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Section = 'B'.

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IQRA NATIONAL UNIVERSITY.

QNO# 01

Part (B)

Data :-

⇒ $H = 26\ ft.$

⇒ g assume diameter $D = 22\ ft.$

⇒ Tangential stress = $600\ lb/ft.$

⇒ Specific weight of water

Tank = $62.4\ lb/ft^3.$

we have to find the

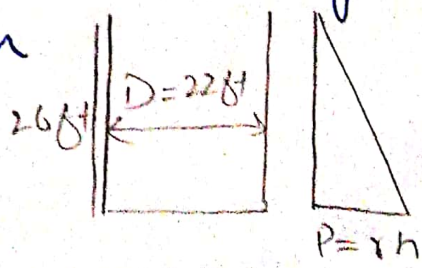
thickness = ?

Solution :-

The pressure develope by

water = $P = \gamma h$

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



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

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

P.T.O

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

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

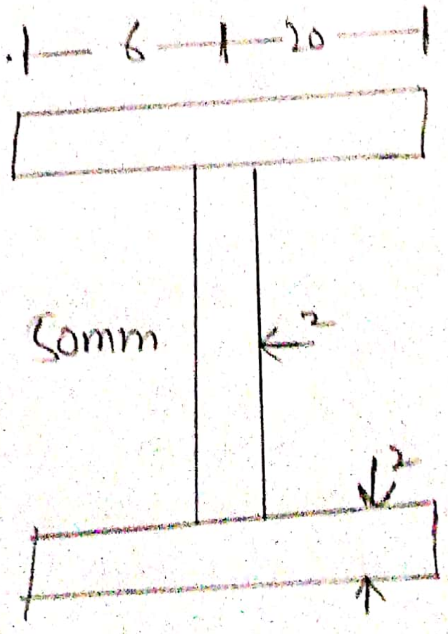
~~$t = \frac{(62.4) \times (26 \times 12)}{(12)^3}$~~

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

$$t = 0.24''$$

Q NO # 01

Part (a)



Required:-

Location of Shear Centre:-

Sol:- As we know.

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

And:-

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

$$= 2\left[\frac{26(2)^3}{12} + (20\times2)(25)^2\right] + \left[\frac{2(50)^3}{12} + 0\right]$$

$$I = 50034.66 + 20833$$

$$I = 70867.99\ mm^4.$$

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

So Shear Centre.

$e = 11.02mm$. Ans:-

Q NO# 03:

Ans: Given Data:

length = 10 ft.

$E = 10.3 \times 10^6$

$b = 0.75$

$h = 2$

Factor of Safety = 7.

Required:

a) Safe load at hinged = ?

b) Safe load at fixed = ?

Sol:-

a) For hinged column.

$L_e = L$

$I = I_x = \frac{(0.75)(2)^3}{12} = 0.5 \text{ in}^4$

$P_{cr} = \frac{n^2 E I \pi^2}{L_e^2} = \frac{(1)^2(10.3\times10^6)(0.5)\pi^2}{(10\times12)^2}$

P.T.O

$$P_{cr} = \frac{50776940}{14400} = 3526.176 \text{ lb}$$

$$P \text{ Safe load} = \frac{P_{cr}}{\text{Factor of safety}}$$

$$= \frac{3526176}{2} = 1763.088 \text{ lb}$$

(B) Strat act column.

$L_e = L/2$ (For Fixed ended)

$$L_e = \frac{10}{2} = 5 \text{ ft.}$$

$$I = I_y = \frac{2 \times (0.75)^3}{12} = 0.07 \text{ in}^4$$

(3.14)

$$P_{cr} = \frac{n^2 E I \pi^2}{L_e^3} = \frac{(1)^2 (10.3 \times 10^6)(0.07)}{(5 \times 12)^2}$$

$$P_{cr} = \frac{7108771.6}{(60)^2}$$

P.T.O

$P_{cr} = 1974.658$ lb

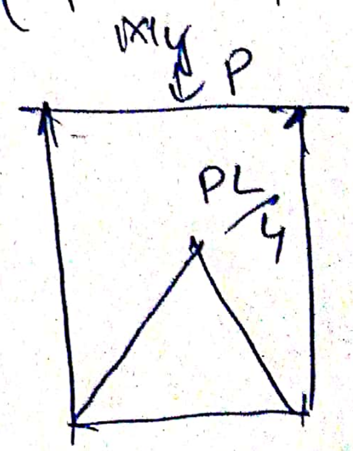
$P_{safe\ load} = \frac{1974.658}{2}$

$= 987.3293$ lb

accure on a & maximum tension e at B there will tension as well & compression which will reduce that effect of each other So we will calculated stress at A & C.

