# Mechanics of Materials I
Homework assignment # 5

Problem 1. A cantilever beam AB with a rectangular cross section has a longitudinal hole drilled throughout its length (see figure). The beam supports a load $P = 600\ N$. The cross section is 25 mm wide and 50 mm high, and the hole has a diameter of 10 mm.
Find the bending stresses at the top of the beam, at the top of the hole, and at the bottom of the beam.
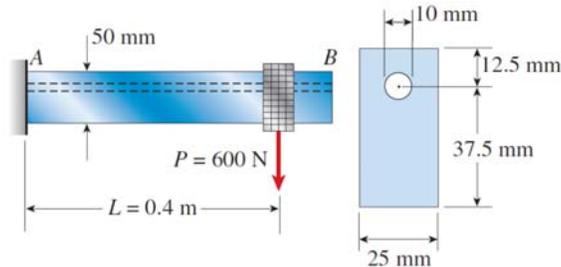

Problem 2. An aluminum pole for a street light weighs 4600 N and supports an arm that weighs 660 N (see figure). The center of gravity of the arm is 1.2 m from the axis of the pole. A wind force of 300 N also acts in the (-y) direction at 9 m above the base. The outside diameter of the pole (at its base) is 225 mm, and its thickness is 18 mm.
Determine the maximum tensile and compressive stresses σ_t and σ_c, respectively, in the pole (at its base) due to the weights and the wind force.
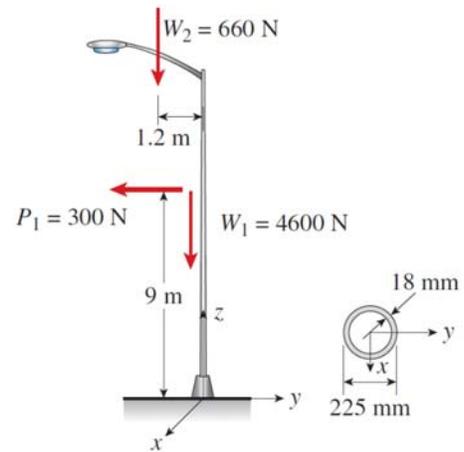

Problem 3. A wood beam reinforced by an aluminum channel section is shown in the figure. The beam has a cross section of dimensions 150 mm by 250 mm, and the channel has a uniform thickness of 6 mm. If the allowable stresses in the wood and aluminum are 8 MPa and 38 MPa, respectively, and if their moduli of elasticity are in the ratio 1 to 6, what is the maximum allowable bending moment for the beam?
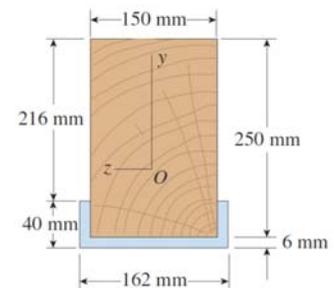

Problem 4. A concrete slab is reinforced by 16-mm-diameter steel rods placed on 180-mm centers as shown. The modulus of elasticity is 20 GPa for the concrete and 200 GPa for the steel. Using an allowable stress of 9 MPa for the concrete and 120 MPa for the steel, determine the largest bending moment in a portion of slab 1 m wide.
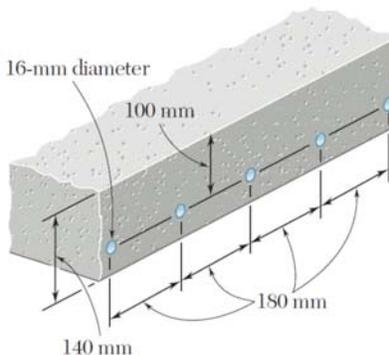
Problem 5. The couple M acts in a vertical plane and is applied to a beam oriented as shown. Determine (a) the angle that the neutral axis forms with the horizontal, (b) the maximum tensile stress in the beam.

$I_{y'} = 6.74$ in^4
$I_{z'} = 21.4$ in^4
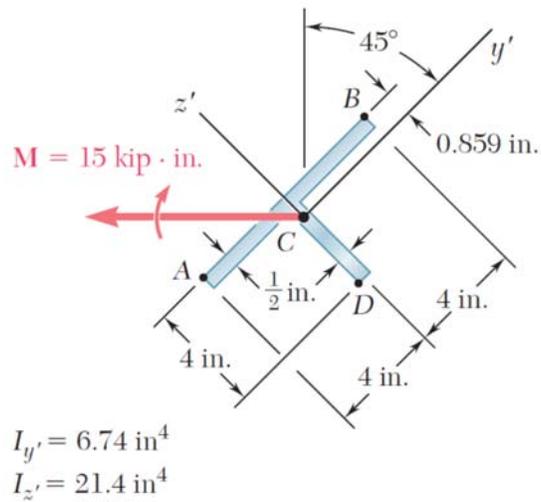
Problem 6. The couple M acts in a vertical plane and is applied to a beam oriented as shown. Determine the stress at point A.

$I_y = 8.7$ in^4
$I_z = 24.5$ in^4
$I_{yz} = +8.3$ in^4
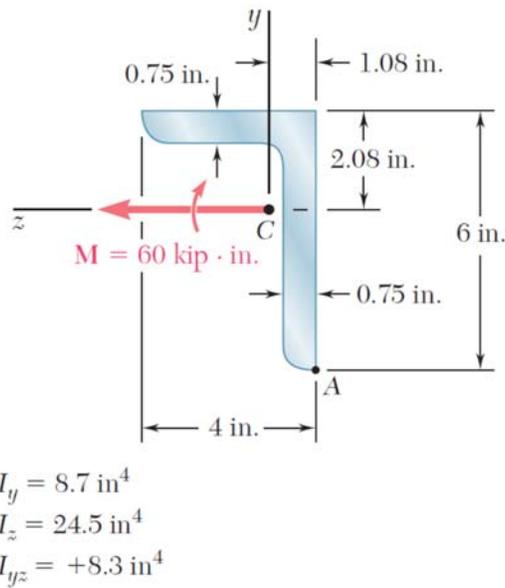
Problem 7. For the crane hook shown, determine the largest tensile stress in section a-a.

Section a-a