→ M. Amir Hamza

→ 7986

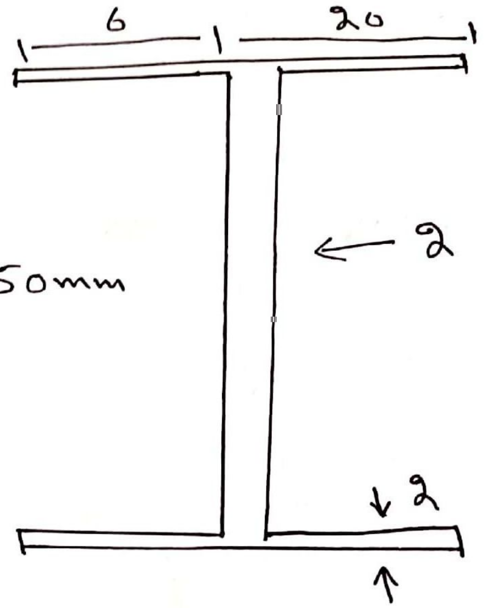
→ MOS=2

→ Final Paper

→ 23-06-2020

→

Ans:->



Required:->

Location of shear centre?

Solution:->

As we know that

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

and

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

$$\Rightarrow 2\left(\frac{25(2)^3}{12} + (20\times2)(25)^2\right) + \left(\frac{2(50)^3}{12} + 0\right)$$

$$I = 50034.66 + 20833$$

$$I = 70867.99\ mm^4$$

(P-T-O) =>

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

So

Shear Centre

<u>Answer:</u> $\boxed{e = 11.02 \text{ mm}}$ Ans

=>

Q No#1:-> (Part - B)

Ans:->

Given Data:->

Height = 26 ft

Tengential stress = 6000 psi

Specific weight of water = 62.4 lb/ft³

Required Data:->

Thickness of wall of water tank = t = ?

