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Section B

Fourth Semester

Subject ⇒ MOS II

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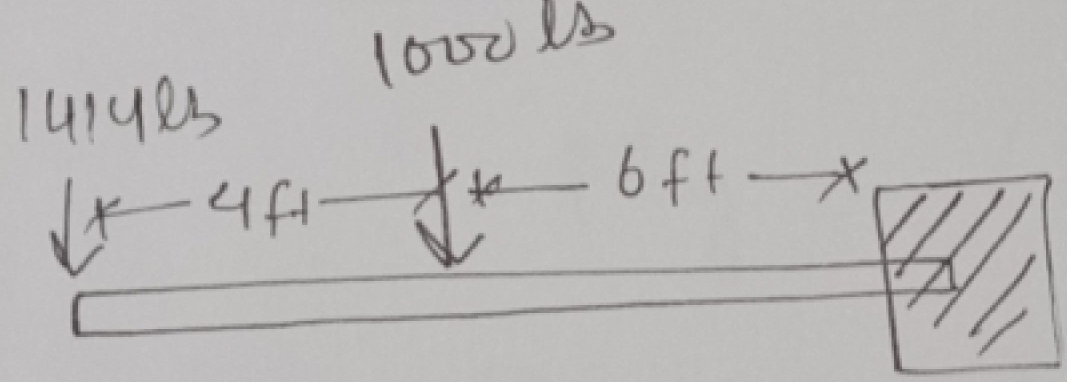
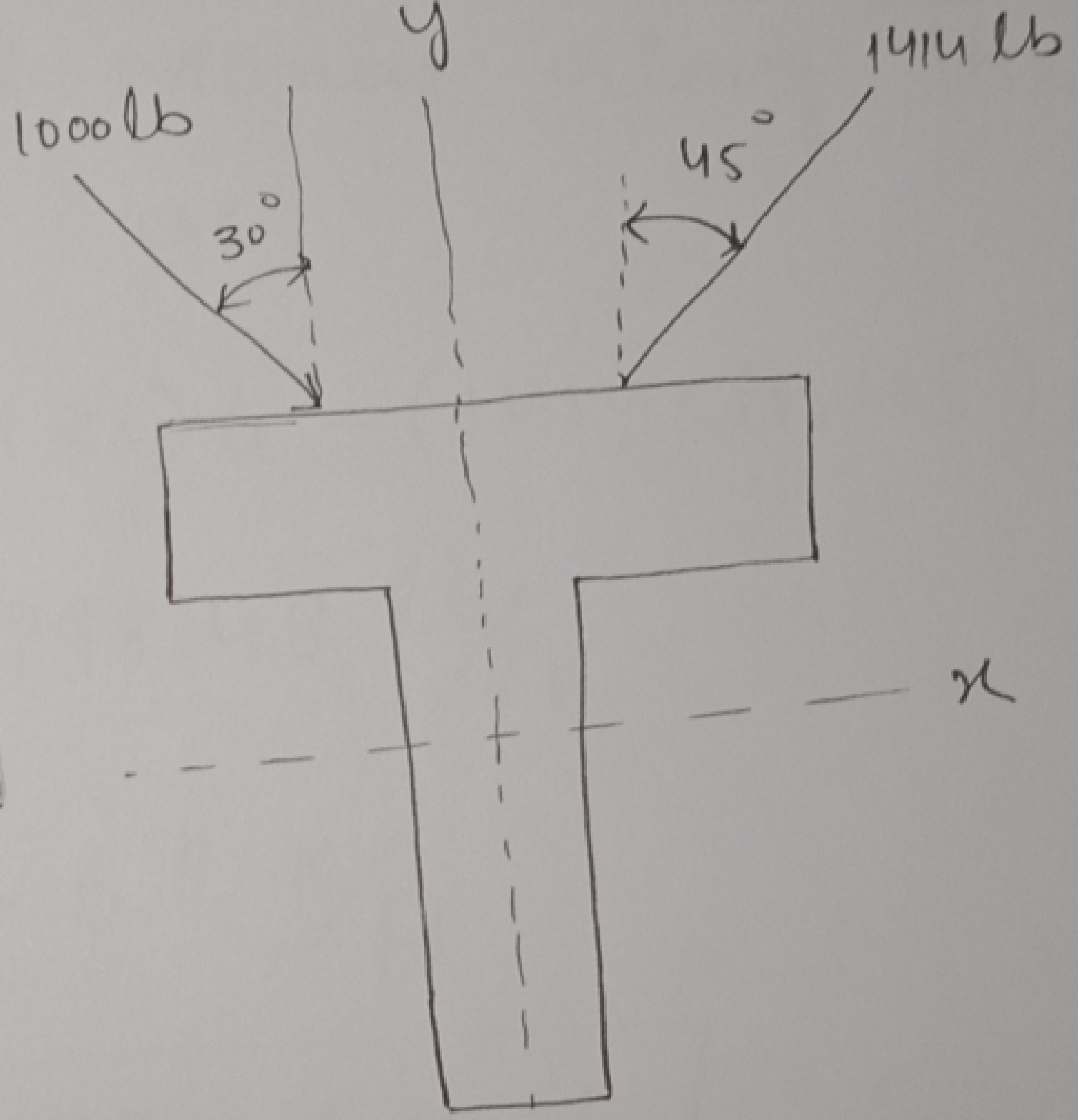
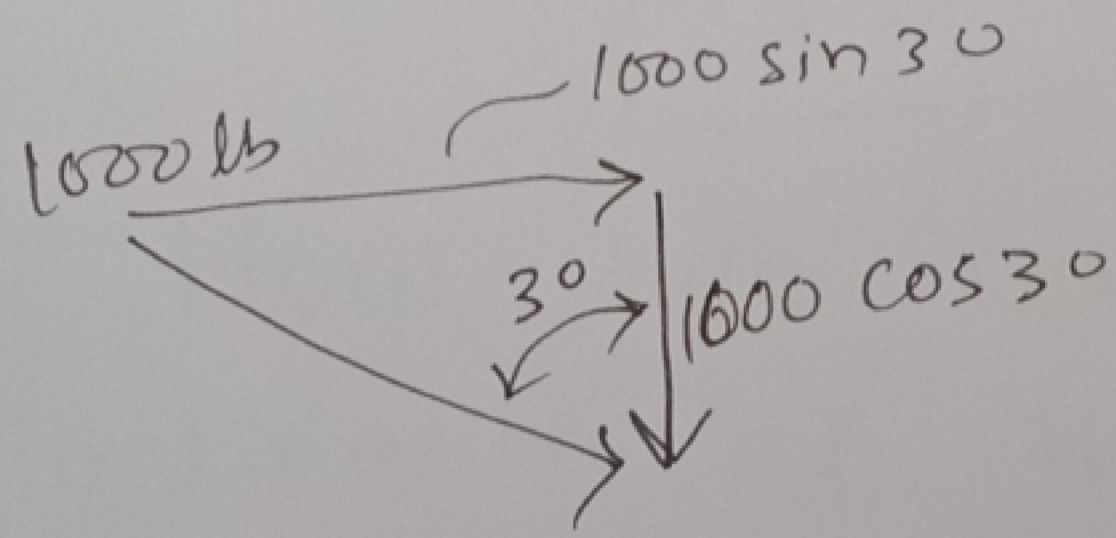
PESHAWER

