



NAVRACHANA UNIVERSITY

School: School of Engineering and Technology
Program/s: B.Tech Mechanical
Year: 2nd **Semester:** 3rd
Examination: End semester Examination
Examination year: November – 2023

Course Code: ME 223 **Course Name:** Strength of Material

Date: 24/11/2023

Time: 13:00 to 15:00

Total Marks: 40

Total Pages: 02

Instructions:

- Write each answer on a new page.
- Use of a calculator is permitted

Q. No.	Details	Marks	COs	BTL #
Q.1	<p>Attempt the following (Any 03, Each of 05 Marks)</p> <p>A. Draw the shear force and bending moment diagram for the beam shown in figure 01.</p> <p>B. Consider a beam which is simply supported over a span of 4 m and having I section whose dimensions are shown in figure 02. Determine the load that the beam can carry per meter length, if the allowable stress in bending is 30.82 N/mm².</p> <p>C. For a metallic bar shown in figure 03, determine the change in volume by considering $E = 2 \times 10^5$ N/mm² and $\mu = 0.25$. Also, find the change that should be made in 4 MN loads, in order that there should be no change in volume of the bar.</p> <p>D. Two shafts of the same material and same length are subjected to the same torque, if the first shaft is of a solid circular section and the second shaft is of hollow circular section whose internal diameter is 2/3 of the outside diameter and maximum shear stress developed in each shaft is the same, then compare the weight of the shafts.</p>	15	CO5 CO6 CO7	BT 1 BT 2 BT 3 BT 4 BT 5
Q.2	<p>A. For a beam shown in figure 04 use Macaulay's method and determine the deflection at the mid – point and also the position and the maximum deflection.</p>	06	CO1 CO2	BT 1 BT 2 BT 3
	<p>B. A point in a strained material is subjected to stresses as shown in figure 05. Use Mohr's Circle method and determine the normal and tangential stresses on the inclined plane. Check the answer analytically. Also, analytically determine Major Principal Stress, Minor Principal Stress and Maximum Shear Stress.</p>	07	CO3 CO4	BT 4 BT 5
Q.3	<p>Attempt the following (Any 02, Each of 06 Marks)</p> <p>A. For a rectangular bar subjected to two direct stresses σ_1 and σ_2 in two mutually perpendicular direction, derive the expression for normal stresses, tangential stresses, major and minor principal stresses and its location.</p> <p>B. Derive the expression of shear stress produced in a circular shaft subjected to torsion. Also, state its assumptions.</p> <p>C. Derive the expression of slope and deflection induced in a simply supported beam subjected to uniformly distributed load over entire span. Also, mention the</p>	12	CO1 CO2 CO3 CO4	BT 1 BT 2 BT 3 BT 4 BT 5

expression of maximum deflection and maximum slope.

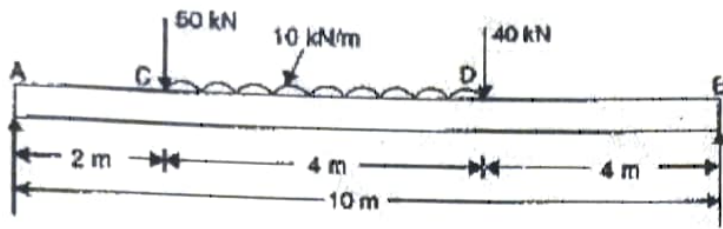


Figure 01

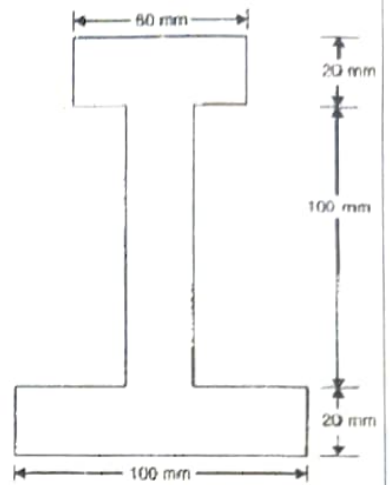


Figure 02

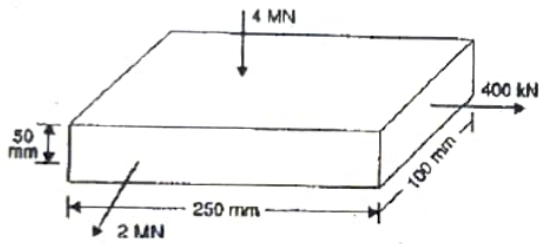


Figure 04

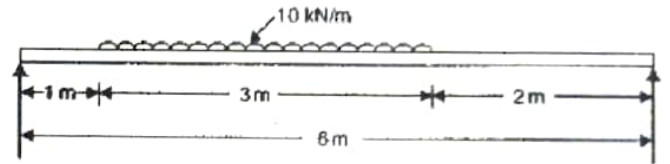


Figure 04

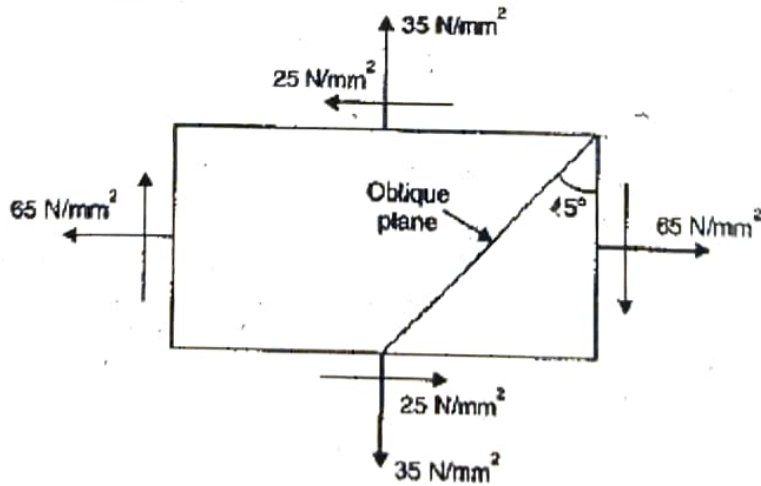


Figure 05

*****End of Question Paper*****