ASSIGNMENT II

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DEPARTMENT : BE (CIVIL)

SECTION : "B"

SUBJECT : MOS II

INSTRUCTOR : SIR SAQIB.

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QUESTION No.1

GIVEN DATA:

Length, L = 16 ft = 192 inches

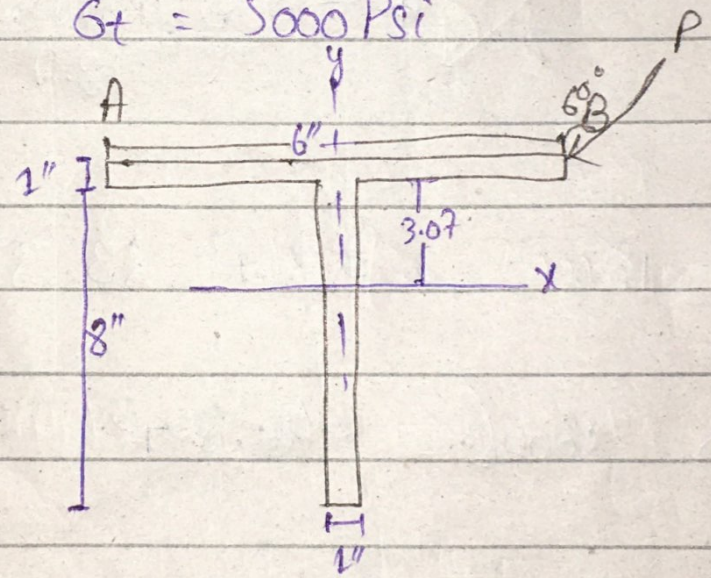
$\theta = 60°$

$I_x = 112.6\ in^4$

$I_y = 18.7\ in^4$

$\sigma_c = 12000\ Psi$

$\sigma_t = 5000\ Psi$



REQUIRED DATA:

Load $P = ?$

SOLUTION:

As we know that.

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②

$$\sigma_c = \frac{M_x y}{I_x} + \frac{M_y x}{I_y}$$

$$\Rightarrow \sigma_c = \frac{(P\cos\theta)y}{I_x} + \frac{(P\sin\theta)x}{I_y}$$

$$\Rightarrow \sigma_c = \frac{192 \times P\cos 60° \times 40.07}{112.7}$$

$$+ - \frac{192 \times P \times \sin 60° \times 6}{18.7}$$

$$\Rightarrow 12000 = 3.46P - 53.35P$$

$$\Rightarrow 12000 = -49.89P$$

$$\Rightarrow P = \frac{12000}{-49.89P}$$

$$\Rightarrow \boxed{P = 240.5291 \text{ lb}}$$

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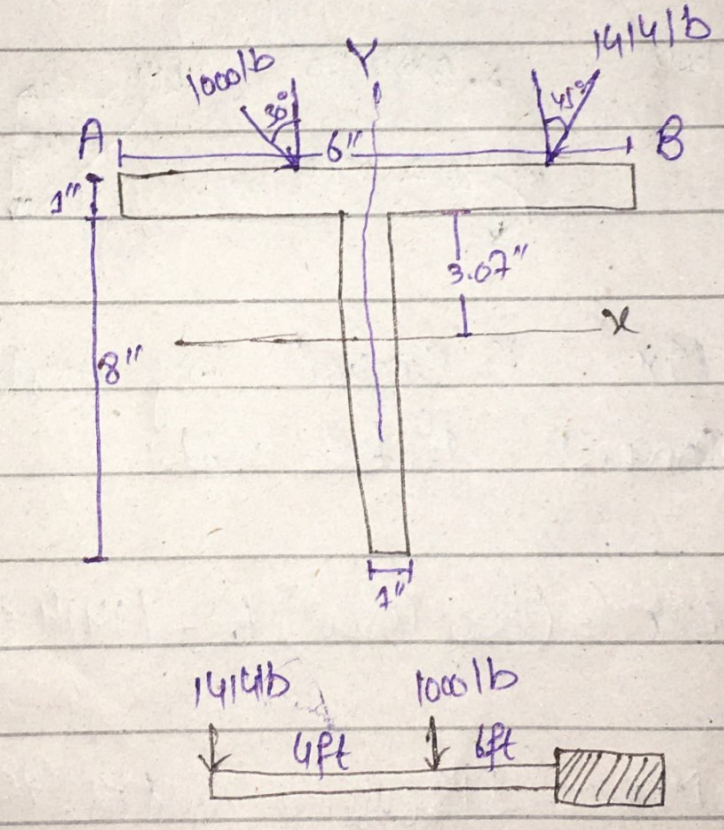
QUESTION No. 2

