FINAL EXAM

NAME	SABI-UL-HASSAN
ID	7932
SECTION	B
SUBJECT	MOS II
DEPARTMENT	BE (C)
TEACHER	Engr. Muhammad Saqib
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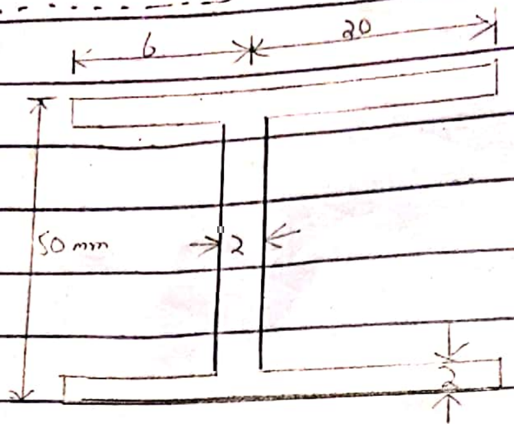
SEMESTER	4th

QUESTION No 2(a)(CLO 2)

Determine the location of the the centerline dimensions?



To Find :~

Location of the shear center

Solution :~

As we know that

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

Then

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

putting values in equation

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

$$I = 65034.66 + 20833.33$$

$$I = 85867.99$$

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Now,

$$e = \frac{2(50)^2(26)^2}{4(85867.99)}$$

$$e = 9.8406 \ m$$

RESULT.

The location of shear centre $= e = 9.8406 \ mm$

QUESTION No 1 (b)

DETERMINE the thickness of ---

------ weight of water is $62.4 \ lb/ft^3$

TO FIND :~

Thickness $= t = ?$

GIVEN THAT :~

$h = 26ft \times 12$

Tangential stress $= 6000 \ Psi$

Specific weight $= 62.4 lb/ft^3 = 62.4/12^3$

Diameter $= d = 22ft \times 12$

SOLUTION :~

As we know that

$$\sigma_t = \frac{PD}{2t} \quad -(i)$$

where pressure exerted by water is $P = \gamma h$

So, we get

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

then, after cross multiplication

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

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

$$t = \frac{0.036 \times 312 \times 264}{6000 \times 2}$$

$$t = 0.247''$$

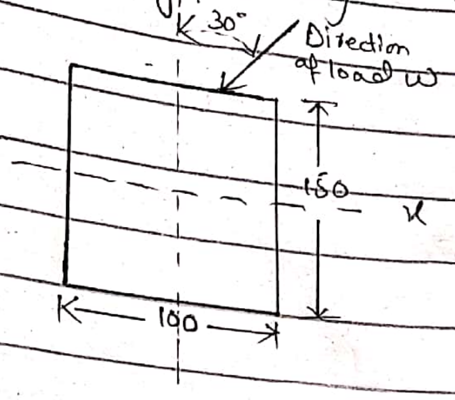
$$t = 0.0205 ft$$

HENCE

The thickness of water tank $= t = 0.0205 ft$

QUESTION No 2(A) (CLO-3)

The 100 by 150 mm wooden ...
... the weight of the beam?



To FIND :~

$$\sigma_x = \frac{M_x y}{I_x}$$ (Bending Stress)

$$\sigma_x = \frac{M_y x}{I_y}$$ (Bending stress)

Location of Neutral axis = ?

Total bending stress $= \sigma = \sigma_x + \sigma_y$

GIVEN THAT :~

Load = 4KN = 4000 N

$\theta = 30°$

Length = 3 m

SOLUTION :~

$$M_x = P \cos \theta \cdot y$$

$$= 4000 \cos(30)° \times 0.075$$

$$\boxed{M_x = 259.8 \text{ Nm}}$$

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$$M_y = P\sin\theta\, x$$

$$\Rightarrow M_y = 4000 \times \sin 30^\circ \times 0.05$$

$$\boxed{M_y = 100\ Nm}$$

Now

$$I_x = \frac{bh^3}{12}$$

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

$$\boxed{I_x = 2.8125 \times 10^{-5} m^4}$$

And

$$I_y = \frac{hb^3}{12}$$

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

$$\boxed{I_y = 1.25 \times 10^{-5} m^4}$$

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

$$\sigma_x = \frac{259.8}{2.8125 \times 10^{-5}}$$

$$\boxed{\sigma_x = 9.237\ MNm^{-2}}$$

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

$$\sigma_y = \frac{100}{1.25 \times 10^{-5}}$$

$$\boxed{\sigma_y = 8\ MNm^{-1}}$$

Now

Total bending stress $= \sigma = -\sigma_x + \sigma_y$

$$\sigma = -9.237 + 8$$

$$\boxed{\sigma = -1.237\ MNm^{-2}}$$

For Neutral axis

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

$$\tan\alpha = \frac{2.8125 \times 10^{-5}}{1.25 \times 10^{-5}} \times \frac{\cancel{1000}}{\cancel{2598}} \times \frac{3.46 \times 10^{3}}{2 \times 10^{3}}$$

