Q. Code:345744

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

B.E. / B. TECH DEGREE EXAMINATIONS, MAY2024

Sixth Semester

CH18303 - MECHANICS OF SOLIDS FOR CHEMICAL ENGINEERING

(Chemical Engineering)

***(Regulation2018/ 2018A*)**

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

CO1 Recognize the fundamental concepts of stress and strain in mechanics of solids and structures.

CO2 Discuss the mechanical properties of solids and relationships between various moduli characterization.

CO3 Acquire knowledge on types of beams and loads and determine the shear force and bending moment diagrams.

CO4 Apply the deflection, shear stress and bending stress in beams subjected to transverse loading.

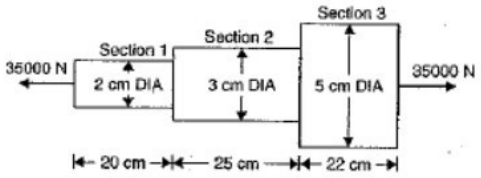
CO5 Determine the shafts used for power transmission and discuss the pressure vessels employed in chemical industries.

PART- A (10x2=20Marks)
(Answer all Questions)

		CO	RBT LEVEL
1	Calculate the minimum diameter of steel wire which is used to raise a load of 4000N, if the stress in the rod not to exceed 150 MN/m ^{2}.	**1**	**3**
2	Relate Poison Ratio with lateral strain.	**1**	**2**
3	A cantilever beam having length 'L', it carries point load 'W' at its free end. Draw the bending moment diagram.	**2**	**3**
4	Mention the important points to draw shear force and bending moment diagram.	**2**	**2**
5	Compare the limitations of double Integration method and Macaulay's methods applied to simply supported beam under transverse loading.	**3**	**2**
6	Tabulate the different types of curves used in SF and BM diagram with their corresponding loads.	**3**	**2**
7	Determine the moment required to bend a circular rod of diameter R mm to have mean radius of 10R m. E = 205GPa.	**4**	**3**
8	List the blunder assumptions in the expression of shear stress.	**4**	**2**
9	Draw the shear stress distribution profile for a section of a beam of square cross section.	**5**	**2**
10	Write the expression for torsional stiffness and torsional flexibility and the relation between them.	**5**	**2**

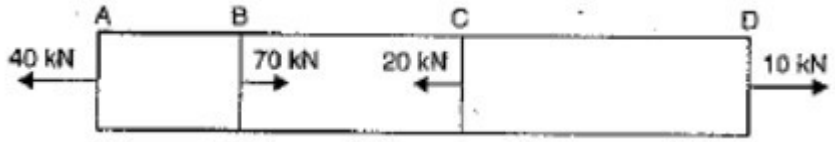
PART- B (5x 14= 70Marks)

		Marks	CO	RBT LEVEL
11(a)	An axial pull of 35 kN is acting in a bar consisting of three lengths as shown in figure-1. If the young's modulus is $E=2 \times 10^5 N/mm^2$, Determine (i) stresses in each section, (ii) total extension of the bar.	**(14)**	**1**	**3**



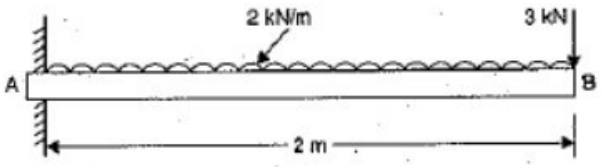
OR

11(b)	A brass bar having cross sectional area of $1000mm^2$, is subjected to axial forces as shown in figure in which AB=0.6m, BC=0.8m and CD=1.0m	**(14)**	**1**	**3**



Calculate the total elongation of the bar. Take $E=1\times 10^5$ N/mm^2

12(a)	Calculate and construct the shear force and bending moment diagram of a cantilever beam as shown in figure.3	**(14)**	**2**	**3**



OR

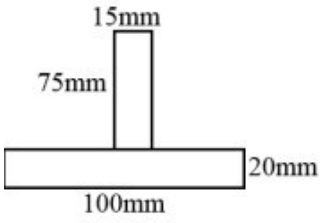
12(b)	A cantilever beam of length 5m length carries point loads of 3kN, 2kN, 1kN at 1m, 3m and 5m from the fixed end. Calculate and construct the shear force and bending moment diagram for the cantilever.	**(14)**	**2**	**3**
13(a)	A simply supported beam ABC of length 4 m is subjected simultaneously to a point load of 2 kN acting at B located at a distance 1 m from the left end of the beam (A) and a uniformly varying load that has a maximum value of 4 kN/m at the left end of the beam and linearly reduces to 0 kN/m at the other end of the beam. Draw the shear force and bending moment diagram. Determine the maximum bending moment and the location of its occurrence and include it in the SF & BM diagram.	**(14)**	**3**	**3**

(OR)

13(b)	A beam of ABC of length 8 m is supported at between a pinned and a roller support. The beam carries simultaneously, a point load of 4 kN at the midspan of the beam and an UDL of 1 kN/m spans over a length of 5 m starting from the left end of the beam. Draw the SF and BM diagram for the beam and evaluate the salient features of the diagram (maximum BM, its location).	**(14)**	**3**	**3**
14 (a)	A simply supported beam of length 6 m is subjected to point loads of 2 kN and 4 kN at a distance 2 m and 4 m respectively from the left end of the beam. Obtain expressions for slope and deflection of the beam and using these expressions evaluate the deflection and slope at the midspan of the beam. Use E = 200 GPa and I = 0.02 m^4.	**(14)**	**4**	**3**

(OR)

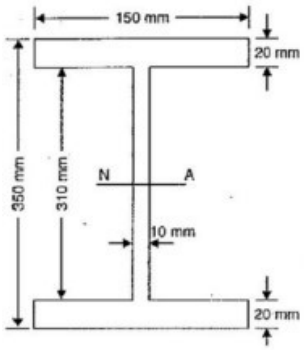
14(b)	State the Mohr's theorem for determination of slope and deflection in a beam subjected to transverse loading. For a simply supported beam of length L m that carries a uniformly distributed load of W kN/m over the whole span of the beam, draw the shear force and bending moment diagram and determine the maximum slope and deflection of the beam using Moment area method.	**(14)**	**4**	**3**
15(a)	A cantilever beam of length 5 m and of cross section as shown below is subjected to a point load of 100 N load at the free end, what additional uniformly distributed load (UDL) can be safely applied on it, if the bending stress is not to exceed 80 N/mm^2 . Neglect self-weight of the beam.	**(14)**	**5**	**3**



(OR)

15(b)	A simple beam of length 3m and of cross section as shown below is subjected to a point load of 200N load at the mid span of the beam. Sketch	**(14)**	**5**	**3**

the shear stress distribution at a section 1m from the left end of the beam.



PART- C (1x 10 =10 Marks)

		Marks	CO	RBT LEVEL
16(a)	Evaluate and Draw the shear force and bending moment diagram for the overhanging beam subjected to external loads as shown in the diagram. Determine the maximum bending moment and its location and the location of point of contraflexure.	**(10)**	**2**	**4**