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

$S_C = \frac{M_x y}{I_x} + \frac{M_y x}{I_y}$ (Tension)



Now Mx & My

So $M_x = \frac{P\cos 60 \times (10 \times 12)}{4}$

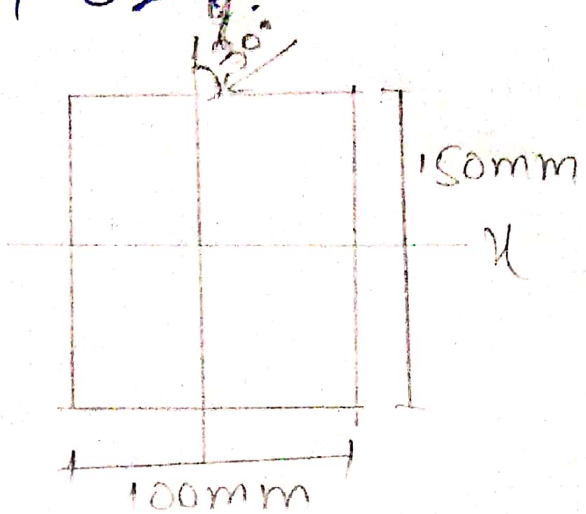
$M_x = 48 P \cos 60.$

$$M_y = \frac{P \sin 60 (16 \times 12)}{4}$$

$$M_y = 50 P \cos 60.$$

Question NO # 02;

Part (a).



Moment of inertia:-

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

$$I_z = 2.8125 \times 10^{-5}.$$

Now;

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

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

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

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

P.T.O

$M = \cos Q = P\cos Q = M_z$

$= 18\cos 30^\circ = M_z$

$M_z = 1.8510.$

$M\sin Q = P\sin Q = M_y.$

$M_y = 12\sin 30^\circ$

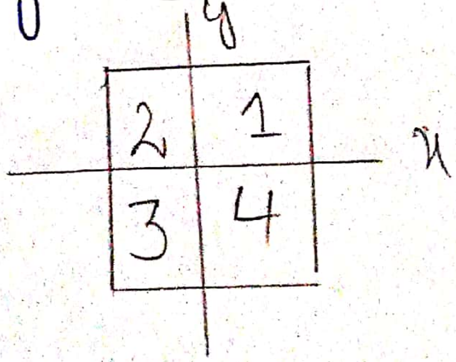
$M_y = -11.8563$

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

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

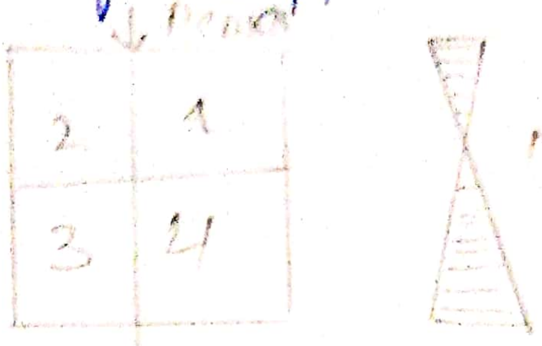
$$= 882628\ Nm^2$$

Sign Convention.

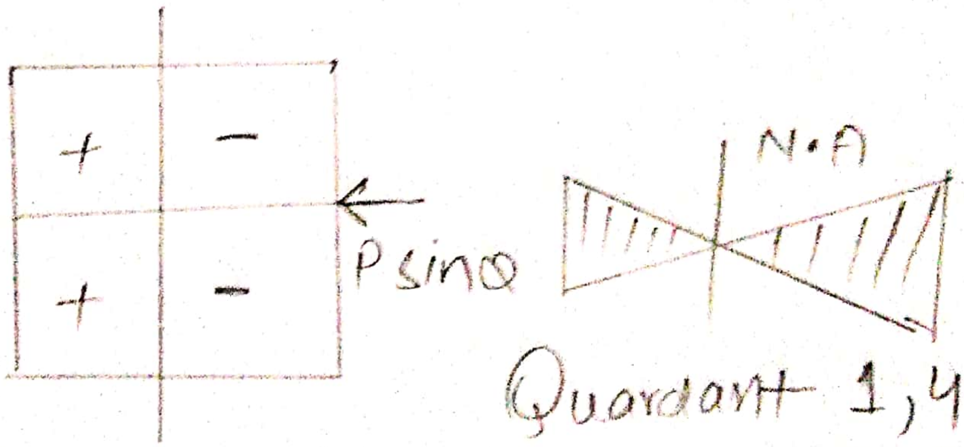


P.T.O

if we Take Compression as a Negative & Tension as positive & The beam is a Simply Supported -



Quardant 1,2 -ive.
Quardant 3,4 +ive.



