CBCS SCHEME

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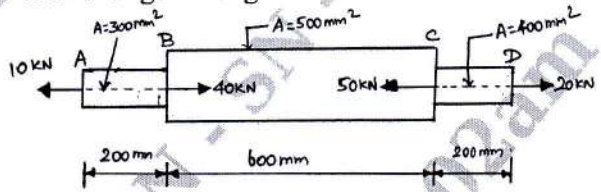
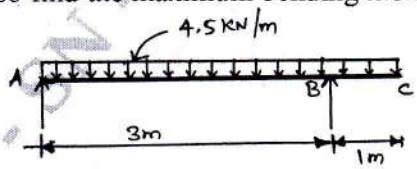
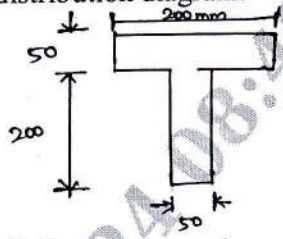
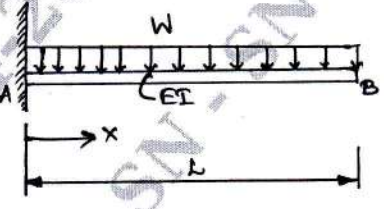
BAE304

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
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: i) Engineering stress ii) True stress iii) Hooke's law iv) Poisson's ratio v) Plane stress.	10	L1	CO1
	b.	Derive the equilibrium equations for the state of stress.	10	L3	CO1
		OR			
Q.2	a.	A member ABCD is subjected to point load as shown in Fig.Q.2(a). Determine the total change in length of the member. Take E = 200GPa.  Fig.Q.2(a)	12	L3	CO2
	b.	A plane element in a boiler is subjected to tensile stresses of 400MPa on one plane and 150MPa on the other at right angles to the former. Each of the above stresses is accompanied by a shear stress of 100MPa such that when associated with the minor tensile stress tends to rotate the element in anticlockwise direction. Find: i) Principal stresses and their directions. ii) Maximum shearing stresses and the directions of the plane on which they act.	8	L3	CO2
		Module – 2			
Q.3	a.	Derive the relation between shear force and bending moment.	6	L2	CO2
	b.	An over hanging beam ABC is loaded as shown in Fig.Q.3(b). Draw the shear force and bending moment diagrams and find the point of contra flexure if any and also find the maximum bending moment and its location.  Fig.Q.3(b)	14	L3	CO2

		OR			
Q.4	**a.**	Derive the bending stress equation.	**10**	**L3**	**CO2**
	b.	A T-shaped cross section of a beam shown in Fig.Q.4(b) is subjected to a vertical shear force of 100kN. Calculate the shear stress at important points and draw the shear stress distribution diagram.  All dimensions are in mm. Fig.Q.4(b)	**10**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Derive the equation for deflection, slope and bending moment radius of curvature.	**10**	**L3**	**CO2**
	b.	Establish an equation for maximum deflection of a cantilever beam with a point load at its free end.	**10**	**L2**	**CO2**
		OR			
Q.6	**a.**	What are the assumptions made for deriving equation for pure torsion?	**4**	**L1**	**CO2**
	b.	A solid shaft of 120mm diameter is required to transmit 200kW at 100rpm. If the angle of twists not to exceed 2°, find the length of the shaft. Take modulus of rigidity for the shaft material as 90GPa.	**8**	**L3**	**CO2**
	c.	A hollow shaft is to transmit 200kW at 80rpm. If the shear stress is not to exceed 60MPa and internal diameter is 0.6 of the external diameter. Find the diameters of the shaft.	**8**	**L3**	**CO2**
		Module – 4			
Q.7	**a.**	Derive an equation for principle of virtual work for a particle.	**10**	**L3**	**CO2**
	b.	Determine the vertical deflection of the free end of the cantilever beam shown in Fig.Q.7(b).  Fig.Q.7(b)	**10**	**L3**	**CO3**
		OR			
Q.8	**a.**	Find the maximum stress, deformation and strain energy stored in a 2m long and 25mm diameter beam, when an axial pull of 15kN is applied i) Gradually ii) Suddenly on it. Take E = 100GPa.	**10**	**L4**	**CO3**

	b.	State and prove Maxwell's reciprocal theorem.	10	L2	CO2
		Module – 5			
Q.9	a.	Explain the different types of fracture in detail and explain the modes.	10	L2	CO3
	b.	Define creep and explain the stages of creep.	10	L2	CO3
		OR			
Q.10	a.	Define fatigue and explain the testing method of fatigue failure.	10	L2	CO3
	b.	Illustrate the S-N curve and explain its salient features.	10	L2	CO3

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