GIVEN DATA:

$L = 10\ ft$

$I_x = 112.6\ in^4$

$I_y = 18.7\ in^4$



REQUIRED DATA:

Max Compression, $\sigma_c = ?$

Max Tension, $\sigma_t = ?$

Inclination of neutral axis at wall, $\alpha = ?$

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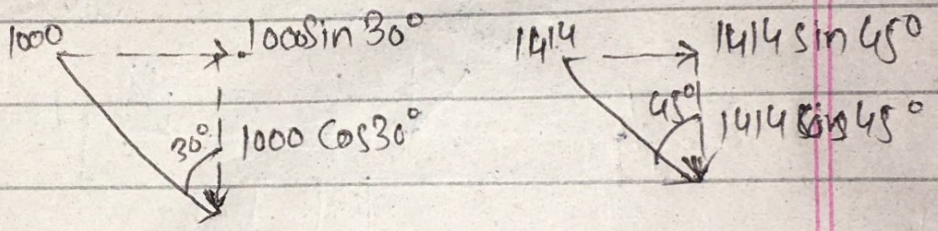
SOLUTION:

First we have to find the moments at x and y

$M_x = ?$ $M_y = ?$

As the forces are inclined so first we have to solve it into its components.



As M_x is caused by vertical component of ~~be~~ load.

$$M_x = (1000 \cos 30°)\,6 + (1414 \cos 45°)\,8$$

$$\Rightarrow M_x = 5196.15 + 7998.79$$

$$\Rightarrow \boxed{M_x = 13194.941}\ \text{lbft}$$

Now M_y is caused by horizental component of load.

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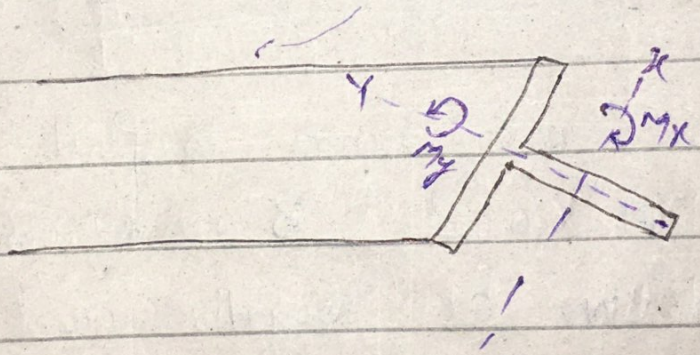
$$My = (1000 \sin 30°)6 + (1414 \sin 45°)8$$

$$\Rightarrow My = 3000 + 7998.7$$

$$\Rightarrow \boxed{My = 10998.79} \text{ lbft}$$

As the resulting Moment My is anticlockwise which causing Tension at "A" and compression at "B"



Now stresses at extreme fibers due to Mx and My

$$\sigma x = \frac{Mx\, y}{Ix}$$

$$\Rightarrow \sigma x = \frac{13194.941 \times 4.07''}{112.6 \text{ in}^4}$$

⑥

$$\Rightarrow \boxed{\sigma_x = 8.24 \text{ M lb/ft}^2}$$

Now

$$\sigma_y = \frac{M_y \, x}{I_y}$$

$$\Rightarrow \sigma_y = \frac{10998.79 \times 3''}{18.7 \text{ in}^4}$$

$$\Rightarrow \boxed{\sigma_y = 30.0491 \text{ M lb/ft}^2}$$

Now we have to find load at A and B by considering compression as negative and tension as positive.

$$\sigma_A = \sigma_x + \sigma_y$$

$$\Rightarrow \sigma_A = 8.24 + 30.0491$$

$$\Rightarrow \boxed{\sigma_A = 38.7392 \text{ M lb/ft}^2} \text{ (Tension)}$$

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$$\sigma_B = \sigma_x - \sigma_y$$

$$\Rightarrow \sigma_B = 8.24 - 30.491$$

$$\Rightarrow \boxed{\sigma_B = -22.51 \text{ Mlb/ft}^2} \text{ (Compression)}$$

Now we have to find the angle of neutral axis.

$$\tan\alpha = \frac{I_x}{I_y} \times \frac{M_y}{M_x}$$

$$\Rightarrow \tan\alpha = \frac{5.43 \times 10^{-3}}{9.018 \times 10^{-4}} \times \frac{10998.79}{13194.941}$$

$$\Rightarrow \tan\alpha = 5.0180$$

$$\Rightarrow \alpha = \tan^{-1}(5.0180)$$

$$\Rightarrow \boxed{\alpha = 78.72}$$