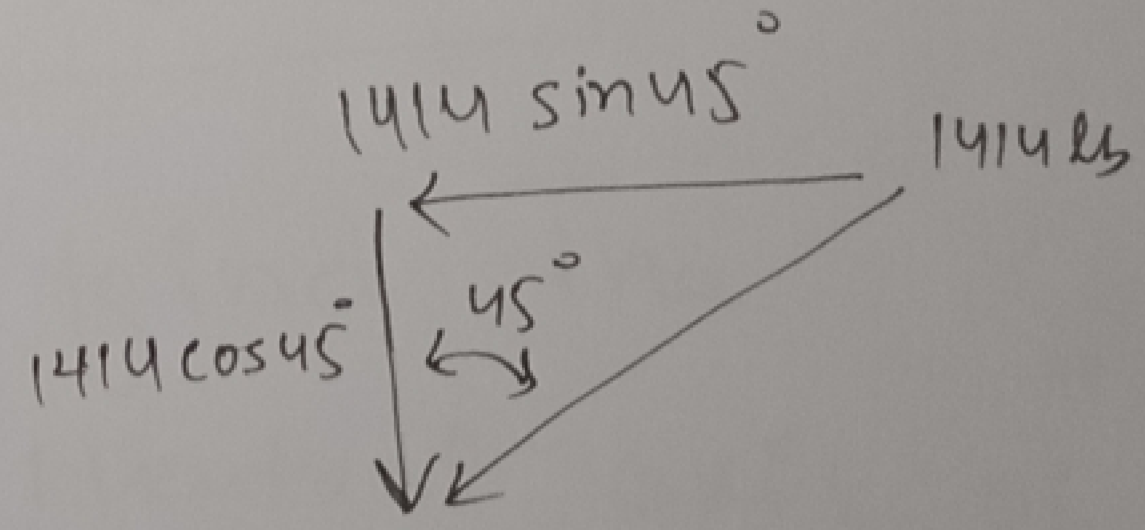
Problem No #1336. A cantilever beam 10 ft long with the same T section in problem 1335 carries two concentrated loads applied as shown in figure. Compute the inclination of the Nutral axis as the wall and the maximum compressive and tensile stresses.





