

Third Semester B.E./B.Tech. Degree Examination, June/July 2026

Mechanics of Solids and Fluids

Time: 3 hrs

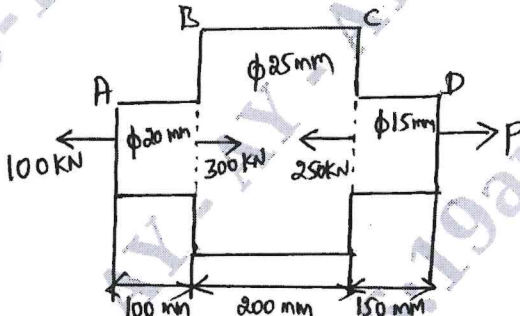
Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
 2. M : Marks, L: Bloom's level, C: Course outcomes.

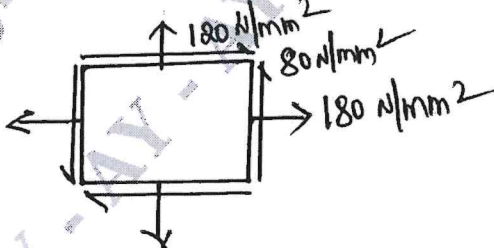
Module – 1

			M	L	C
Q.1	a.	Derive an expression for extension of uniformly tapering circular bar.	10	L3	CO1
	b.	Explain the stress strain diagram of mild steel and aluminum.	10	L2	CO1

OR

Q.2	a.	Determine the stresses in various segments of circular bar shown in Fig. Q2(a). Compute the total Elongation taking $E = 195 \text{ GPa}$.	10	L3	CO1
		 Fig. Q2(a)			
	b.	Derive the relation between Young's modulus, Modulus of rigidity and Bulk modulus.	10	L3	CO2

Module – 2

Q.3	a.	Derive an expression for element subjected to Biaxial direct stresses.	10	L3	CO2
	b.	The state of stress at a point in a strained material is shown in Fig. Q3(b). Determine the principle planes, stresses, maximum shear stress and direction.	10	L3	CO2
		 Fig. Q3(b)			

OR

Q.4		For the state of stress shown in Fig. Q4, determine Principal stress, Principal plane also obtain maximum shear stress and verify answer by constructing Mohr's circle.	20	L3	CO2
Fig. Q4					
Module – 3					
Q.5	a.	Derive Torsional equation with usual notations.	10	L3	CO3
	b.	A hollow circular steel shaft has to transmit 60 kW at 210 rpm such that the maximum shear stress does not exceed 60 MN/m ² . If the ratio of internal to external diameter is equal to 3/4 and the value of rigidity modulus is 84 GPa. Find the dimensions of the shaft and angle of twist in a length of 3m.	10	L3	CO3
OR					
Q.6	a.	Derive an expression for a critical load in a column subjected to compressive load, when both ends are hinged.	10	L3	CO3
	b.	Using Rankine's formula, determine the crippling load for a mild steel strut 500 mm long with a rectangular section 50 mm × 12.5 mm having : i) Hinged ends ii) Fixed ends. Take $a = \frac{1}{6500}$ and $\sigma_c = 330 \text{ N/mm}^2$.	10	L3	CO3
Module – 4					
Q.7	a.	Define the following terms : i) Mass density ii) Weight density iii) Specific volume iv) Specific gravity v) Viscosity.	10	L1	CO4
	b.	State and derive Pascal's law.	10	L2	CO4
OR					
Q.8	a.	Derive an expression for total pressure force and depth of pressure for a vertical surface submerged in water.	10	L3	CO4
	b.	Determine the total pressure on a circular plate of diameter 1.5m which is placed vertically in water such a way that the centre of plane is 3m below the free surface of water. Also find the position of centre of pressure.	10	L3	CO4
Module – 5					
Q.9	a.	Explain different types of fluid flow.	10	L2	CO5
	b.	Derive the equation of continuity and obtain an expression for continuity.	10	L3	CO5
OR					
Q.10	a.	List the assumptions and applications of Bernoulli's equation.	10	L1	CO5
	b.	The water is flowing through a taper pipe of length 100 m having diameter 600 mm at the upper end and 300 mm at the lower end, at the rate of 50 l/s. The pipe has slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62 N/cm ² .	10	L3	CO5