ASSIGNMENT : 01

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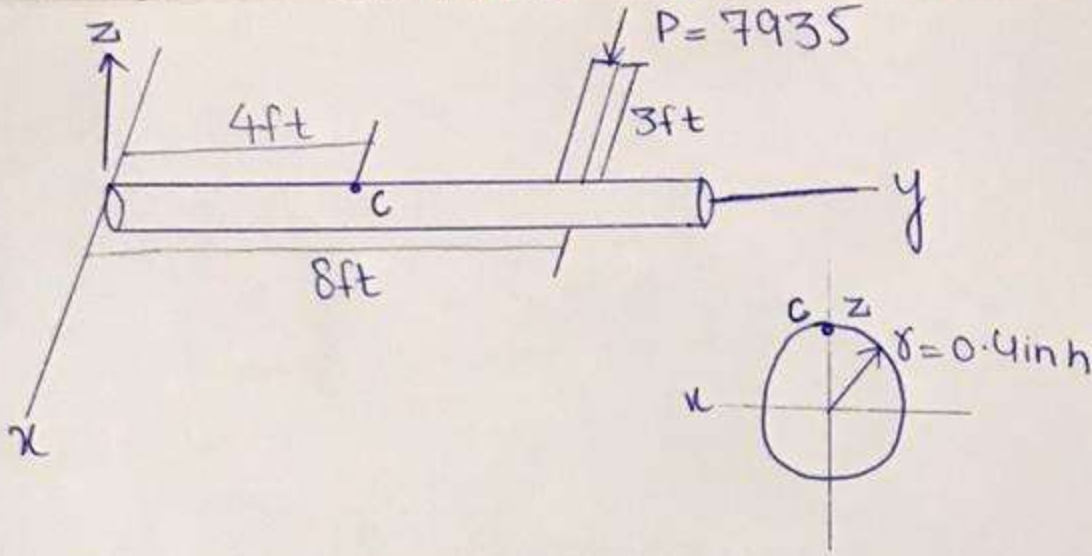
SUBJECT : MECHANICS OF SOLIDS -2

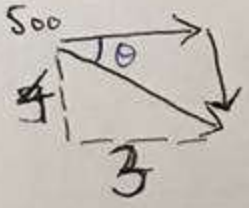
SUBMITTED TO : ENGR.SAQIB KHAN



→ Solve the beam reactions and
→ Determine the state of stress at
→ The value of P= 7935 lb.

SOLUTION:

For inclined force



$$\tan\theta = \frac{4}{3} \Rightarrow \theta = 53.130$$

$$F_x = 500 \cos 53.130 = 300\,lb$$

$$F_y = 500 \sin 53.130 = 399\,lb$$

$\Sigma F_{A,y} = 0$

$F_{A,y} + 300\,lb = 0$

$\boxed{F_{A,y} = -300\,lb}$

$\Sigma F_{A,z} = 0$

$F_{A,z} - 399\,lb = 0$

$\boxed{F_{A,z} = 399\,lb}$

Moments at point A:

$\Sigma M_{A,x} = 0$

$M_{A,x} - 399 \times 8 = 0$

$\boxed{M_{A,x} = 3192\,lb}$

$\Sigma M_{A,y} = 0$

$M_{A,y} - 399 \times 3 = 0$

$\boxed{M_{A,y} = 1197\,lb}$

$\Sigma M_{A,z} = 0$

$M_{A,z} - 7935 \times 8 - 300 \times 3 = 0$

$M_{A,z} - 64380 = 0$

$\boxed{M_{AZ} = 64380\,lb}$

REACTION AT POINT C:

$\Sigma V_{C,x} = 0$

$V_{C,x} - 7935 = 0$

$\boxed{V_{C,x} = 7935\,lb}$

$\Sigma V_{C,y} = 0$

$V_{C,y} - 300 = 0$

$\boxed{V_{C,y} = 300\,lb}$

$\Sigma V_{c\cdot z} = 0$

$V_{c\cdot z} + 399 = 0$

$\boxed{V_{c\cdot z} = -399\,lb}$

Moment at point C.

$\Sigma M_{c\cdot x} = 0$

$M_{c\cdot x} + M_{A\cdot x} - 399 \times 4 = 0$

$M_{c\cdot x} + 3192\,lb - 1596 = 0$

$\boxed{M_{c\cdot x} = 1596\,lb}$

$\Sigma M_{c\cdot y} = 0$

$M_{c\cdot y} + M_{A\cdot y} + 0 = 0$

$\boxed{M_{c\cdot y} = -1197\,lb}$

$\Sigma M_{c\cdot z} = 0$

$M_{c\cdot z} + M_{A\cdot z} - 7935 \times 3 = 0$

$M_{c\cdot z} + 64380 - 23805 = 0$

$\boxed{M_{c\cdot z} = 40575\,lb}$

-> Stresses:

Normal stress:

$$6 = \frac{N}{A}$$

$A = \pi r^2 = 3.14(0.4)^2$

$A = 0.5024$

$$6 = \frac{300N}{0.5024} = 597.13\ lb/in^2$$

$\boxed{6_N = 0.597\ Ksi}$

Torsional stress:

$$\tau = \frac{Tc}{J}$$

$$J = \frac{1}{2}\pi r^4 = \frac{1}{2}\,3.14\,(0.4)^4 = 0.0402\ \text{inch}^4$$

$$\tau = \frac{1197 \times (0.4)}{0.042} = \frac{14364 \times 0.4}{0.0402}$$

$$\tau = 142925.37\ \text{lb/in}^2$$

$$\boxed{\tau = 142.925\ \text{ksi}}$$

$= 1197\ \text{lb ft} \times 12\ \frac{\text{inch}}{\text{ft}} = 14364\ \text{lb in}$

Shear stress:

$$\tau = \frac{VQ}{It}$$

$$Q = A \cdot y'$$

$$Q = \tfrac{1}{2}\pi r^2 \times 4/3 \cdot r/\pi$$

$$Q = \left[\frac{1}{2}(3.14)(0.4)^2\right] \times \left[\frac{4}{3} \times \frac{0.4}{3.14}\right]$$

$$\boxed{Q = 0.04266\ \text{in}^3}$$

$$I = \frac{\pi D^4}{34} = \frac{(3.14)(0.8)^4}{34}$$

$$\boxed{I = 0.0402}$$

$$\boxed{V = 3991\ \text{lb}}$$

$$t = 20\% \times 0.4 \Rightarrow \boxed{t = 0.08}$$

$$\tau = \frac{3391 \times 0.04266}{0.0402 \times 0.08}$$

$$\tau = 5.294\ \text{lb/ft}$$

$$\boxed{\tau = 0.053\ \text{ksi}}$$