# 3.11 Problem Set # 6

# Due Friday, October 17, 2003

This problem set covers Torsion (Ch. 3 Gere) & Beam bending (Ch. 5 Gere). Transformations of Stresses/Strains (Ch. 7 Gere) will be covered in the next problem set—you have actually already done some of them on pset 2. It is generally more likely that you will encounter a torsion or beam bending problem on the midterm than a stress transformation

**Problem #1** (Warm Up Torsion—hint: solve for polar moment of inertia first)
Determine the maximum shear stress and rate of twist ($d\theta/dx$) of the given shaft if a 10 kNm torque is applied to it. If the length of the shaft is 15 m, how much would it rotate by? Let G = 81 GPa, D = 75 mm



**D = 75mm**

**10kNm**

**L = 15m**

**Shaft subject to 10kNm torque**
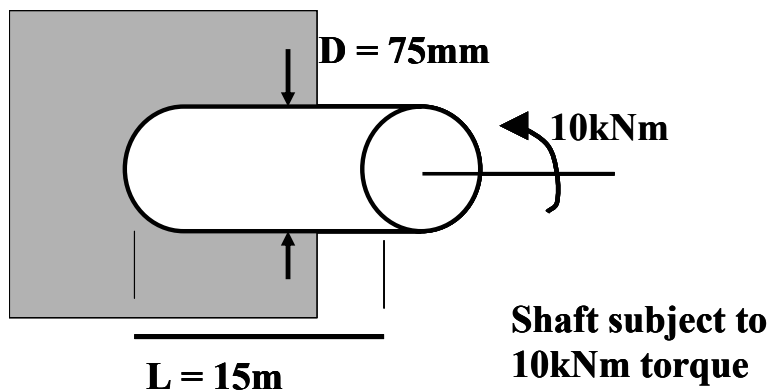
Circular Bar Torsion
**Problem #2** GERE Problem 3.3-3

Non-Uniform Torsion
**Problem #3** GERE Problem 3.4-2

## Stresses and Strains within a Beam

Normal Stresses in Beams
**Problem #4** GERE Problem 5.5-3

Normal Stresses in Beams
**Problem #5** GERE Problem 5.5-6

Shear Stresses in Beams

**Problem #6**

A loaded, simply supported W 10 x 45 beam is shown below. For this beam:
**A**. Determine the maximum bending stress 6 feet from the left end of the beam.
**B**. Determine the horizontal shear stress at a point 4 inches above the bottom of the beam
cross section and 6 feet from the left end of the beam.
**Unless otherwise indicated, all joints and support points are assumed to be pinned or hinged joints.**
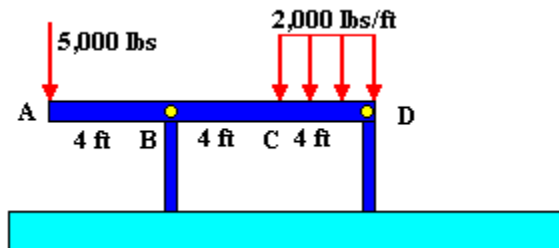


Hint: You will need to start off by drawing a Free Body Diagram for this problem, and
determining the shear forces and bending moments.