MECH 3130: Mechanics of Materials  
Spring 2004  
Quiz #5

A simply supported beam with shear-force and bending-moment diagrams is shown in the figure. If the cross-section of the beam is T-shaped as shown, determine the values of maximum tensile and compressive bending stresses.

\[ C_2 = \frac{A_1 \overline{c}_1 + A_2 \overline{c}_2}{A_1 + A_2} \]

\[ = \frac{(6 \times 0.8)(8.4) + (8 \times 0.8)(4)}{(6 \times 0.8) + (8 \times 0.8)} \]

\[ = \frac{5.89''}{87.5''} \]

\[ C_1 = 2.91'' \]

\[ I_{2c} = (I_1 + A_1 d_1^2) + \left( I_2 + A_2 d_2^2 \right) \]

\[ = \left[ \frac{1}{12} (6 \times 0.8)^3 + (6 \times 0.8)(5.89 - 8.4)^2 \right] + \left[ \frac{1}{12} (0.8)^3 + (0.8 \times 8)(5.89 - 4)^2 \right] \]

\[ = 87.5 \text{ in}^4 \]

\[ A + B : \]

\[ M = -\frac{4000 \times 12}{12} \text{ lb - in} \]

\[ \sigma = -\frac{M y}{I_{c_1}} \quad \sigma_{c_1} = -\frac{(-4000 \times 12)(2.91)}{87.5} = 1596.3 \text{ psi} \]

\[ A + C : \]

\[ M = \frac{3200 \times 12}{12} \text{ lb - in} \]

\[ \sigma_{c_1} = -\frac{(3200 \times 12)(2.91)}{87.5} = 1277 \text{ psi} \]

\[ \sigma_{c_2} = -\frac{(3200 \times 12)(5.89)}{87.5} = 2589 \text{ psi} \]