Solution :→





First of All find moment along M_x and M_y as well

$$M_x = (1000 \cos 30)6 + (1414 \cos 45)10$$

$$M_x = 15194.64 \ lb/ft$$

OR

$$M_x = 15.1 \ K/ft$$

OR

$$\boxed{M_x = 2174.4 \ Ksi}$$

Now we fingd Momen along The Y-direction as;

$$M_y = (1000 \sin 30)6 - (1414 \sin 45)10$$

$$M_y = -6998.48 \ lb/ft$$

OR $M_y = -6.9 \ K/ft$

OR $\boxed{M_y = -993.6 \ Ksi}$

Now we can find The inclination of the Neutral axis of The wall. For This we Need Ix (Moment of Inertia along the x) and also Iy (Moment of Inertia along

The y - direction. And also need of My and My which as already we have find in the previous page. as well.

→ So we have formula for the Neutral axis That as;

$$\tan\alpha = \frac{I_x}{I_y} \cdot \frac{M_y}{M_x} \quad \text{——} \quad (A)$$

here $I_x = 112.6 \text{ in}^4$

$I_y = 18.4 \text{ in}^4$

$M_y = 993.6 \text{ Psi}$

$M_x = 2174.4 \text{ Psi}$

So Putting These values in eq (A)

We get

$$\tan\alpha = \frac{112.6 \text{ in}^4}{18.7 \text{ in}^4} \times \frac{993.6 \text{ psi}}{2174.4 \text{ psi}}$$

