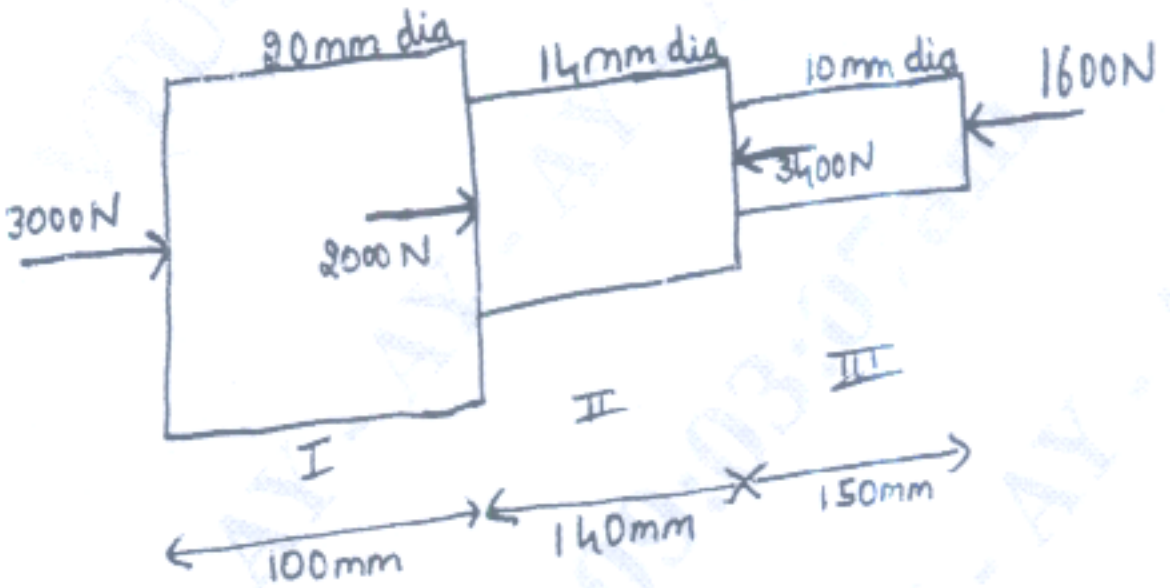
CBCS SCHEME - Make-Up Exam

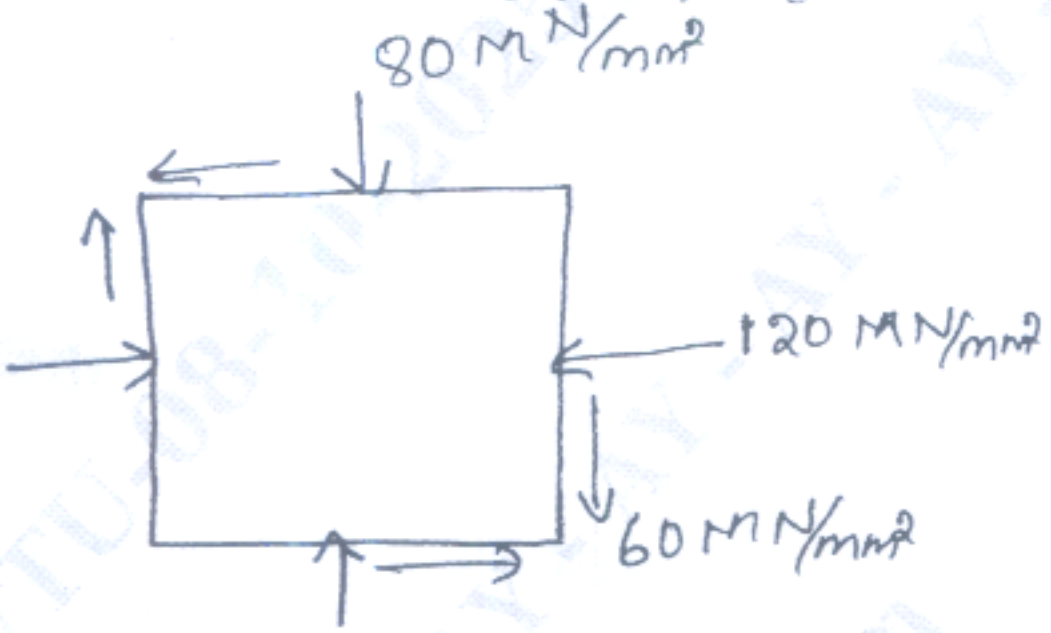
USN | | | | | | | | | | BMT301

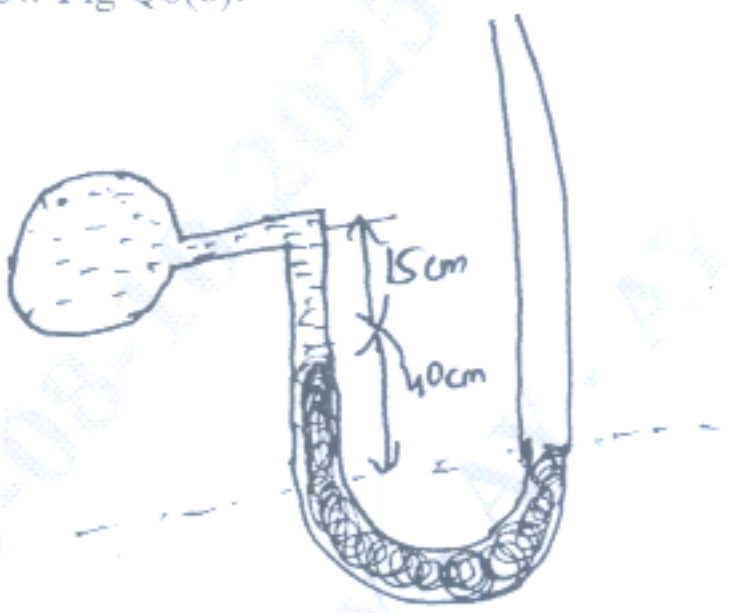
Third Semester B.E./B.Tech. Degree Examination, June/July 2025
Mechanics of Solids and Fluids

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.	State Hooke's Law and derive an expression for extension of deformation in uniform cross sectional bar in tension.	6	L2	CO1
	b.	Define the following : i) Stress ii) Strain iii) Modulus of Elasticity iv) Poisson's ratio.	4	L1	CO1
	c.	Determine the overall change in length of the bar shown in Fig Q1(c), with following data : E = 100000 N/mm^2.  Fig Q1(c)	10	L3	CO1
		OR			
Q.2	a.	Define the following with equations i) Volumetric Strain ii) Rigidity Modulus iii) Bulk Modulus	6	L1	CO1
	b.	Derive an expression for elongation of bar due to its self weight.	4	L2	CO1
	c.	A flat bar of steel of 24 mm wide and 6 mm thick is placed between two aluminum alloy flats (24 mm × 9 mm) each. The three flats are fastened together at their ends. An axial tensile load of 20 kN is applied to the composite bar. What are the stresses developed in steel and aluminium alloy? Assume E_s = 210000 MPa and E_A = 70000 MPa.	10	L3	CO1
		Module – 2			
Q.3	a.	Derive equations for stresses on an inclined plane in an elastic 2D plate which is subjected to biaxial tensile stresses.	10	L2	CO2

	b.	The square plate is subjected to stresses of 85 MPa and 60 MPa is x and y direction (both tensile) and a shear stress of 45 MPa such that the shear forces on vertical face cause clockwise couple. Determine the normal and shear stresses on an inclined plane whose normal is inclined at 40 degree to the horizontal.	10	L3	CO2
		OR			
Q.4		The state of stress on a 2D body is shown in the Fig Q4(a). Determine principal planes, principal stresses, maximum shear stress and their planes analytically and validate the answers graphically using Mohr's circle.  Fig Q4	20	L3	CO2
		Module – 3			
Q.5	a.	With the assumptions pure torsion theory, derive the torsional equation.	12	L2	CO3
