CBCS SCHEME

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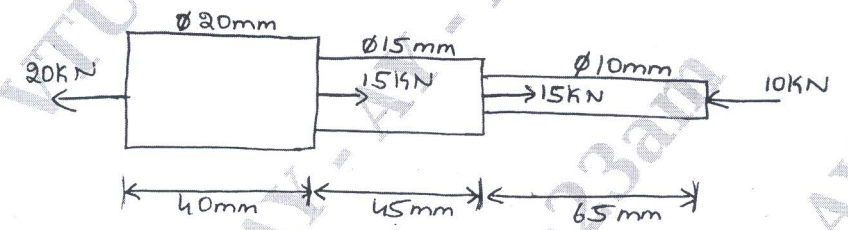
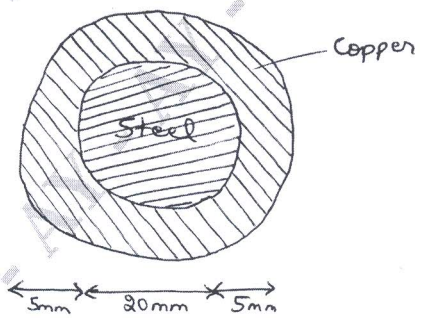
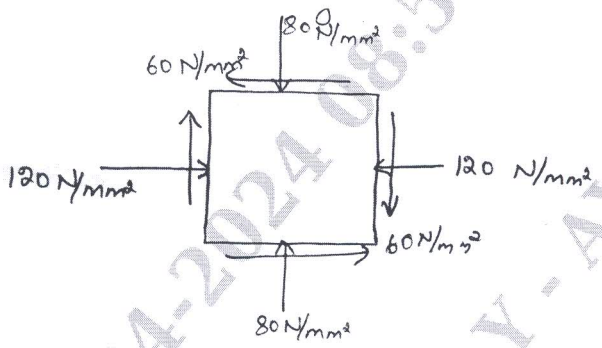
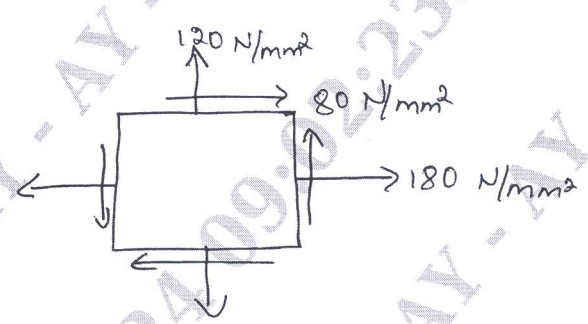
BMT301

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
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.	Define the following : i) Stress ii) Strain iii) Young's modulus iv) Shear stress v) Poisson's ratio vi) Volumetric strain vii) Elastic Limit viii) Tensile strength ix) Modulus of Rigidity x) Bulk modulus.	10	L1	CO1
	b.	A stepped circular steel bar of a length 150mm with diameter 20, 15 and 10mm along the lengths 40, 45 and 65mm respectively are subjected to various forces as shown in Fig.Q1(b) below. If E = 200kN/mm^2 determine the total change in its length and stress in individual bars.  Fig.Q1(b)	10	L3	CO1
		OR			
Q.2	a.	State Hooke's Law. Derive an equation in a extension of bar in a circular bar of uniformly reducing cross section.	10	L2	CO1
	b.	A compound bar consists of a circular rod of steel of diameter 20mm rigidly fitted into a copper tube of internal diameter 20mm and thickness 5mm as shown in Fig Q2(b). If the bar is subjected to a load of 100kN, find the stresses developed in two materials. Take $E_S = 2 \times 10^5$ N/mm^2 ; EC = 1.2×10^5N/mm^2.  Fig.Q2(b)	10	L3	CO1

		Module – 2			
Q.3	**a.**	The state of stress in a two dimensionally stressed body as shown in Fig.Q3(a). Determine the principal planes, principal stress, maximum shear stress and their planes, Analytically and validate the answer's graphically (using Mohr's circular).  Fig.Q3(a)	**20**	**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 torsional equation for a circular shaft with usual notations. State the assumptions made.	**10**	**L2**	**CO4**
	b.	Derive an expression for a critical load in a column subjected to compressive load, when both ends are fixed.	**10**	**L2**	**CO4**
		OR			
Q.6	**a.**	Determine the diameter of solid shaft which will transmit 440 kW at 280rpm. The angle of twist must not exceed one degree per meter length and the maximum tonsional shear stress is to be limited to 40kN/mm^2. Assume G = 84kN/mm^2.	**10**	**L4**	**CO4**
	b.	Derive an expression for a critical load in a column subjected to compressive load when one end fixed and the other end free.	**10**	**L3**	**CO4**

		Module – 4			
Q.7	**a.**	Define the following terms with SI units : i) Weight density and mass density ii) Dynamic viscosity and kinematic viscosity. iii) Specific gravity. iv) Capillarity v) Ideal fluid	**10**	**L2**	**CO3**
	b.	An oil of thickness 1.5mm is used for lubrication between a square of size (0.9m × 0.9m) slides down an inclined plane having an inclination of 20° with the horizontal. The weight of square plate is 392.4N and it sides down the plane with uniform velocity of 0.2m/s. Find kinematic viscosity of oil. Specific gravity of oil is 0.7.	**10**	**L3**	**CO3**
		OR			
Q.8	**a.**	Drive an expression for total pressure force and depth of pressure for a vertical surface submerged in water.	**10**	**L2**	**CO3**
	b.	A simple U-tube manometer containing to a 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 in the pipe, if the difference of mercury level in two limbs is 40cm and height of fluid in the left from the center of the pipe is 15cm below.	**10**	**L3**	**CO3**
		Module – 5			
Q.9	**a.**	Derive continuity equation for fluid flow in three dimensional Cartesian co-ordinate.	**10**	**L2**	**CO2**
	b.	Explain different types of fluid flow.	**10**	**L2**	**CO2**
		OR			
Q.10	**a.**	Derive Eule's equation of motion for ideal fluids and hence deduce Bernoulli's equation.	**10**	**L2**	**CO2**
	b.	The water is flowing through a taper pipe of length 100m having diameters 600mm at the upper end and 300mm at the lower end, at the rate of 50 liters/s. The pipe has slope of 1 in 30. Find the pressure at the lower end if the pressure at the higher level is 19.62N/cm^2.	**10**	**L3**	**CO2**

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