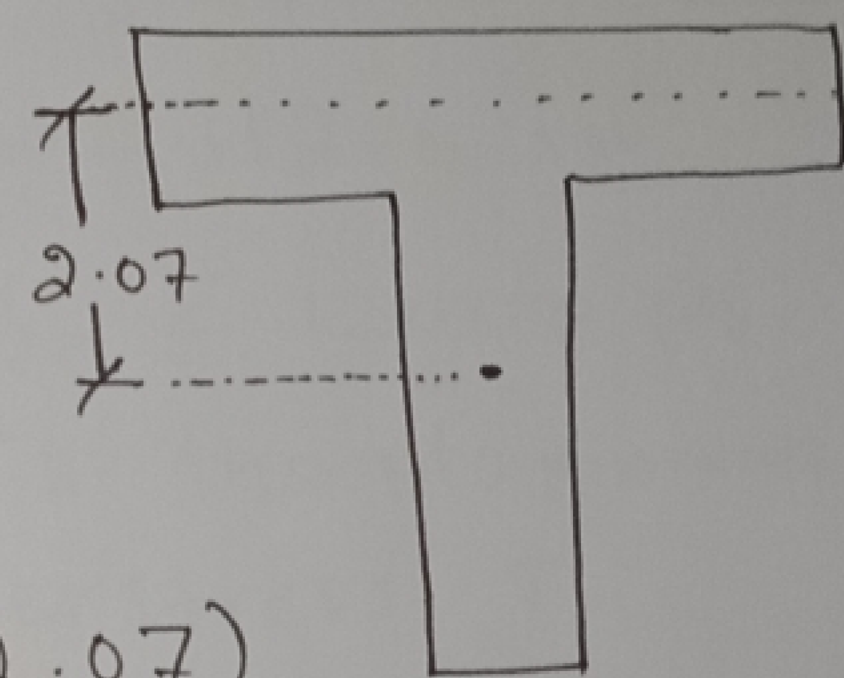
$$\tan\alpha = 6.0213 \times 0.456$$

$$\alpha = \tan^{-1}(6.0213 \times 0.456)$$

Hance The Inclination of the Nutral Axis as

$$\alpha = 70^\circ$$

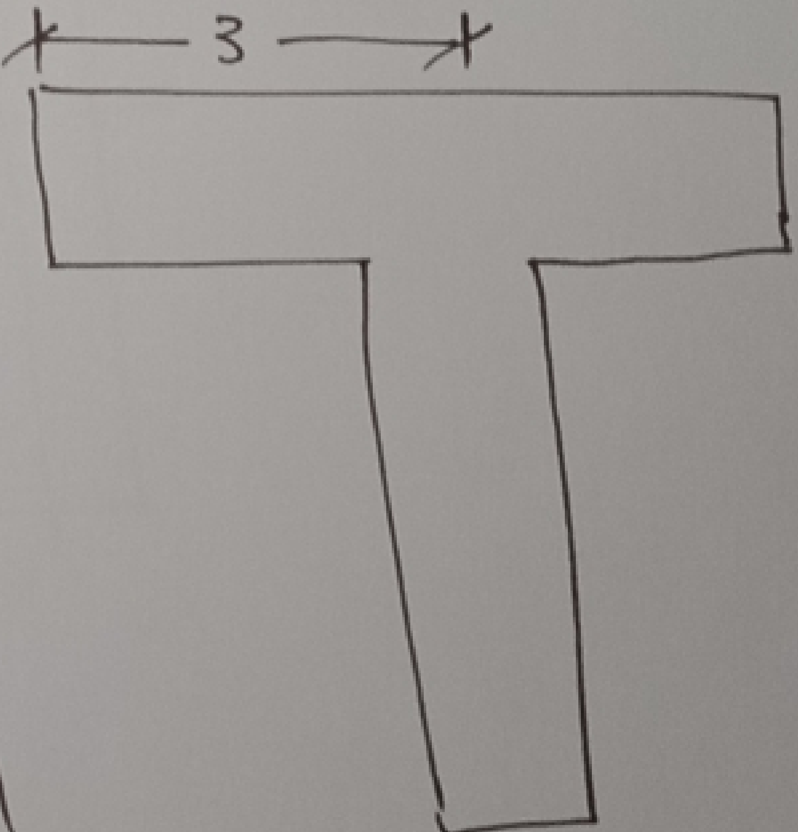
Now we find compressive and Tensile stresses.