Solution:->

$$P = \gamma h$$

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

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

Putting values

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

P-T-O =>

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

Answer:->

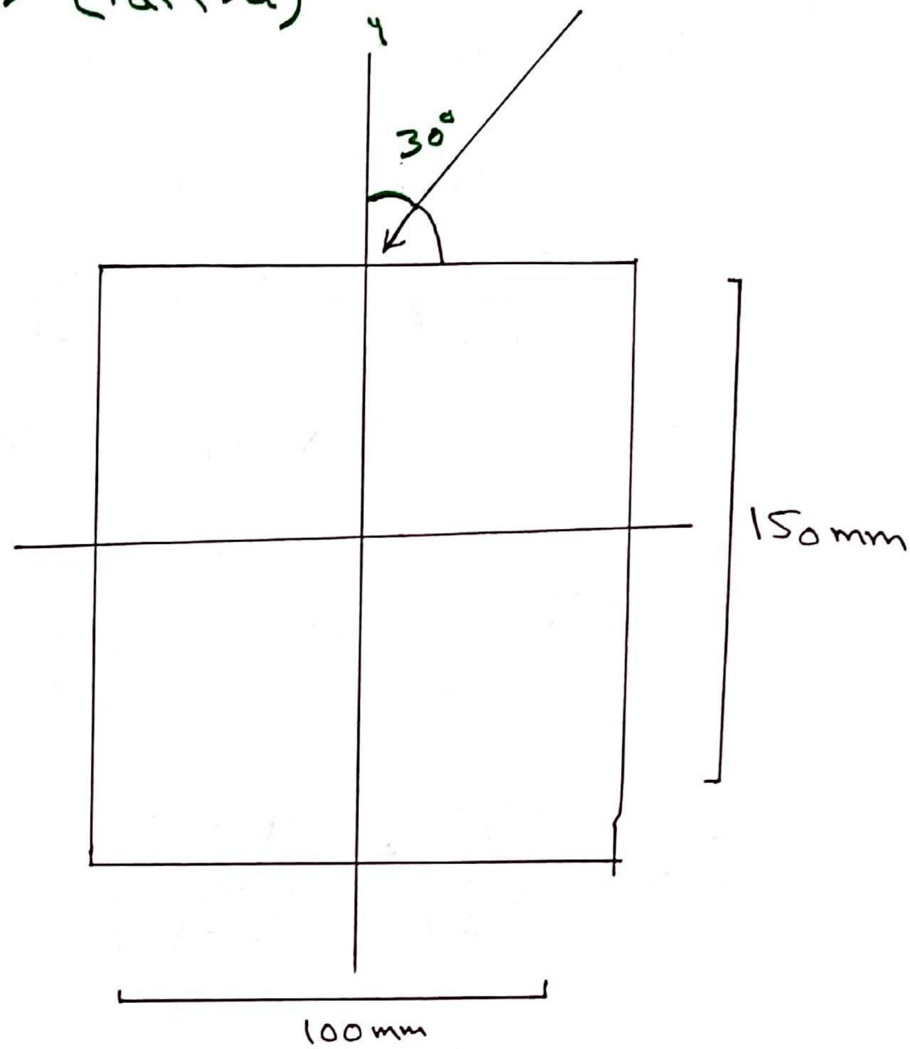
$$\boxed{t = 0.24 \text{ inch}}$$

=>

Q No 2 :→ (Part : a)

(5)

Ans :→



Moment of Inertia

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

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

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

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

$$\sigma = \frac{M_z Y}{I_z} + \frac{M_y Z}{I_y}$$

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

P-T-O ⇒

where

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

$$= 12 \cos 30^\circ$$

$$\boxed{M_z = 1.8510}$$

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

$$12 \sin 30^\circ$$

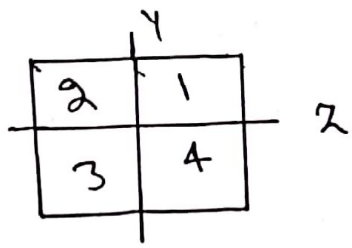
$$\boxed{M_y = -11.8563}$$

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

$$\sigma = \frac{1.851}{2.812 \times 10^{-5}} + \left(\frac{-11.8563}{1.25 \times 10^{-5}}\right)$$

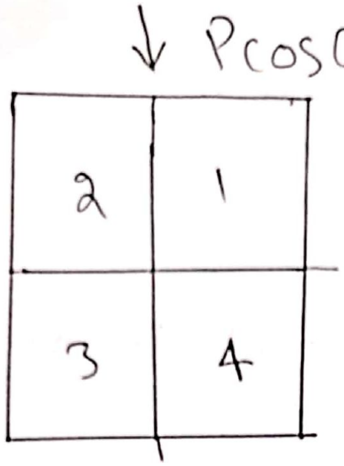
$$\boxed{\sigma = 882678 \ N/m^2}$$

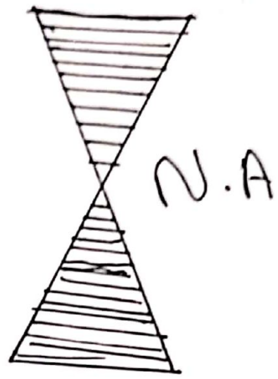
Sign Convention



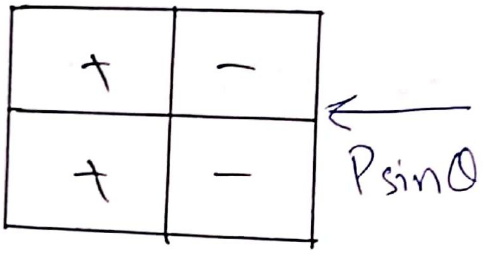
⇒ If we take compression as negative and tension as positive and the Beam is simply supported.

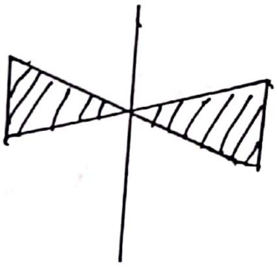
(P-T-O) ⇒





Quardant 1.2 — ive
" 3.4 + ive





Quardant 1.4 − ive
" 2.5 + ive

In case of Unsymetrical loading the Neutral axis lines of an angle of "X". The principle axis and the algebric sum of stress at N.A is Zero

$$\sigma = \frac{M\cos + y}{I_z} + \frac{M\sin\theta}{I_y} - z \quad \text{—— (1)}$$

in this case N.A passes through 2.4

(P − T − O) =>

4

(8)

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

let consider a point "A" on N.A lies in Quardent 2, where

- Bending stress due to $P\cos\theta$ is compressive
- Bending stress due to $P\sin\theta$ is tensile.

eq (1)

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

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

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

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

Now Put values of $I_z \cdot I_y$ and θ in eq (2)

