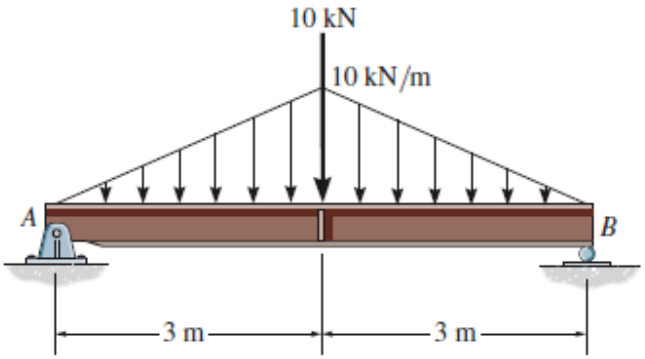
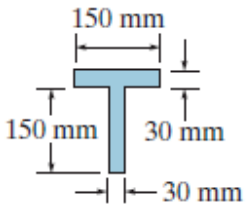
Exam 2
January 7, 2010
120 minutes

Problem 1 (30 Points)

For the T-beam and loading shown below:

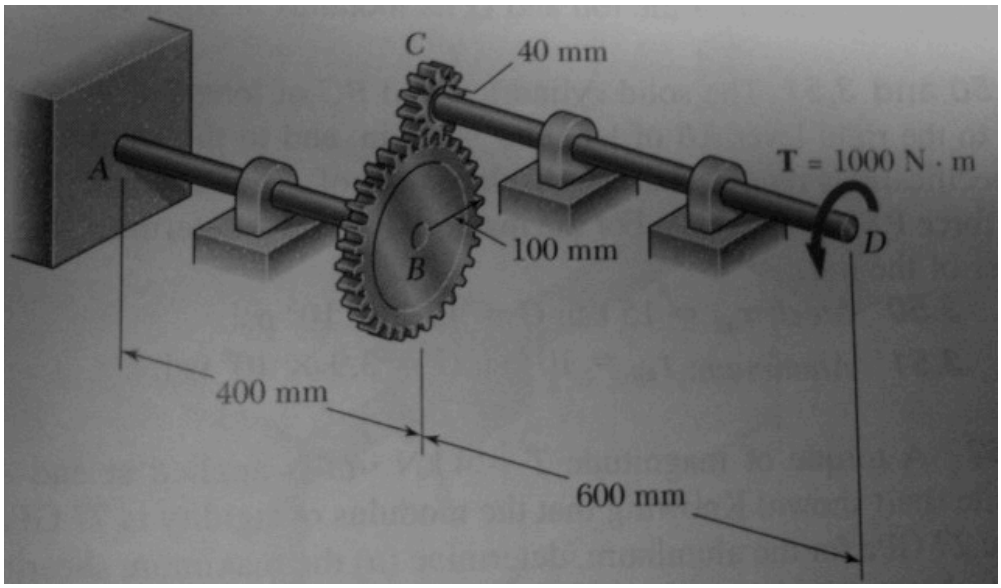
a) Find the equations and draw the Shear and Moment Diagrams
b) Calculate the Maximum Compressive Stress
c) Calculate the Maximum Tensile Stress





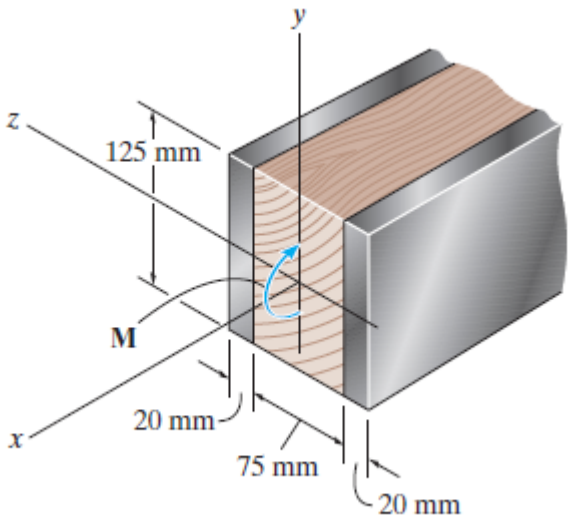
Problem 2 (25 Points)

The design of the system shown below requires that steel shafts of the same diameter be used for both AB and CD. It is further required that the maximum shear stress in the system does not exceed 60MPa, $\tau_{max} \leq 60MPa$, and that the angle of twist of end D of shaft CD does not exceed 1.5 degrees, $\phi_D \leq 1.5^\circ$. Knowing that G = 77GPa, determine the required diameter of the shafts.



