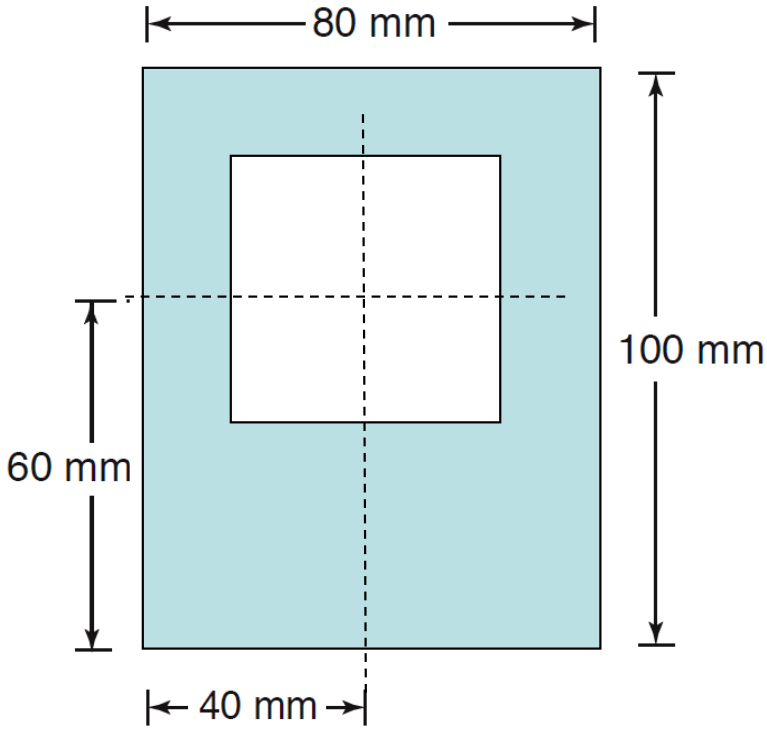
MEEG3311 Homework 2 – Chapter 4

Reminder: Please write homework only on one side of paper.

2.1

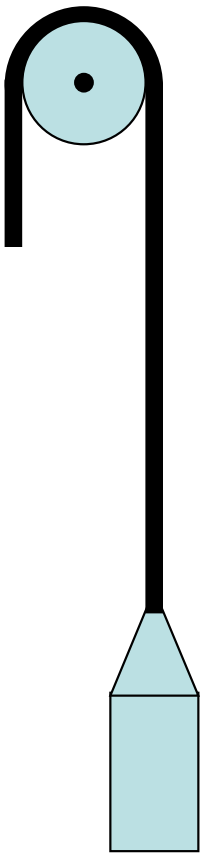
A uniform beam has a rectangular cross section with a 40x40mm square hole in it, as shown.



If the beam is to be loaded by a moment applied as shown below, calculate the location of the neutral axis, and then the Area Moment of Inertia needed to determine the bending stress on the top and bottom faces of the beam.

2.2

The steel cable for a mine elevator is 500 meters long. Under the maximum load of 5 megaNewtons, it sees a tensile stress of 150 MPa. The elastic modulus of the steel is 70 GPa.



Calculate:

A. The cross sectional area

B. The diameter of the cable, in mm

C. The total elongation of the cable

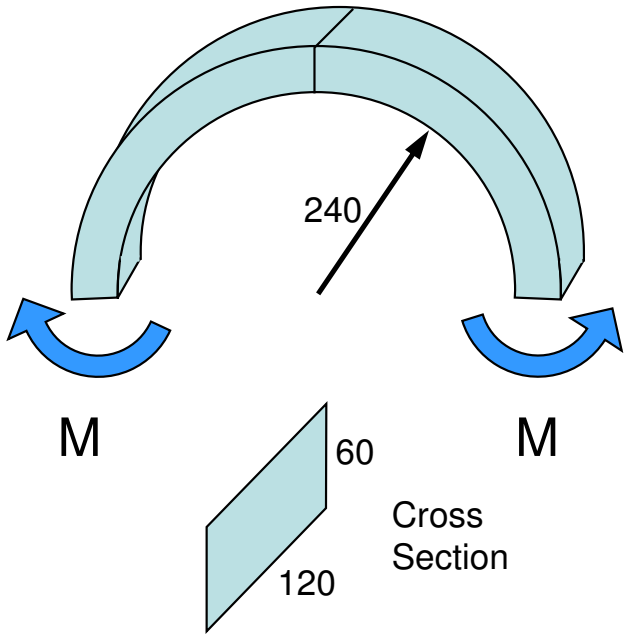
D. The spring rate of the cable

2.3

Determine the minimum diameter of a solid (round) shaft that would be required to allow a motor running at 3600 RPM to transmit 500 kW of power without causing a torsional shear stress of more than 60 MPa.

2.4

The curved bar shown here has a rectangular cross section that is 60mm high (thick) and 120mm wide. Its inner radius is 240mm.



A. Find the distance between the centroid and the neutral axis.

B. If the bar is loaded with a moment, M, of 4000 N-m, find the stresses at the innermost and outermost radii. Tell if they are tensile or compressive.

2.5

A cantilevered beam with a round tube cross section has an outer diameter of 100 mm and a wall thickness of 10 mm. The load perpendicular to the beam at its tip is 15,000 N, and the beam is 1.2 m long from the point of force to the wall where the beam is fastened.

A. Draw a reasonably scaled sketch of the arrangement.

B. Calculate the maximum bending and shear stresses.