

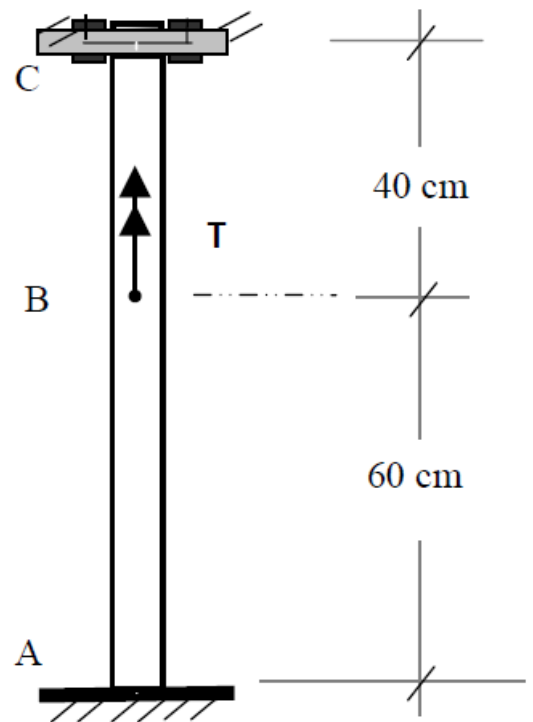
**DRAFT FOR
YOUR
REVIEW**

Problem # 1

Shaft ABC has a solid circular cross section with diameter $d = 4$ cm. The shaft is held fixed at end A while end C allows a rotation angle ϕ of *not* more than 0.02 radians and is subjected to a torque \mathbf{T} applied at B. For a shaft material with the *given* information:

- Determine the maximum allowable *torque* \mathbf{T} that may safely be applied.
- Determine the relative angle of twist $\phi_{C/B}$ corresponding to \mathbf{T} .

Given: Allowable shear stress $\tau = 50$ MPa; $G = 70$ GPa.



Problem # 4

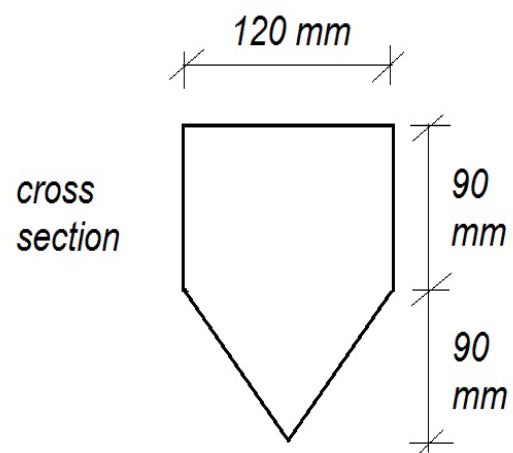
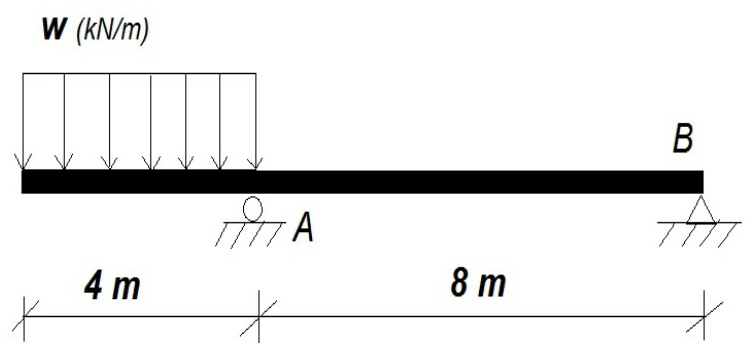
The given beam is subjected to a downward uniformly distributed load w (kN/m) as shown.

- Determine the moment of inertia of the beam's cross section about the Neutral Axis.
- Determine the maximum value of w that can be applied given the following information :

Safety Factor = 2

For tension $\sigma_{ult} = 30 \text{ MPa}$

For compression $\sigma_{ult} = 40 \text{ MPa}$.

