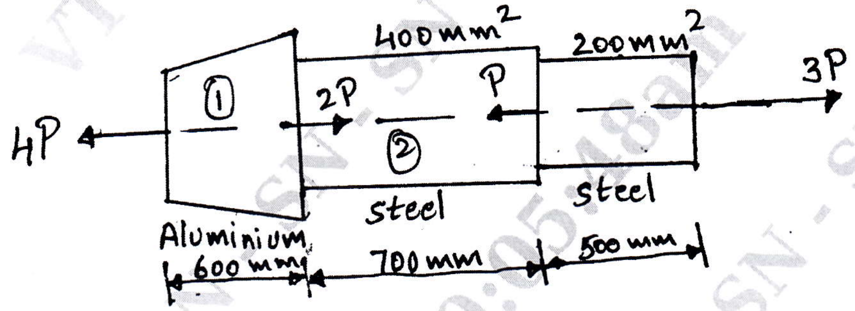
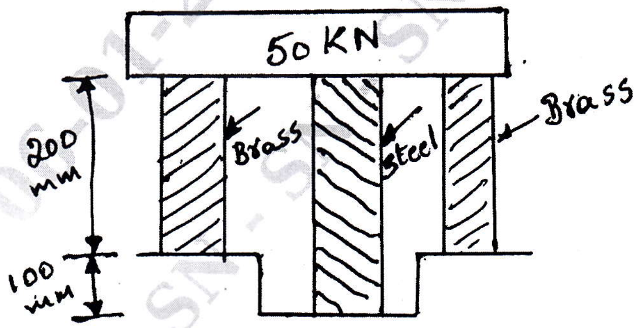
USN | | | | | | | | | | | **BMR401**

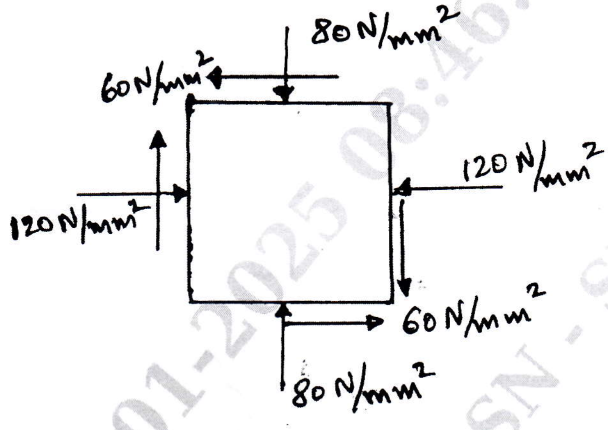
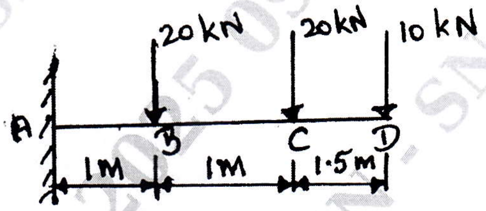
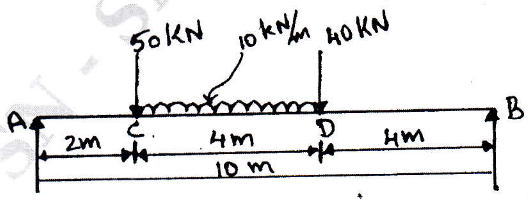
Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

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 terms: (i) Stress (ii) Strain (iii) Young's modulus (iv) Poisson's ratio (v) Hooke's law	**10**	**L1**	**CO1**
	b.	With neat sketch, explain the stress-strain diagram for mild steel.	**10**	**L2**	**CO1**
		OR			
Q.2	**a.**	A round bar with stepped portion is subjected to the forces as shown in Fig.Q2(a). Determine the magnitude of force P, such that net deformation in the bar does not exceed 1 mm. Young's modulus for steel is 200 GPa and that of aluminium is 70 GPa. Big end diameter and small end diameter of the tapering bar are 40mm and 12.5mm respectively.  Fig.Q2(a)	**10**	**L3**	**CO2**
	b.	A steel rod of cross sectional area 1600 mm^2 and two brass rods each of cross sectional area of 1000 mm^2 together support a load of 50 kN as shown in Fig.Q2(b). Find the stresses in the rod, Young's modulus for steel = $2\times10^5\ N/mm^2$, Young's modulus for brass = $1\times10^5\ N/mm^2$.  Fig.Q2(b)	**10**	**L3**	**CO2**

		Module – 2			
Q.3		The state of stress in a two dimensionally stressed body is shown in Fig.Q3. Determine graphically (by drawing Mohr's circle) the principal stresses, principal planes, maximum shear stress and its planes.  Fig.Q3	**20**	**L3**	**CO2**
		OR			
Q.4	**a.**	Derive the equations for stresses in thin cylinders.	**10**	**L1**	**CO1**
	b.	A pipe of 400mm internal diameter and 100mm thickness contains a fluid at a pressure of 80 N/mm^2. Find the maximum and minimum hoop stress across the section. Also, sketch the radial pressure distribution and hoop stress distribution across the section.	**10**	**L3**	**CO3**
		Module – 3			
Q.5	**a.**	Derive the relationship between load, shear force and bending moment.	**10**	**L2**	**CO2**
	b.	Draw the shear force and bending moment diagram for the cantilever beam shown Fig.Q5(b).  Fig.Q5(b)	**10**	**L3**	**CO3**
		OR			
Q.6	**a.**	Derive SFD and BMD for simply supported beam carrying a point load at Mid point.	**10**	**L2**	**CO2**
	b.	A simply supported beam of length 10m, carries the uniformly distributed load and two point loads as shown in Fig.Q6(b). Draw SFD and BMD for the beam. Also calculate the maximum Bending Moment.  Fig.Q6(b)	**10**	**L3**	**CO3**

Module – 4					
Q.7	**a.**	Derive the relation between bending stress and radius of curvature.	**10**	**L2**	**CO2**
	b.	A steel plate of width 120 mm and of thickness 20 mm is bent into a circular arc of radius 10 m. Determine the maximum stress induced and the bending moment which will produce the maximum stress. Take Young's modulus = 2×10^5 N/mm^2.	**10**	**L3**	**CO4**
OR					
Q.8	**a.**	What are the assumptions made in pure bending?	**05**	**L1**	**CO1**
	b.	Derive expressions for shear stress distribution across a rectangular section.	**15**	**L2**	**CO3**
Module – 5					
Q.9	**a.**	Derive Torsional equations.	**10**	**L2**	**CO3**
	b.	Determine the diameter of a solid steel shaft which will transmit 90 kW at 160 rpm. Also determine the length of the shaft if the twist must not exceed 1° over the entire length. The maximum shear stress is limited to 60 N/mm^2. Take the value of modulus of rigidity as 8×10^4 N/mm^2.	**10**	**L3**	**CO3**
OR					
Q.10	**a.**	Determine Euler's crippling load for a column when both ends hinged or pinned.	**10**	**L2**	**CO2**
	b.	A hollow mild steel tube 6 m long 4 cm internal diameter and 5 mm thick is used as a strut with both ends hinged. Find the crippling load and safe load taking factor of safety as 3. Take E = 2×10^5 N/mm^2.	**10**	**L3**	**CO3**

* * * * *