Quardant 1,4 -ive
Quardant 2,3 +ive

incase of unsymmetrical loading the Neutral axis lies at an angle of "α" the principal axis & the algebraic sum of stress at N.A is zero.

P.T.O

$$\sigma = \frac{m\cos\theta\, y}{I_z} + \frac{m\sin\theta}{I_y} z \longrightarrow (1)$$

in this Case, N.A passes through 2,4, so.

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

Let Cosider a point 'A' on N.A Lies in quadrants 3, where.

- Bending stress due to $P\sin\theta$ is Tensile.
- Bending stress due to $p\sin\theta$ is Tensile.

eq (1)

$$\Rightarrow 0 = -\frac{M\cos\theta\, y_A}{I_z} + \frac{m\sin\theta}{I_y} z_A$$

$$\Rightarrow \frac{M\cos y_A}{I_z} + m\frac{\sin\theta}{I_y} z_A.$$

$$\frac{y_A}{z_A} = \frac{I_z}{I_y}\frac{\sin\theta}{\cos\theta} \Rightarrow \tan\alpha = \frac{I_z}{I_y}\tan\theta$$

eqn (II)

P.T.O

Now put values of I_z, I_y & Q in equ (II).

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

$$\Rightarrow \tan\alpha = \frac{3.8125\times10^{-5}}{1.25\times10^{-5}}(\tan 30^\circ)$$

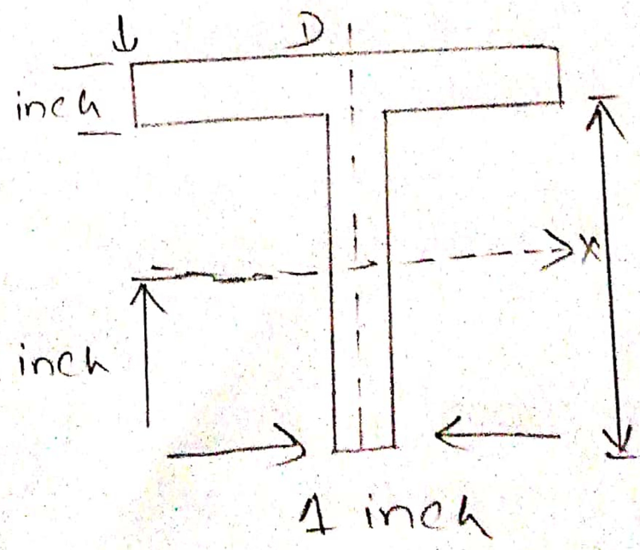
$$\tan\alpha = -14.4129.$$

$$\alpha = \tan^{-1}(-14.4129)$$

$$\alpha = 1.5^\circ.$$

$$\alpha = 1^\circ\ 30'\ 5''.$$ Ans:

Q NO # 02
part (B).



L = 16 ft.

$I_x = 112.6 \text{ inch}^4$

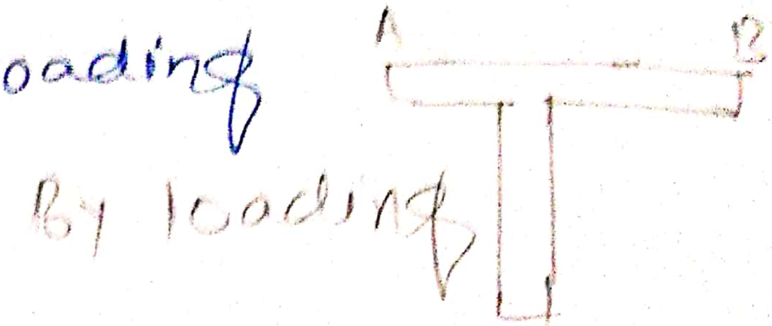
$I_y = 18.7 \text{ in}^4$

$\delta_c = 12000$ psi

$\delta_t = 5000$ psi.

Sol:-

By loading



Hfer we can judge that maximum compression would.

$$M_y = 48P \sin 60$$

Now

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

$$\Rightarrow 1200 = \frac{48P \cos 60^\circ \times 3.07 +}{112.6}$$

P.T.O

$$\frac{48p \sin 60 \times 30}{18.7}$$

Solving the equation

$\Rightarrow$ $p = 1638.6 \text{ lb}$

Now;

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

$$5000 = 48p\cos 60 \times (593) + \frac{48p\sin 60 \times 0.5}{18.7}$$

Solving the equation

$p = 2104.9 \text{ lb}$

So the maximum load p applied should 1638.6 lb.