(2) HW4 ANTHONY SMITH 2-22-06

4.4

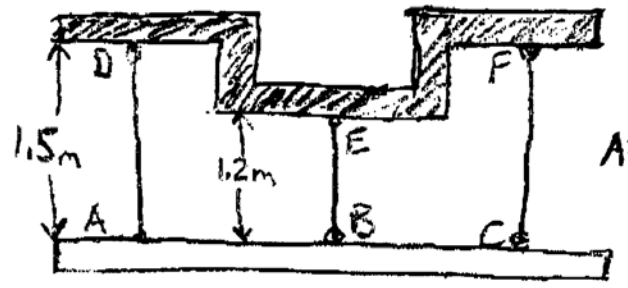
ALL MEMBERS HAVE SAME DISPLACEMENT

$\sigma_{Y_A}$ (BE) = 500 MPa $\sigma_{Y_S}$ (AD, CF) = 250 MPa

$\varepsilon = \varepsilon_{AD} = \varepsilon_{FC}$

$1.5\varepsilon = 1.2\varepsilon_{BE}$

$\varepsilon_{BE} = 1.25\varepsilon$




$A = 1\times10^{-4}\,m^2$

$\sigma_{BE} = E_A \varepsilon_{BE} = E_A\, 1.25\varepsilon = E_A\, 1.25 \frac{\sigma}{E_S}$

$\sigma_Y = \sigma_{Y_S}(AD, CF)$ $\sigma_{Y_A}(BE) = 2\sigma_Y$ $E_A = 72.0\,GPa$ $E_S = 200\,GPa$

AT $\sigma_Y$:

$\sigma_{BE} = 1.25(0.36)\sigma_Y$

$$P_Y = \sum_{i=1}^{3} \sigma_i A = A(2\sigma_Y + \sigma_{BE}) = 2.45\,\sigma_Y A$$

$$P_Y = 2.45(250\,MPa)(1\times10^{-4}m^2) \quad \boxed{61.25\,KN}$$

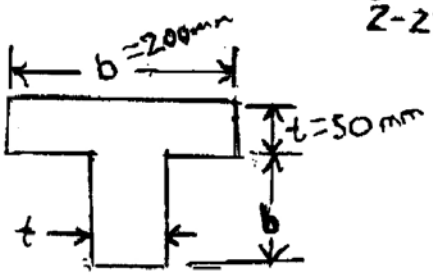
AT $\sigma_{Y_A}$:

$$P_P = \sum_{i=1}^{3} \sigma_i A = (\sigma_Y \times 2 + 2\sigma_Y \times 1)A = 4\sigma_Y A$$

$$P_P = 4(250MPa)(1\times10^{-4}m^2) = \boxed{100\,KN}$$

(3) HW4 ANTHONY SMITH 2-22-06

4.17



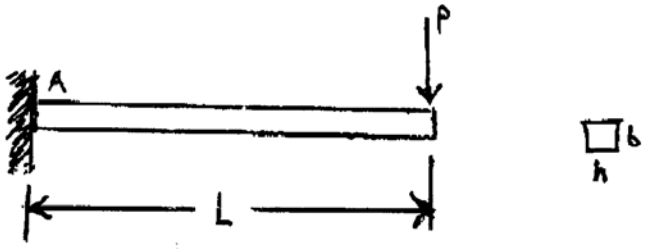

$$M_p = Y bt \cdot \frac{t}{2} + Y bt \cdot \frac{b}{2}$$

$$= Y bt\left(\frac{t+b}{2}\right)$$

$$= 260\ MPa\ (1.25\times10^{-3}\ m^3)$$

$$\boxed{M_p = 325\ KN\cdot m}$$ ✓

4.26




FOR BEAMS WITH RECTANGULAR CROSS SECTION

$P_p = 1.5 P_Y$

$P_Y = P_p / 1.5$

$$M_Y = P_Y L = \frac{Y bh^2}{4(1.5)}$$

ASSUME $L > 5h$

SMALL EFFECT OF V ON $M_p$

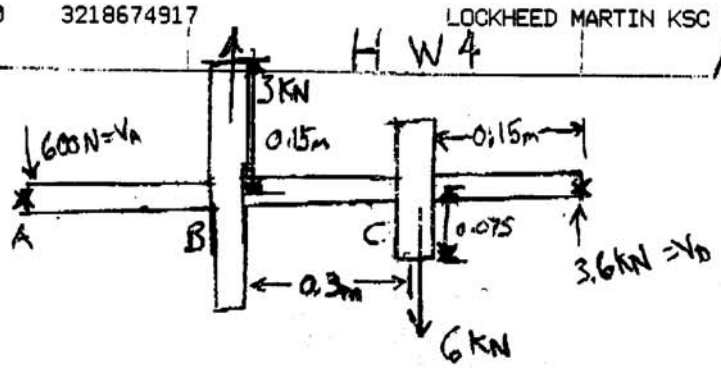
a) $$P = \boxed{\frac{Y h^2 b}{6L} = P_Y}$$

b) $$\boxed{P_p = \frac{Y h^2 b}{4L}}$$

c) $$\boxed{\frac{P_p}{P_Y} = 1.5}$$ ✓

(4) HW 4 ANTHONY SMITH 2-22-06

4.33




$$\sigma = \frac{Mr}{I} \qquad \tau = \frac{Tr}{J}$$

YEILDING OCCURS WHEN M&T ARE NEAR S.F.

$$\therefore \quad \sigma = \frac{(SF)Mr}{I} \qquad \tau = \frac{Tr(SF)}{J}$$

$$I = \frac{\pi r^4}{4} = \frac{\pi d^4}{4(16)}$$

$$J = \frac{\pi r^4}{2} = \frac{\pi d^4}{2(16)}$$

$$\sigma = \frac{(SF)M(32)}{\pi d^3} \qquad \tau = \frac{(SF)T(16)}{\pi d^3}$$

@C:

$$\tau_{MAX} = \frac{Y}{2} = \sqrt{\left(\frac{\sigma}{2}\right)^2 + \tau^2} = \frac{1}{2}\sqrt{\sigma^2 + [2\tau]^2}$$

$$Y = \frac{SF\,32}{\pi d^3}\sqrt{M^2 + T^2}$$

$$d = \left(\frac{SF\,32}{\pi Y}\sqrt{M^2+T^2}\right)^{\frac{1}{3}}$$

$\sum M_A = 0 = V_A(0) + 3k(0.3) - 6k(0.6) + V_D(0.75)$

$V_D = 3.6\,KN$

$\sum M_D = 0 = V_D(0) - 6k(0.15) + 3k(0.45) + V_A(0.75)$

$V_A = -600N$

$T_c = Fr = 6\times10^3(0.075) = 450\,Nm$

$M_c = V_D \cdot CD = 0.15(3.6\times10^3) = 540\,Nm$

$$d = \left(\frac{(1.85)32}{\pi\,290\times10^6}\sqrt{(540)^2 + (450)^2}\right)^{\frac{1}{3}}$$

$d = \boxed{35.75\,mm}$ ✓