	b.	A shaft of length 2 m is fixed at one end and subjected to a twisting couple of 2 kNm at the free end. Its diameter is 50 mm. Find the maximum shear stress induced. Also determine the torsional strength of the shaft and torsional rigidity by calculating angular twist. Take G = 83 GPa.	8	L3	CO3
		OR			
Q.6	a.	Derive equation for Euler's load for along column in both sides fixed condition.	10	L2	CO3
	b.	Derive equation for Euler's load for a long column in both sides hinged condition.	10	L2	CO3
		Module – 4			
Q.7	a.	Define the following with equations i) Viscosity ii) Specific Volume iii) Capillarity iv) Surface tension v) Mass density and Weight density.	10	L1	CO4
	b.	The dynamic viscosity of an oil used for lubrication between a shaft and sleeve is 6 poise. The shaft is of 0.4m and rotates at 190 rpm. Calculate the power lost in the bearing for a sleeve length of 90 mm. The thickness of the oil film is 1.5 mm.	10	L3	CO4

		OR			
Q.8	**a.**	Derive an equation for Total pressure and centre of pressure for horizontal plane surface submerged in static fluid.	**10**	**L2**	**CO4**
	b.	A simple U-tube manometer containing mercury is connected to pipe in which a fluid of specific gravity 0.8 and having vacuum pressure is flowing. The other end of the manometer is open to the atmosphere. Find the vacuum pressure is pipe, if the difference of mercury level in the two limbs is 40 cm and the height of the fluid in the left from the centre pipe is 15 cm below Fig Q8(b).  Fig Q8(b)	**10**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Define the following : i) Ideal flow and Real flow ii) Incompressible and compressible flow iii) Laminar and turbulent flow iv) Steady and unsteady flow v) Uniform and non-uniform flow	**10**	**L2**	**CO5**
	b.	Derive continuity equation in three dimensions for fluid flow.	**10**	**L2**	**CO5**
		OR			
Q.10	**a.**	Derive Euler's equations of motion for ideal fluids and hence deduce Bernoullis equation.	**10**	**L2**	**CO5**
	b.	The water is flowing through a pipe having diameters 20cm and 10 cm at section 1 and 2 respectively. The rate of flow through pipe is 35 ℓtrs/sec. The section 1 is 6 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 N/cm^2, find the intensity of pressure at section 2.	**10**	**L3**	**CO5**

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