Reg. No. | | | | | | | | | | | | |

B.E./ B. TECH.DEGREE EXAMINATIONS, MAY 2023

Third Semester

CH18303 – MECHANICS OF SOLIDS FOR CHEMICAL ENGINEERING

(Chemical Engineering)

(Regulation-2018A)

TIME:3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Recognize the fundamental concepts of stress and strain in mechanics of solids and structures.	**2**
CO 2	Discuss the mechanical properties of solids and relationships between various moduli characterization.	**3**
CO 3	Acquire knowledge on types of beams and loads and determine the shear force and bending moment diagrams.	**3**
CO 4	Apply the deflection, shear stress and bending stress in beams subjected to transverse loading.	**3**
CO 5	Determine the shafts used for power transmission and discuss the pressure vessels employed in chemical industries.	**5**

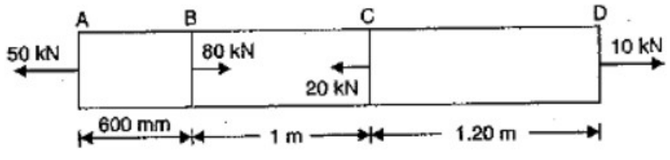
PART- A(10x2=20Marks)

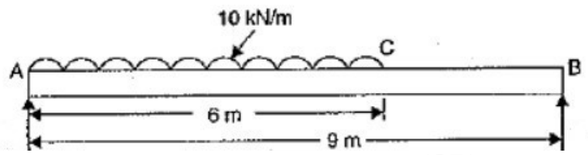
(Answer all Questions)

		CO	RBT LEVEL
1.	Find the Young's modulus of a rod of diameter 40 mm and of length 300 mm which is subjected to a tensile load of 70 kN and the extension of the rod is equal to 0.5 mm.	**1**	**1**
2.	Show the relationship between elastic constants and Poison's ratio.	**1**	**2**
3.	Draw the bending moment diagram for a simply supported beam carrying a uniformly distributed load of 'W' per unit length over the entire span.	**2**	**2**
4.	Mention the significance of point of contraflexure.	**2**	**1**
5.	Highlight the expressions for the slope at the supports and deflection of a simply supported beam, carrying a point load at the centre.	**3**	**2**
6.	What are the methods used to calculate slope and deflection?	**3**	**1**
7.	Compare section modulus and moment of resistance of a beam.	**4**	**2**
8.	Calculate the section modulus of a rectangular beam 200 mm deep and 300 mm wide which is simply supported over a span of 8 m.	**4**	**2**

9.	List the assumptions involved in torsion equation.	**5**	**1**	
10.	Mention the end conditions for long columns.	**5**	**1**	

PART- B (5x 14=70Marks)

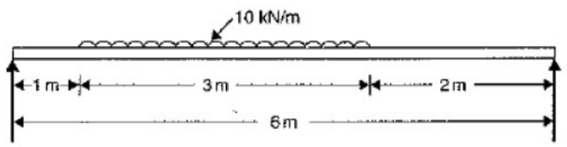
			Marks	CO	RBT LEVEL
11. (a)	**(i)**	A brass bar having a cross sectional area of 1000mm^2 is subjected to axial forces has shown in figure. Calculate the total elongation of the bar. E=1.05 ×10^{5}N/mm^2 	**(7)**	**1**	**3**
	(ii)	A stepped straight bar of steel is of square sections through out with sides 10mm,12mm and 16mm with axial lengths of 80mm,100mm and 120mm respectively. The bar is subjected to an axial force P such that the total change in its length is 0.05mm. Determine the magnitude P, if Youngs Modulus is 200GPa and Poison's ratio is 0.3.	**(7)**	**1**	**3**
		(OR)			
(b)	**(i)**	A mild steel of rod 20mm diameter and 300mm long is enclosed centrally inside a hollow tube of external diameter 30mm and internal diameter of 25mm. The ends of the tube and rods are brazed together and the composite bar is subjected to an axial pull of 40KN. If E for steel and copper is 200GN/m^2 and 100GN/m^2 respectively, find the stresses developed in the rod and tube. Also find the extension of the rod.	**(7)**	**1**	**3**
	(ii)	A metallic bar 300mm × 100mm × 40mm is subjected to a force of 5kN (tensile), 6kN (tensile) and 4kN (tensile) along x, y and z directions respectively. Determine the change in the volume of the block. Take E=2×10^{5}N/mm^2 and poison's ratio=0.25	**(7)**	**1**	**3**
12. (a)		Draw the shear force and bending moment diagram of a beam is shown in figure.	**(14)**	**2**	**3**



(OR)

(b) A simply supported beam of length 8 m rest on supports 6 m apart, the right hand end is overhanging by 2m. The beam carries uniformly distributed load of 1600 N/m over the entire length, Draw the shear force and bending moment diagrams and find the point of contraflexture if any. **(14) 2 3**

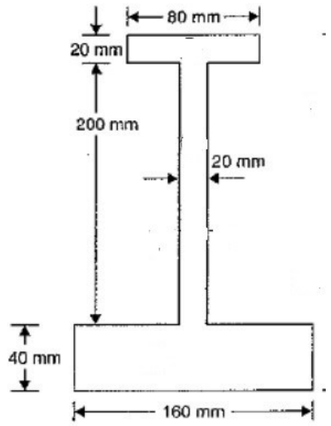
13. (a) A beam of length 6m is simply supported at its ends. It carries uniformly distributed load of 10kN/m is shown in figure. Determine the deflection of beam at its mid point and also the position and maximum deflection. Take EI=4.5×10^{8}N/mm^2 **(14) 3 3**



(OR)

(b) An overhanging beam ABC is loaded as shown in figure. Find the slopes over each support and at the right end. Calculate also the maximum upward deflection between the supports and the deflection at the right end. Take E=2×10^{5}N/mm^2 and I=5×10^{8}mm^4 **(14) 3 3**

14. (a) A cast iron bracket subject to bending has the cross section of I-form with unequal flanges. The dimensions of the section are as shown in figure. Find the position of the neutral axis and moment of Inertia of the section about the neutral axis. If the maximum bending moment on the section is 45MN mm, determine the maximum bending stress. Determine the nature of the stress? **(14) 4 4**



(OR)

(b) A timber beam of rectangular section of length 8m is simply supported. The beam carries uniformly distributed load of 12kN/m run over the entire length and a point load of 10kN at 3m from the left support. If the depth is two times the width and the stress in the timber is not to exceed 8N/mm^2, find the suitable dimensions of the section. **(14) 4 4**

15. (a) A solid circular shaft and a hollow circular shaft whose inside diameter is 0.75 of the outside diameter, are of the same material, of equal lengths and are required to transmit a given torque. Compare the weights of these two shafts if the maximum shear stress developed in the two shafts are equal. **(14) 5 4**

(OR)

(b) Develop a mathematical expression for finding crippling load of a column, when both the ends of the column are hinged. **(14) 5 4**

PART- C (1x 10=10Marks)

(Q.No.16 is compulsory)

		Marks	CO	RBT LEVEL
16.	A tensile load of 40kN is acting on a rod of diameter 40mm and of length 4m. A bore of diameter 20mm is made centrally on the rod. Estimate length the rod should be bored so that the total extension will increase 30% under the same tensile load. Take E=2×10^{5}N/mm^2	**(10)**	1	**5**

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