$$\sigma_x = \frac{M_x Y}{I_x}$$

So $$\sigma_x = \frac{(2174.4)(2.07)}{112.6}$$

$$\sigma_x = 39.9 \text{ ksi}$$ Tension



$$\sigma_y = \frac{M_y X}{I_y}$$

$$\sigma_y = \frac{-993.6 \times 3}{18.7}$$

$$\sigma_y = -159.4 \text{ ksi}$$

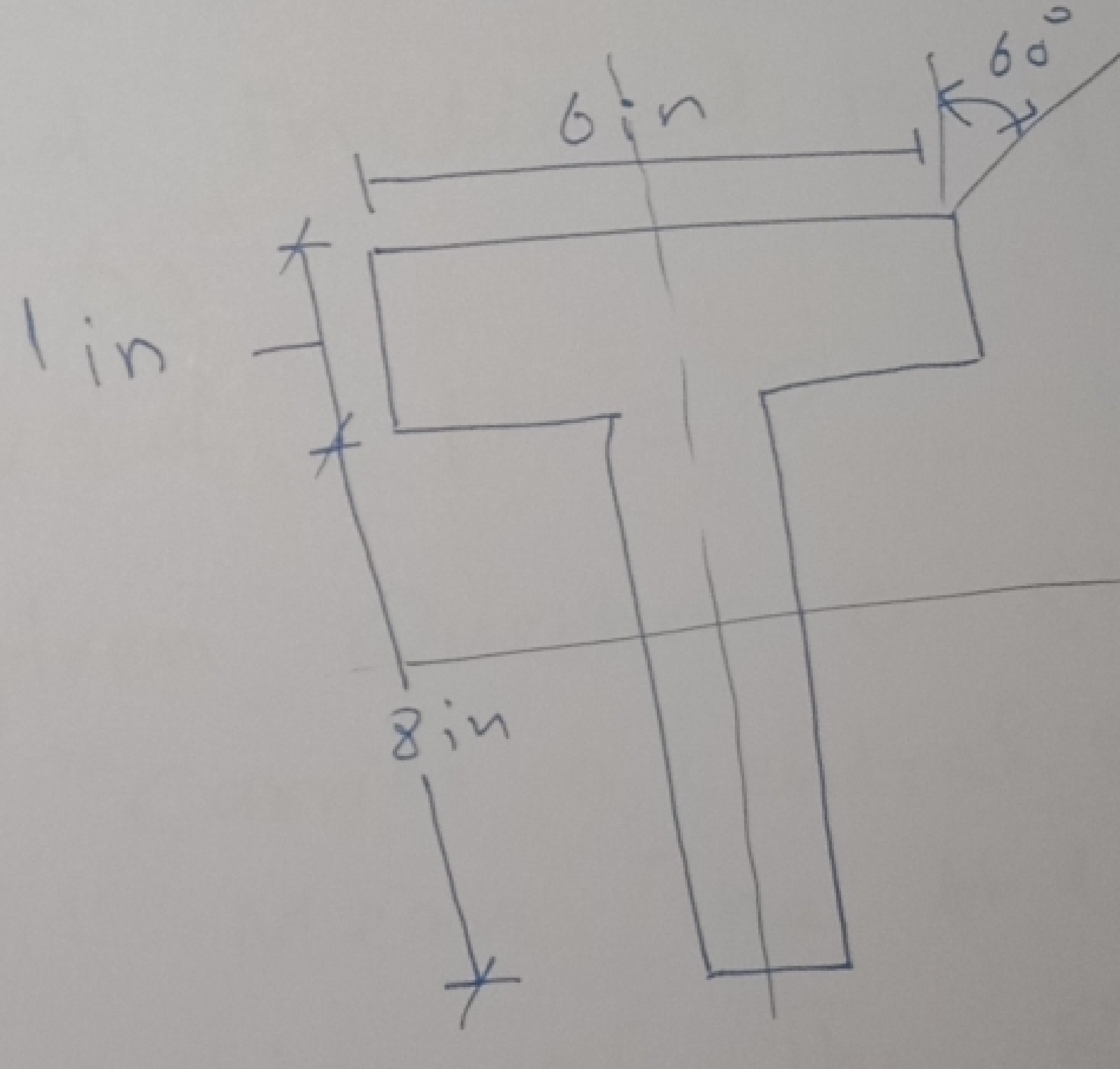
↳ Compression -ve

XXX

(5)

Problem No # 1335

The T-section shown in figure is The cross-section of a simply supposed beam 16 ft long that carries a central concentrated load inclined at 60° to the y-axis The centroidal x-axis is 3.07 in. below The Top The section $I_x = 112.6\ in^4$ and $I_y = 18.7\ in^4$. If $\sigma_c \le 12000$ psi and $\sigma_t \le 5000$ psi. What is the Maximum Load that will not overstress The beam?



