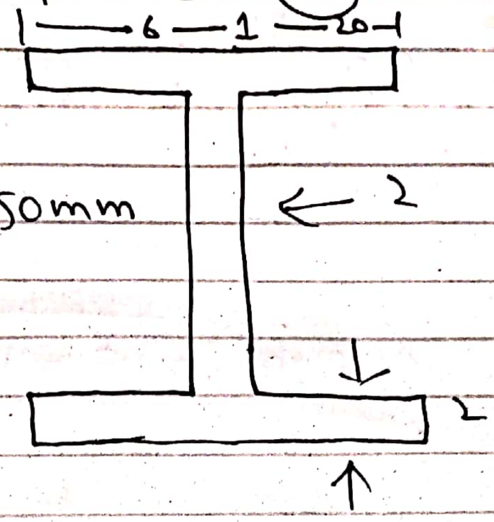
Name :- M. Adil Rehman

ID :- 7939

Section :- B

Subject :- MOS II

Q:-1 part (A)



Required :- Location of shear centre:-

Solve:-

As we know

$$e = \frac{t_f h^2 b^2}{4I}$$

and $I = 2\left(\frac{bh^3}{12} + Ay^2\right) + \left(\frac{bh^3}{12} + Ay^2\right)$

$$= 2\left[\frac{26\,(2)^3}{12} + (20\times2)\,(25)^2\right] + \left[\frac{2(50)^3}{12}\right]$$

$I = 50034.66 + 20833$

$I = 70867.99\,mm^4$

$$e = \frac{2(50)^2 (25)^2}{4(70867.99)} = 11.02\,mm$$

So Shear centre = $\boxed{e = 11.02\,mm}$

Q1:- Part B:-

Given data

$h \Rightarrow 26 ft$

→ assume diameter = D = 22 ft

⇒ tangential stress = 600 lb/ft

⇒ Specific weight of water tank = 62.4 lb/ft³

we have to find thickness

Solution:-

The pressure divided by water = $P = \gamma h$

$$\sigma_t = \frac{PD}{2t}$$

$$\sigma_t = \frac{PD}{2t} \Rightarrow \frac{\gamma h D}{2t}$$

$$2t \times \sigma_t = \gamma h \cdot D$$

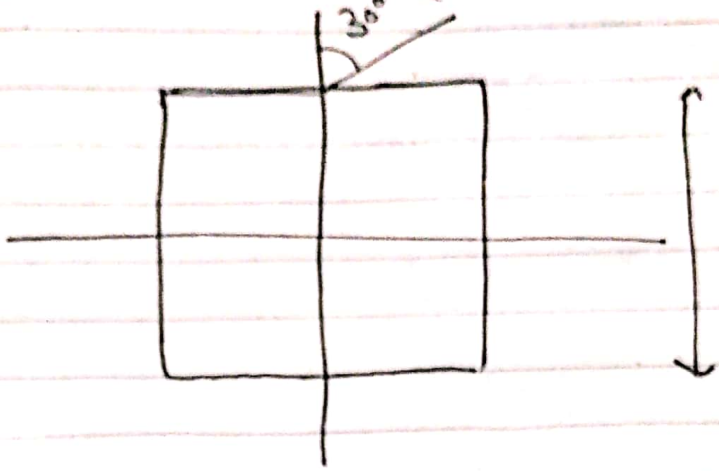
$$2t = \frac{\gamma h D}{6t}$$

$$t = \frac{\gamma h D}{6t \times 2}$$

$$t = \frac{\frac{(62.4)}{(12)^3} \times (26 \times 12) \times (22 \times 12)}{6000 \times 2}$$

