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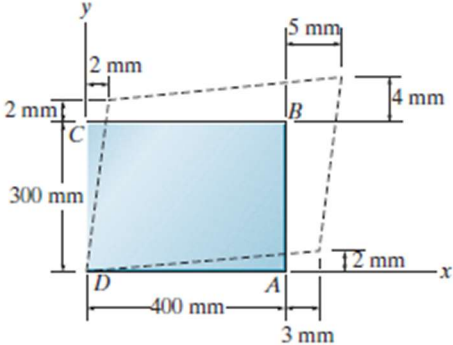
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, May 2023

Course: Strength of Materials
Program: B.Tech. Aerospace
Course Code: MECH 2012

Semester: IV
Time: 03 hrs.
Max. Marks: 100

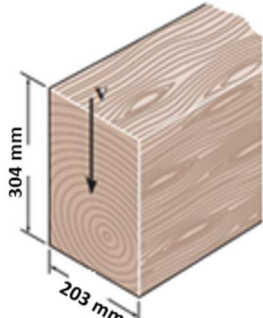
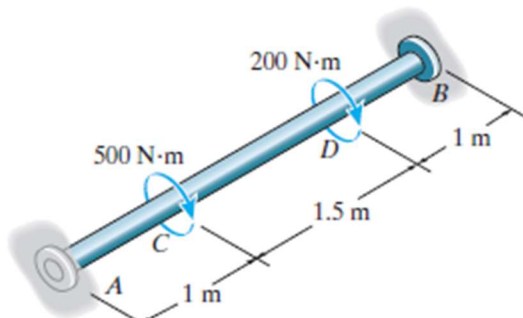
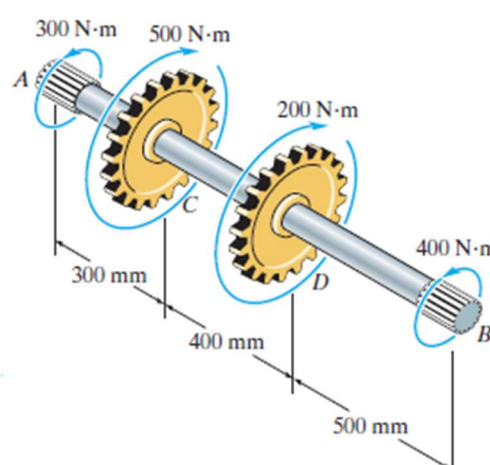
Instructions: 1. Assume suitable right-handed coordinate system if it is not mentioned in problem.

SECTION A
(5Qx4M=20Marks)

S. No.	Question	Marks	CO
Q 1	Explain core of section of column having rectangular cross-section.	4	CO1
Q 2	Define the bending and twisting moment on any shaft. What is the type of internal stresses produced at any section on shaft due to these loading conditions.	4	CO1
Q 3	Explain Young's Modulus and Modulus of Rigidity.	4	CO1
Q 4	Sketch the state of stress in any thin walled cylindrical and spherical pressure vessel.	4	CO1
Q 5	<p>The piece of plastic is originally rectangular. Determine the average normal strain that occurs along the diagonals AC and DB.</p> 	4	CO1

SECTION B
(4Qx10M= 40 Marks)

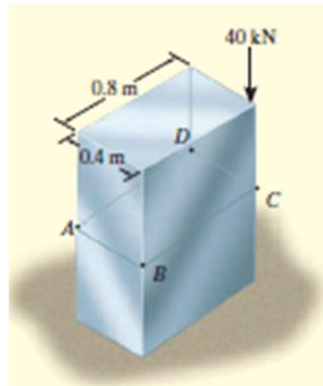
Q 6	Wall thickness of cylindrical shell of 800 mm internal diameter and 2 m long is 10 mm. if the shell is subjected to internal pressure of 1.5 MPa, determine a) circumferential stress b) longitudinal stress c) maximum shear stress and d) change in volume of the shell. Take $E = 205 \text{ GPa}$ and $\nu = 0.3$.	10	CO2
Q 7	A rectangular beam having width 150 mm and depth 250 is simply supported over a span of 5 m. What uniformly distributed load it can	10	CO2

	carry if the maximum permissible bending stress is 120 MPa? What concentrated load can be put at the mid span instead?		
Q 8	<p>The beam has a rectangular cross section and is made of wood having an allowable shear stress of 200 N/m^2 as shown in figure. Determine the maximum shear force V that can be developed in the cross section of the beam. Also, plot the shear-stress variation over the cross section.</p> 	10	CO2
Q 9	<p>The steel shaft has a diameter of 60 mm and is fixed at its ends A and B. If it is subjected to the torques shown, determine the absolute maximum shear stress in the shaft.</p>  <p style="text-align: center;">Or,</p> <p>The splined ends and gears attached to the steel shaft are subjected to the torques shown. Determine the angle of twist of end B with respect to end A. The shaft has a diameter of 40 mm.</p> 	10	CO2

SECTION-C
(2Qx20M=40 Marks)

Q 10

The rectangular block of negligible weight is fixed at ground as shown in figure. It is subjected to a vertical force of 40 kN, which is applied to its corner. Determine the largest normal stress acting on a section through *ABCD*.

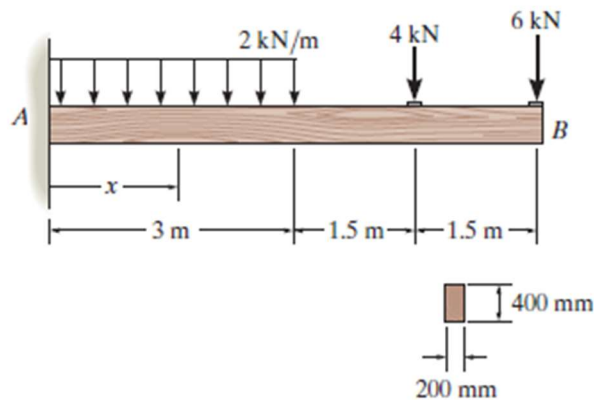


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CO3

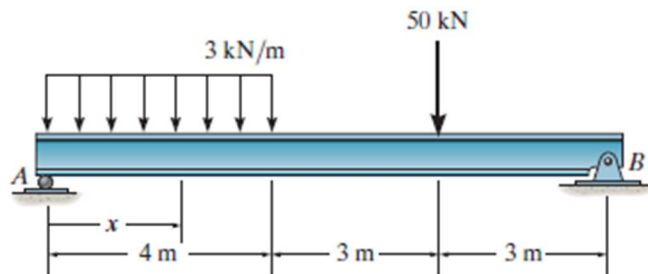
Q 11

The wooden beam is subjected to the load shown. Determine the equation of the elastic curve. If $E_W = 12 \text{ GPa}$, determine the deflection and the slope at end *B*.



Or,

The beam is subjected to the load shown. Determine the equation of the elastic curve. If $EI = 13(10^6) \text{ Nm}^2$. Determine the displacement at $x = 7 \text{ m}$ and the slope at *A*.



20

CO3