(P-T-O) ⇒

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

$$\Rightarrow \frac{2.8125\times10^{-5}}{1.25\times10^{-5}}\tan 30^\circ$$

$$\tan\alpha = -14.4129$$

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

$$\alpha = 1.5^\circ$$

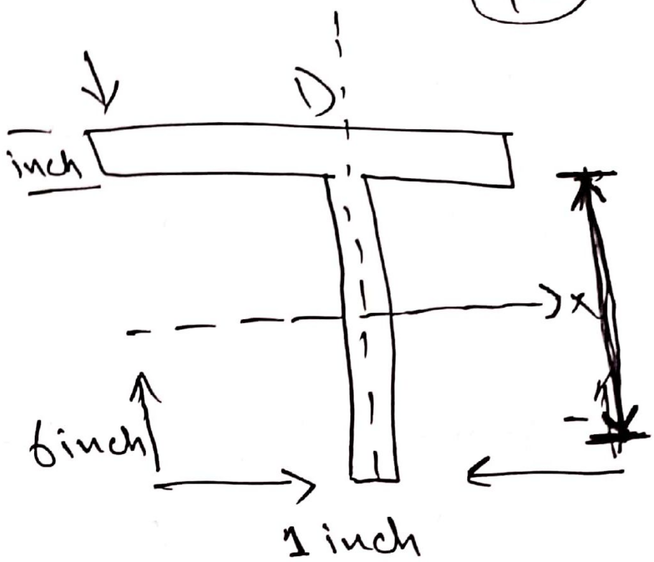
Answer

$$\boxed{\alpha = 1^\circ 30' 5''}$$

Ans

QNo#2:(Par-2)

Given Data:->



$L = 16\ ft$

$I_x = 112.6\ inch^4$

$I_y = 18.7\ in^4$

$\delta_e = 12000\ PSi$

$\delta_t = 5000\ Psi$

Solution:->

By looking

Figer we can judge that

manimum compression would

accure on a and tension c at B.

There will tension as well a compression

which will reduce that effect of

each other so we will calcutate

stress at A and c

so

$$\delta A = \frac{M_x y}{I_x} + \frac{M_y x}{I_y}\ \text{compression}$$

Now Mx and My

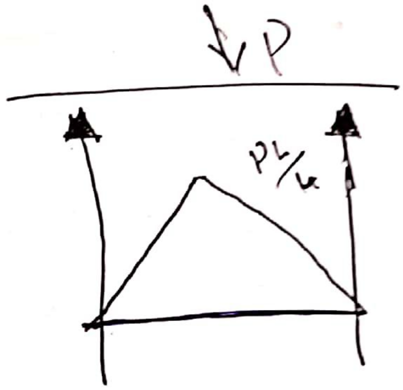
So

(P-T-O)=>

11

$$M_x = \frac{P\cos 60 \times (16 \times 12)}{4}$$

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



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

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

Now

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

$$\frac{48P\cos 60^\circ \times 3.07}{112.6} + \frac{48P\sin 60 \times 3}{18.7}$$

solving the equation

$$\Rightarrow \boxed{P = 1638.6\ lb}$$

Now

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

$$5000 = \frac{48P\cos 60 \times (5.93) + 48P\sin 60 \times 0.5}{18.7}$$

(P-T-O) $\Rightarrow$

Solving the equation

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

So the maximim load P applied should 1638.6

x ———————— x

QNo3:->

Ans:->

Given Data:->

length = 10

$E = 10.3 \times 10^6$

$b = 0.75$

$h = 2$

Factor of safety = 2

Required:->

(a) safe load at hinged = ?

(b) safe load at fixed = ?

Solution:->

(a) For hinged columns.

$Le = L$

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

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

$$= \frac{(1)^2 (10.3 \times 10^6)(0.5)\pi^2}{(10 \times 12)^2}$$

(P-T-O) =>

$$P_{cr} = \frac{5077 6940}{14400}$$

$$= 3526.176 \, lb.$$

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

$$= \frac{3526176}{2}$$

$$\boxed{= 1763.088 \, lb}$$

ⓑ **strut act colum :->**

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

$l_e = 10/2 = 5 ft.$

$$I = I_y = \frac{2 \times (075)^3}{12} = 0.07 \text{ in}^4$$

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

$$= \frac{(1)^2 (10.3 \times 10^6)(0.07)(3.14)^2}{(5 \times 12)^2}$$

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

(P-T-O) =>

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

$$P_{cr} = 1974.658 \text{ lb}$$

$$P \text{ safe load} = \frac{1974.658}{2}$$

$$\boxed{= 98.7.3293 \text{ lb}}$$