Solution :→

Given data:→

⇒ length of The Beam = 6 ft = 6×12 =
⇒ 72 in

⇒ Centroidal distance from The Top — $x = 3.07$ in

⇒ $I_x = 112.6 \, in^4$

⇒ $I_y = 18.7 \, in^4$

⇒ $\sigma_c \leq 12000$ Psi

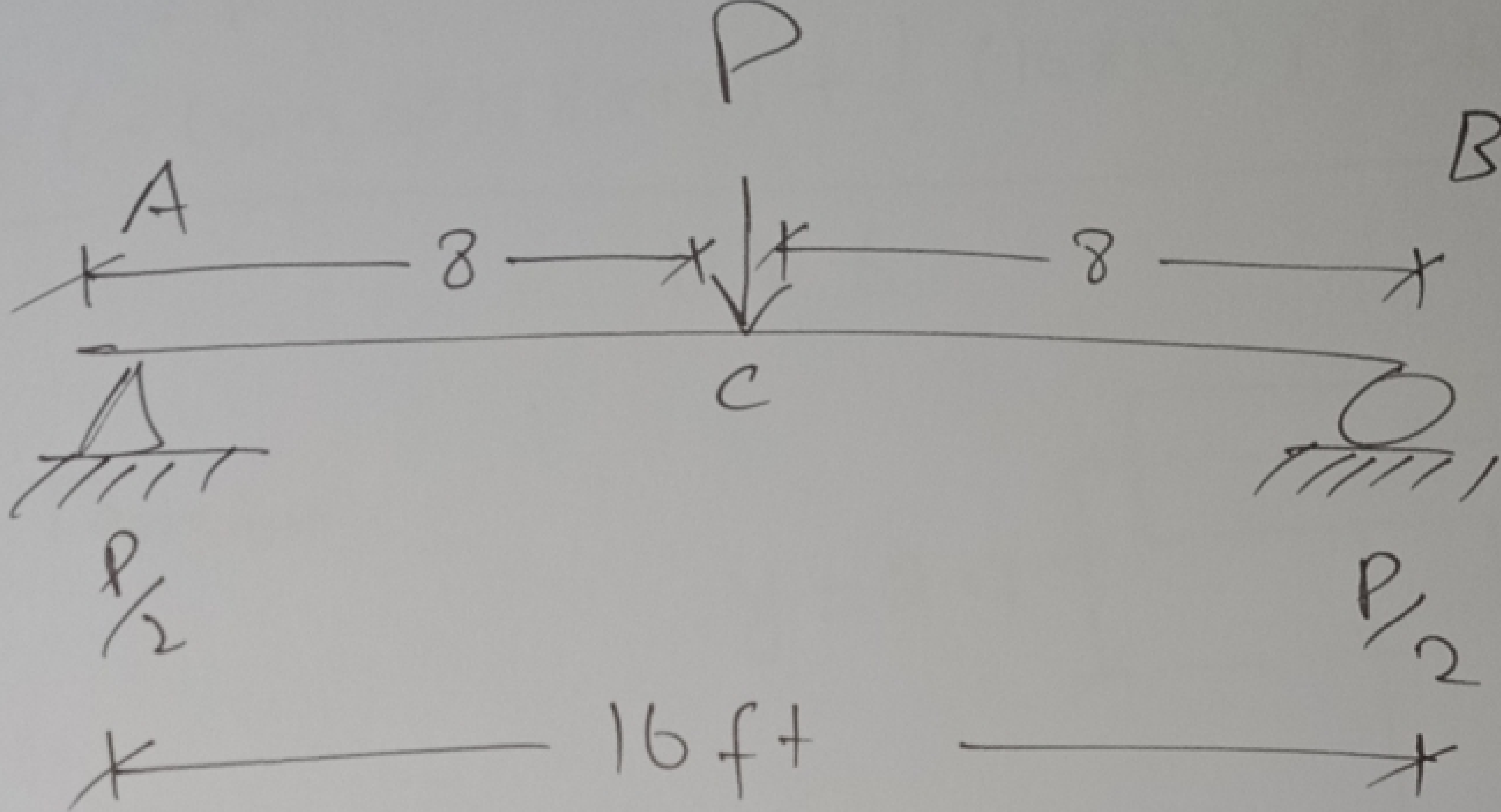
⇒ $\sigma_t \leq 5000$ Psi

⇒ Load inclined to y-axis at 60°.

Required P = ?

So In given Question a statement That Load "Carries a central concentrated Load" Mean The ~~#~~ Load Act on center of The Beam. Mean at the 6 ft from Support

5.0 Simply Supported Beam



Load Act on Centre

let suppose we find M at a point of the load. So, Moment along the x-axis at a Point.