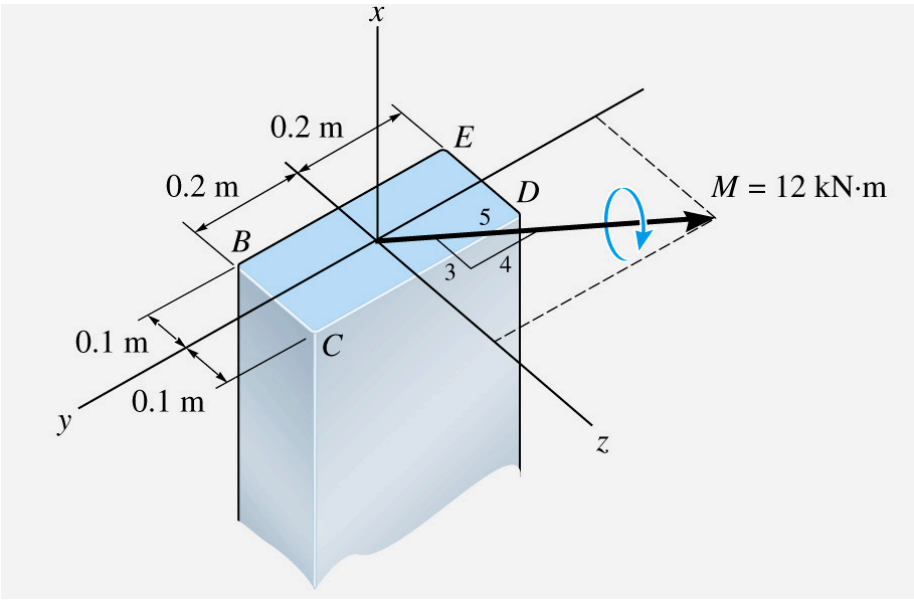
Problem 3 (15 Points)

The composite beam consists of a wood core and two plates of steel. If the allowable bending stress for the wood is $(\sigma_{allow})_w$ = 20MPa, and for the steel $(\sigma_{allow})_{st}$ = 130MPa, determine the maximum moment that can be applied to the beam. E_w = 11GPa, and E_{st} = 200GPa.



Problem 4 (15 Points)

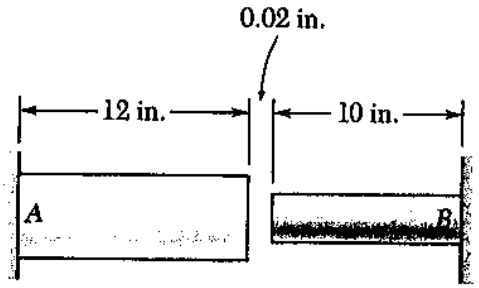
The rectangular cross-section shown below is subjected to a bending Moment M = 12KN-m. Determine the normal stress developed at each corner of the section, and specify the orientation of the Neutral Axis. (Note the bending arrow is coming from inside the paper to the outside.)



Problem 5 (15 Points)

At room temperature (70˚F) a 0.02 inch gap exists between the ends of the rods shown. When the temperature reaches 320˚F, determine:

a) the normal stress in the aluminum rod
b) the change in length of the aluminum rod



Aluminum	Stainless steel
$A = 2.8\ \text{in}^2$	$A = 1.2\ \text{in}^2$
$E = 10.4 \times 10^6\ \text{psi}$	$E = 28.0 \times 10^6\ \text{psi}$
$\alpha = 13.3 \times 10^{-6}/^\circ\text{F}$	$\alpha = 9.6 \times 10^{-6}/^\circ\text{F}$