Reg. No.

B.E/B.TECH DEGREE EXAMINATIONS, MAY 2024
Fourth Semester
MR22401 – SOLID MECHANICS
(Marine Engineering)
(Regulation 2022)

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

| COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Predict the behaviour of the materials for different loading conditions	3
CO 2	Analyse and design the beam based on shear force and bending moment	3
CO 3	Design the beam based on various stresses and Students will select suitable cross-sections for the beams under different loading conditions	3
CO 4	Calculate the deflections that occurred in beams under different loading conditions, select suitable dimensional parameters for the shafts under torsional loads and design the springs	3
CO 5	Design the column and pressure vessel	3

PART- A (20 x 2 = 40 Marks)
(Answer all Questions)

		CO	RBT LEVEL
1.	Compare tensile and compressive stress.	1	2
2.	The Young's Modulus and Modulus of rigidity of a material are 200 GPa and 80 GPa respectively. Determine the Poisson's ratio and bulk modulus of the material.	1	2
3.	How will you apply the principle of superposition in a rod?	1	2
4.	What is compound bar? How the stress in calculated in compound bar.	1	2
5.	Discuss the utility of shear force and bending moment diagrams.	2	2
6.	Explain the point of contra flexure with respect to simply supported beam.	2	2
7.	Draw the shear force diagram for a simply supported beam of span 2 m carrying a point load of 10 kN at midspan.	2	2
8.	How will you apply Clapeyron's theorem of three moments to a continuous beam with simply supported ends?	2	2
9.	Write the assumption in the theory of simple bending?	3	2

| 10.	Explain how bending stress varies across the cross-section of a beam.	3	2
11.	Differentiate between shear stress and bending stress in beams.	3	2
12.	How the Mohr's circle used to calculate the principal stresses.	3	2
13.	Explain the double integration method to calculate the deflection.	4	2
14.	How do you find the slope and deflection of a beam using moment area method?	4	2
15.	Why hollow circular shafts are preferred when compared to solid circular shafts?	4	2
16.	What is the maximum power that can be transmitted by a circular shaft of diameter 60 mm if the maximum shear is not to exceed 90 N/mm^2.	4	2
17.	Give the parameters influencing bucking load of a long column.	5	2
18.	What are the limitations of Eulers formula.	5	2
19.	How does a thin cylinder fail due to internal fluid pressure?	5	2
20.	A storage tank of internal diameter 280 mm is subjected to an internal pressure of 2.56 MPa. Find the thickness of the tank. If the hoop stress is 75 MPa respectively.	5	2

PART- B (5 x 10 = 50 Marks)

|		Marks	CO	RBT LEVEL
21. (a)	A brass bar, having cross-sectional area of 500 mm^2 is subjected to axial forces as shown in Fig. Find the total elongation of the bar. Take E = 80 GPa.	10	1	3

(OR)
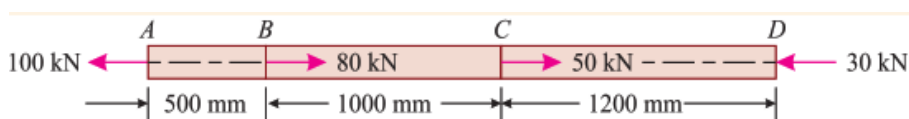
		Marks	CO	RBT LEVEL
(b)	Sketch and explain the working principal of the different types of strain gauge.	10	1	3

22. (a) Construct the shear force and bending moment diagrams for the beam and find the position and value of maximum bending moment.   **10   2   3**
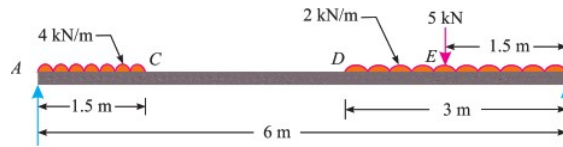

(OR)

(b) Draw the shear force and bending moment diagrams and find the point of contraflexure, if any   **10   2   3**
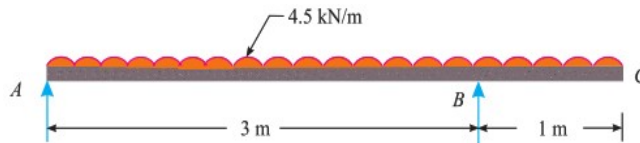
23. (a) A cast iron bracket subjected to bending has the cross section of I form with unequal flanges. The dimensions of the section are shown in fig. Find the position of the neutral axis and moment of inertia of the section about the neutral axis. If the maximum bending moment on the section is 40MN mm. Determine the maximum bending stress. What is the nature of the stress?   **10   3   3**
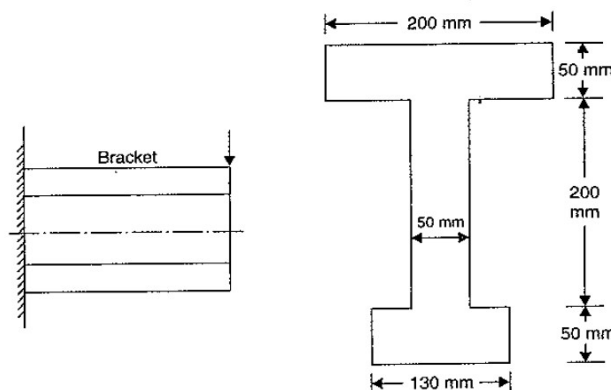
(OR)

(b) A plane element in a boiler is subjected to tensile stresses of 400 MPa on one plane and 150 MPa on the other at right angles to the former. Each of the above Stresses is accompanied by a shear stress of 100 MPa such that when   **10   3   3**

associated with the minor tensile stress tends to rotate the element in the anticlockwise direction. Find the major and minor Principal stresses and their directions.

24. (a)	By using double integration method calculate the slope and deflection of a cantilever beam carries the UDL load throughout the beam.	10	4	3

(OR)

(b)	A hollow shaft diameter ratio 3/8. (Internal dia to outer dia) is to transmit 375 kW power at 100 RPM. The maximum torque being 20 percentage greater than the mean. The shear stress is not to exceed 60 N/mm^2 and twist in a length of four meter not exceed to two degree. Calculate its external and internal diameters which would satisfy both the above conditions. Assume modulus of rigidity, C =0.85 x10 ^{5} N/mm^2.	10	4	3

25. (a)	A hollow C.I column whose outside diameter is 38 mm has a thickness of 2.5 mm. It is 2.3m long and is hinged at both ends.
	Calculate
	  1. Euler's cripping Load
	  2. Cripping load by Rankin's formula using constants as σ$_c$=335 N/mm^2, a= (1/7500)
	  3.Ratio of Euler's and Rankine's critical loads.
	  Take E=2.05 x 10^5 N/mm^2
		10	5	3

(OR)

(b)	Derive the expression for the longitudinal and hoop stress of a thin cylinder.	10	5	3

PART- C (1 x 10 = 10 Marks)

		Marks	CO	RBT LEVEL
26.	A timber beam 140 mm wide and 180 mm deep is to be reinforced by bolting on two steel flitches each 140 mm by 10 mm in section. Calculate the moment of resistance when the flitches attached symmetrically at the top and bottom. Allowable stress in timber is 8 MPa. Find the stress in the beam?	10	3	3

Take

$E_S = 210$ GPa and $E_T = 15$ GPa.