CBCS SCHEME

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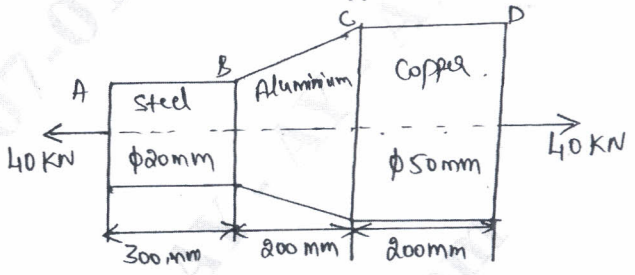
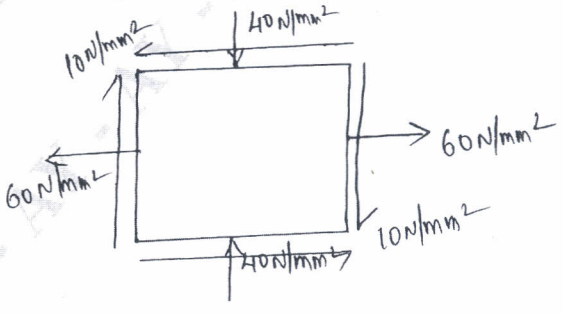
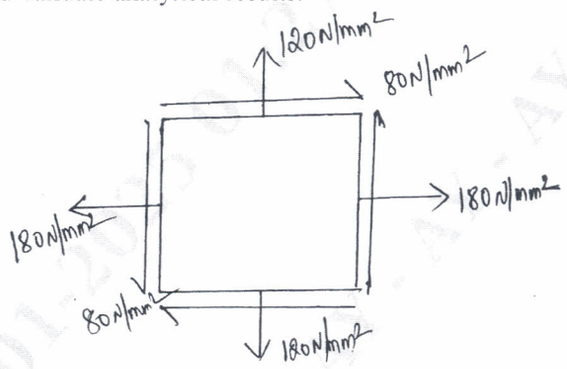
BMT301

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Mechanics of Solid 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.	Illustrate the Deformation of Uniformly Tapering Rectangular bar, with necessary equations.	10	L2	CO1
	b.	A stepped bar is subjected to an internal load as shown in Fig. Q1(b). Calculate the change in length of bar. Take E = 200MPa for steel , E = 70MPa for Aluminum , E = 100MPa for copper.  Fig. Q1(b)	10	L3	CO1
		OR			
Q.2	a.	Derive an expression for relation between E, G and μ as E = 2G(1 + μ).	10	L3	CO1
	b.	Explain the following : i) Bulk modulus ii) Modulus of Rigidity iii) Poission's Ratio iv) Hooke's Law v) Proof stress.	10	L2	CO1
		Module – 2			
Q.3	a.	Explain Principle stress and Principle planes.	4	L2	CO2
	b.	A point is subjected to a tensile stress of 60N/mm^2 and a compressive stress of 40N/mm^2 acting on 2 mutually perpendicular planes and a shear stress of 10N/mm^2 as shown in Fig. Q3(b). Determine the principle stress , planes , Maximum shear stress and verify results by Mohr's Circle method.  Fig. Q3(b)	16	L3	CO2
		OR			

Q.4		The state of stress at a point in a strained material is as shown in Fig. Q4. Determine a) The direction of principal planes. b) The magnitude of principal stress. c) The magnitude of the maximum shear stress and its direction. d) Draw Mohr's circle and validate analytical results.  Fig. Q4	**20**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Derive the expression for Torsional equation.	**10**	**L2**	**CO3**
	b.	A Hollow circular steel shaft has to transmit 60 kW at 210 rpm such that the maximum shear stress does not exceed 60MN/m^2. If the ratio of internal to external diameter is equal to ¾ 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 Euler's expression for Buckling load for column with both ends hinged.	**10**	**L2**	**CO3**
	b.	Find the Euler's crippling load for Hollow cylinder steel column of 40mm external diameter and 4mm thick. The length of column is 2.5mm and is hinged at both ends. Also compute Rankine's crippling load using constant 335 MPa and 1/7500. Take E = 205 GPa.	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the properties of fluids.	**8**	**L2**	**CO4**
	b.	Derive an expression for total pressure force and depth of pressure for a vertical surface submerged in water.	**12**	**L3**	**CO4**
		OR			
Q.8	**a.**	Explain the following terms : i) Total pressure ii) Center of pressure iii) Absolute pressure iv) Gauge pressure v) Vaccume pressure.	**10**	**L2**	**CO4**
	b.	If the velocity profile of a fluid over a plate is parabolic with the vertex 20cm from the plate where the velocity is 120cm/s. Calculate the velocity gradients and shear stresses at a distance of 0 , 10 and 20cm from the plate if the viscosity of the fluid is 8.5 Poise.	**10**	**L3**	**CO4**

		Module – 5			
Q.9	**a.**	Describe the types of fluid flows.	**10**	**L2**	**CO5**
	b.	Derive continuity equation for fluid flow in 3D Cartesian Coordinate.	**10**	**L3**	**CO5**
		OR			
Q.10	**a.**	List the assumptions and applications of Bernoulli's equation.	**10**	**L2**	**CO5**
	b.	An Orifice with orifice diameter 10cm is inserted in a pipe of 20cm diameter. The pressure gauge which is fitted upstream and downstream of the orifice meter gives reading of 19.62N/cm^2 and 9.81N/cm^2. The coefficient of discharge for the orifice meter is 0.6. Find the discharge of water through pipe.	**10**	**L3**	**CO5**

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