$$M_{A_x} = -(P\sin 60^\circ * (8*12)) + \frac{P}{2} * (16*12)$$

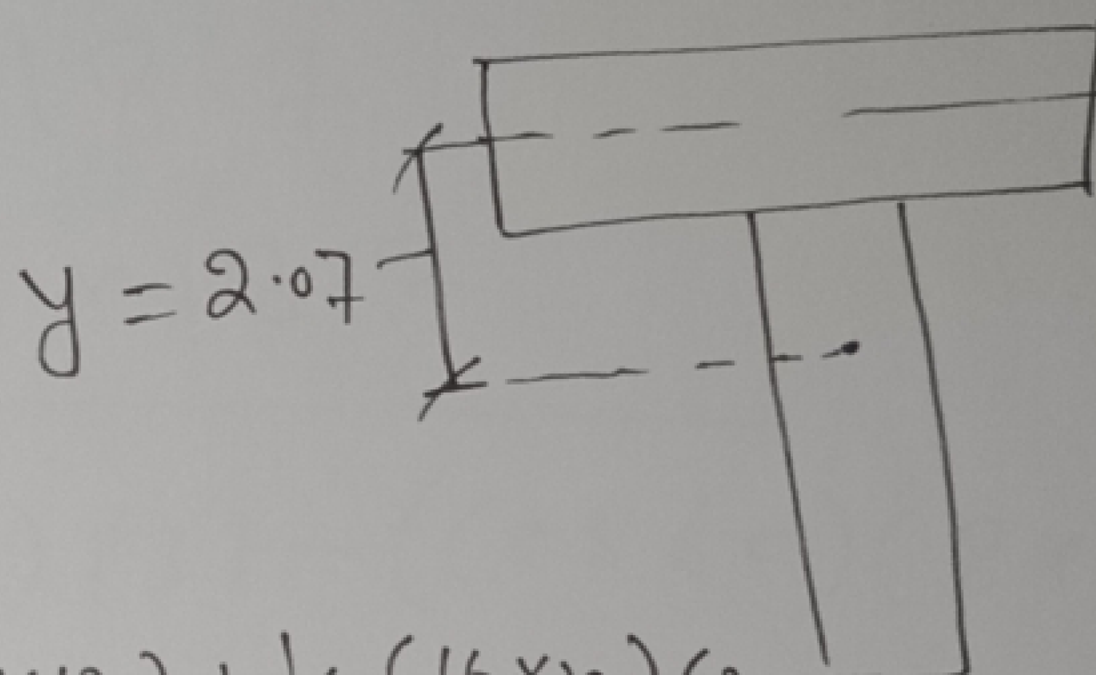
& $$M_{A_y} = -(P\cos 60)(8*12) + \frac{P}{2}(16*12)$$

$$\sigma_x = \frac{M_x y}{I_x}$$

$$\sigma_x = \frac{M_x y}{I_x}$$

$$\sigma_x = \frac{P(-(\sin 60)(8*12) + \frac{1}{2}(16*12)(2.07)}{112.6}$$

$\sigma_x \Rightarrow$ Tension.



$$5000 = \frac{P(-\sin 60)(8*12) + \frac{1}{2}(16*12)(2.07)}{112.6}$$

$$P = \frac{5000 * 112.6}{((0.5)(16*12)(2.07)) - (\sin 60)(8*12)}$$

$$\boxed{P = 4870 \text{ lb}}$$

Now we find $\sigma_y = ?$

for the P. as.

we consider $\sigma_y = 12000$ compression

and $\sigma_x = 5000$ Tension.

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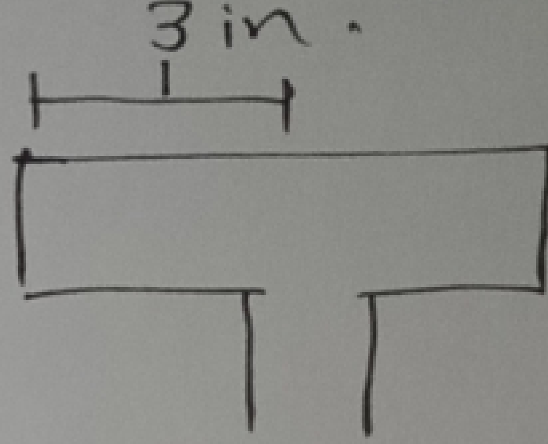

$$\sigma_y = \frac{M_y x}{I_y}$$

$$12000 = \frac{\left[P(-\cos 60)(8*12)) + \frac{1}{2}(16*12)\right](3)}{18.7}$$

$$P = \frac{12000 * 18.7}{(0.5)(16*12)(3) - ((\cos 60)(8*12)}$$

$$\boxed{P = 935 \text{ lb}}$$