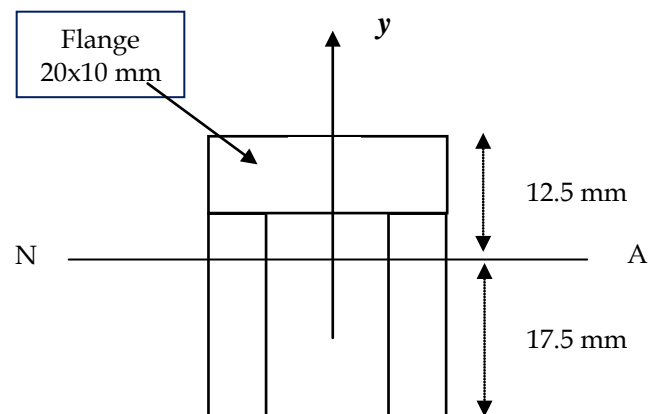
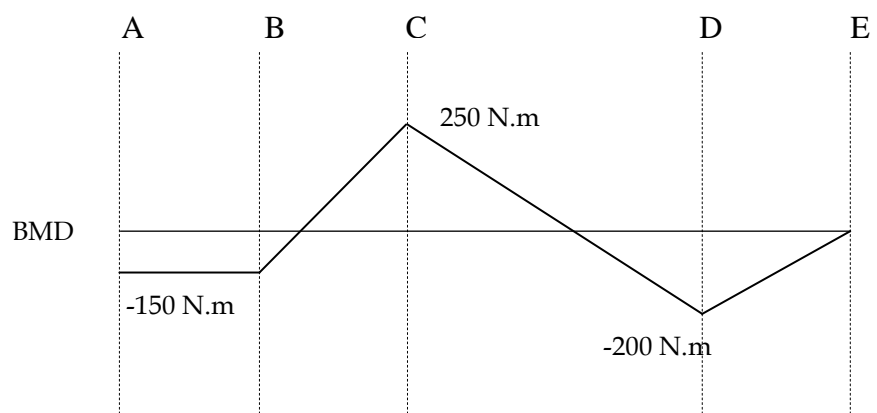


Problem # 5

The bending moment diagram (BMD) and the cross-section of a beam are shown.

- Sketch the bending stress variation along the y-axis at location B.
- Determine the resultant force bending stresses produce on the flange at location B.
- Determine the maximum tensile and compressive stresses in the whole beam and indicate where they act.

Take $I = 3 \times 10^4 \text{ mm}^4$

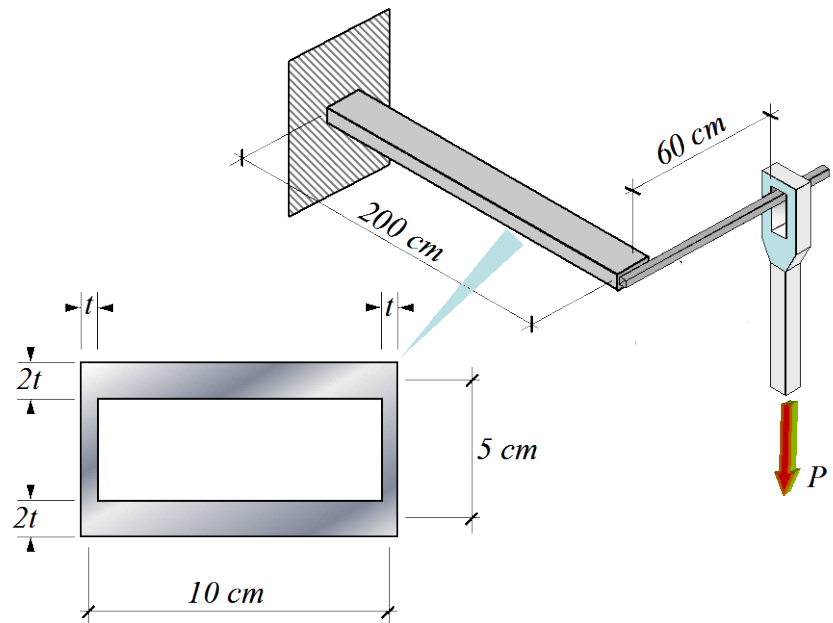


Cross section

Problem # 2

Determine the required thickness, t for the shaft shown below to carry the load $P = 12 \text{ kN}$ safely. The shaft is made from a material for which the allowable shear stress, $\tau_{\text{all}} = 350 \text{ MPa}$ and the allowable angle of twist, θ_{all} is 2 Degrees.

Given $G = 80 \text{ GPa}$



Tube Cross Section

Problem # 3

Draw the **shear force and bending moment diagrams** for the beam shown below using the summation (graphical) method. Write the *degree of the curve* on each one.

The reactions are: $A_y = 50 \text{ kN} \uparrow$; $B_y = 20 \text{ kN} \downarrow$