So $\boxed{t = 0.24''}$

Q:-2 Part (a)



moment of inertia

$$I_z = \frac{bh^3}{12} \Rightarrow \frac{0.1\ (0.15)^3}{12}$$

$$I_z \Rightarrow 2.8125 \times 10^{-5}$$

Now $I_y = \frac{bh^3}{12} \Rightarrow \frac{(0.15)^2 (0.1)^3}{12}$

$$I_y = 1.25 \times 10^{-5}$$

$$6 = \frac{M_z y}{I_z} + \frac{M_y z}{I_y}$$

$$6 = \frac{M \cos\theta}{I_z} + \frac{M \sin\theta}{I_y}$$

where $M = \cos\theta \Rightarrow P\cos\theta = M_z$

$= 12\cos 30^\circ$

$$\boxed{M_z = 1.8510}$$

$M\sin\theta = P\sin\theta = M_y$

$12\sin 30^\circ$

$$\boxed{M_y = -11.8563}$$

$$\sigma = \left(\frac{M_z}{I_z}\right) + \left(\frac{M_y}{I_y}\right)$$

$$\sigma = \frac{1.851}{2.812\times10^{-5}} + \left(\frac{-11.8563}{1.25\times10^{-5}}\right)$$

$$\boxed{\sigma = 882678 \ N/m^2}$$

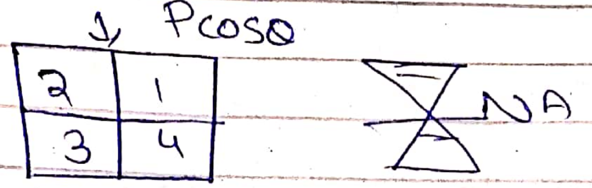
sign conversion

y

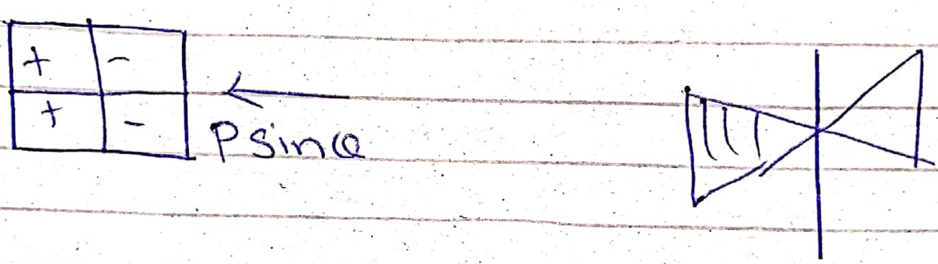
2	1
3	4

—z

* If we take compression as negative and tension as positive and the beam is Simply supported



Quadrant 1·2 -ive
3:4 +ive



Quadrant 1·4 -ive
2·3 +ive

In a case of unsentirael loading the neutral axis lines of an angle of "x°" the principal axis and the negative sum of stress at NA is zero

$$6 = \frac{M\cos y}{I_x} + \frac{M\sin\theta}{I_y} - x \quad (1)$$

$$\sigma = \frac{M\cos\theta \cdot y}{I_z} + \frac{M\sin\theta}{I_y} z$$

[scribbled] let consider a part "A" on NA lies in quadrant '2'

=> Bending stress due to $P\cos\theta$ is compressive

=> Bending stress due to $P\sin\theta$ is tensi

eq (1)

$$0 = -\frac{M\cos\theta y_A}{I_z} - \frac{M\sin\theta z}{I_y}$$

$$\frac{M\cos\theta y_A}{I_z} = \frac{M\sin\theta z_A}{I_y}$$

$$\frac{y_A}{z_A} = \frac{I_z \sin\theta}{I_y \sin\theta}$$

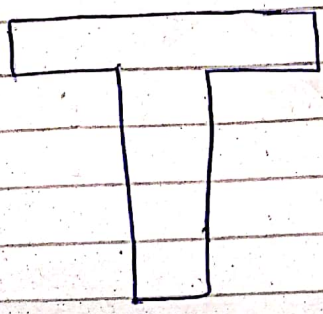
$$\tan\alpha = \frac{I_z}{I_y}\tan\theta \quad \text{——— (2)}$$

Put [scribbled] I_y, I_z and θ in eq (2)

$$\tan x = \frac{I_z}{I_y} \tan 30$$

$$\Rightarrow \frac{2.8125 \times 10^{-5}}{1.25 \times 10^{-5}} \tan 30^\circ$$

Q2:- B part

Given 

$L = 16 ft$

$I_x = 112.6 \, in^4$

$I_y = 18.7 \, in^4$

$\sigma_e = 12000$ PSi

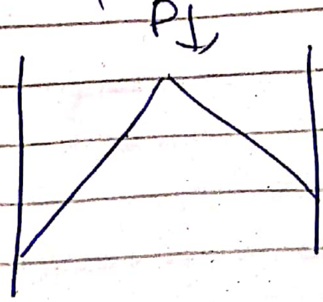
$\sigma_t = 5000$ PSi

Solve:-

$$I_A = \frac{M_x y}{I_x} + \frac{M_y x}{I_y} \quad (Comp)$$

$$I_c = \frac{M_x y}{I_x} + \frac{M_y x}{I_y} \quad (tension$$

Now M_x & M_y



So M_x $\frac{P\cos 60 \times (16\times12)}{12}$

$$\boxed{M_x = 48P\cos 60}$$

$$M_y = \frac{P\sin 60 (16\times12)}{4}$$

$$\boxed{M_y = 48P\sin 60}$$

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

$$= 12000 = \frac{48P\cos 60^\circ \times 3.07}{112.6}$$

$$= \frac{48\, p \sin 60^\circ \times 3}{18.7}$$

$P = 1638.6\, lb$

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

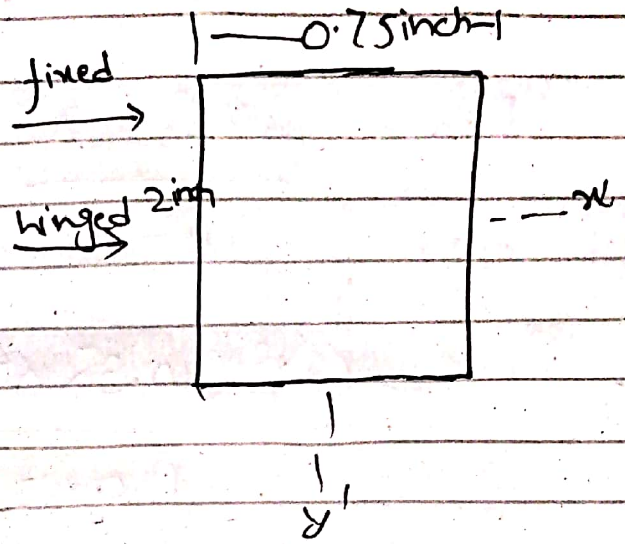
$$5000 = \frac{48\, p \cos 60 \times (5.93)}{112.6} + \frac{48\, p \sin 60^\circ \times 0.5}{18.7}$$

$\boxed{P = 2104.9\, lb}$

P applied should be 1638.6 lb

Q:- 3:-

Solve :-



Given data

Length, $l = 10 ft$

Breath, $b = 0.75''$

height $= h = 2''$

factor of Safety $= 2$

$E = 10.3 \times 10^6$

Required data

Safe load $= P_{safe} = ?$

Solution :-

Case 1 Struct column act as hinged column

about an axis perpendicular to the 2in dimension then

Case 2 :

column act as a fixed end about axis parallel to 2in i.e y-axis

$$I = I_y = \frac{(2)(0.75)^3}{12}$$

$I_y = 0.07 in^4$

Now for fix ended

$l_e = L/2$

$$P_{cr} = \frac{n^2 E I \pi^2}{l_e}$$

$$P_{cr} = \frac{(1)^2 (10.3 \times 10^6)(0.07)(3.14)^2}{(120/2)}$$

$\Rightarrow P_{cr} = 1974.65\ lb$

for P - Safe $\Rightarrow$ $P_{safe} = \frac{P_{cr}}{\text{factor of safety}}$

$$P_{safe} = \frac{1974.65}{2}$$

$$P_{safe} = 987.32 \text{ lb}$$

In both cases we take smaller values of Psafe

$$\boxed{P_{safe} = 987.32 < 1763.07}$$