$$\tan\alpha = 3.8925$$

$$\alpha = \tan^{-1}(3.8925)$$

$$\boxed{\alpha = 75.59^{o}}$$

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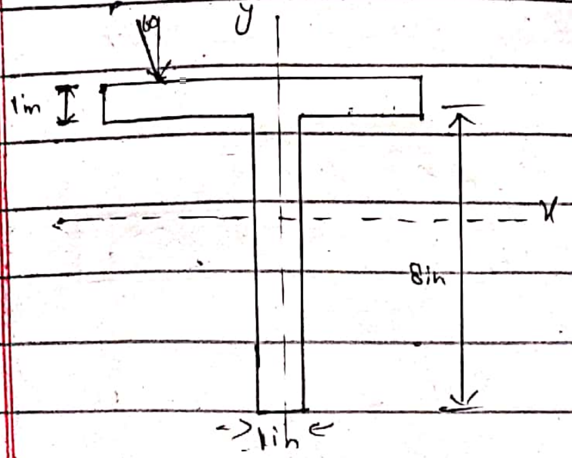
QUESTION No 2 (b)

The T section in fig 3 ...

.... not overstress the beam?



To FIND :~

Maximum load, $P = ?$

SOL :~

As we know that

$$M = \frac{Pl}{4}$$

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

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

Now we have to find stress at point A, B, C, D.

For Point A

$$\sigma = -\frac{M_x y}{\bar{I}_x} + \frac{M_y x}{\bar{I}_y}$$

$$= \frac{(48 P \cos 60)(3.07)}{112.6} - \frac{(48 P \sin 60)(3)}{18.7}$$

$$= -0.654p - 6.6p$$

$$= 7.2p \quad \text{Compression}$$

and

so Compression $\leq$ 12000 psi

$$12000 = -7.25p$$

$$\boxed{P = 1655.1 \text{ lb}}$$

For Point B

$$\sigma = -\frac{48 p \cos 60(3.07)}{112.6} + \frac{(48 p \sin 60)(3)}{18.7}$$

$$= -0.654p + 6.6p$$

$$= 6.01p \quad \text{Tension}$$

And

Tension $\leq$ 5000 psi

$$5000 = 6.01 p$$

$$P = \frac{5000}{6.01}$$

$$\boxed{P = 831.94 \text{ lb}}$$

We have consider minimum value of P so

$$\boxed{P = 831.94 \text{ Lb}}$$

For C point

$$\sigma = +\frac{(48p\cos 60)(3.07)}{112.6} + \frac{(48p\sin 60)(30)}{18.7}$$

$$= +0.654p + 6.6p$$

$$= 7.25p$$

And

Tension $\leq$ 5000 psi

$$5000 = 7.26P$$

$$\boxed{P = 689.65\ \text{lb}}$$

For Point D :-

$$\sigma = +\frac{(48p\cos 60)(3.07)}{112.6} - \frac{(48p\sin 60)(3)}{18.7}$$

$$= 0.654p - 6.6p$$

$$= -5.946p$$

And

Compression $\leq$ 12000 psi

$$12000 = -5.946P$$

$$\boxed{P = 2018.16\ \text{lb}}$$

We have considered minimum value of P so

$$\boxed{P = 689.65\ \text{Lb}}$$

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QUESTION No 03

A 10 ft long strut ____ and $E = 10.3 \times 10^6$?

To Find:-

Safe load $= P_{safe} = ?$

Given That:-

$L = 10ft$

$b = 0.75''$

$h = 2''$

Factor of safety $= 2$

$E = 10.3 \times 10^6$

Solution:-

Case I :-

Strut column act as hinged column about an axis perpendicular to the 2inch dimension then,

$$I = I_x = (0.75)(2)^3/12$$

$$= 0.5\ in^4$$

$Le = L$ (for hinged Ended column)

$$P_{cr} = n^2 \frac{EI\pi^2}{le^2}$$

$$P_{cr} = \frac{(1)^2(10.3 \times 10^6)(0.5)(3.14)^2}{(10 \times 12)^2}$$

$P_{cr} = 3526.17\ lb$

$$P_{SAFE} = \frac{P_{cr}}{\text{factor of safety}}$$

$$P_{SAFE} = \frac{3526.17}{2}$$

$P_{safe} = 1763.08\ lb$

CASE II

Column act as a fixed end about axis parallel to 2 inch ie y axis

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

$I_y = 0.07\ in^4$

Now for fixed Ended

$$Le = L/2$$

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

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

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$P_{cr} = 1974.65$ lb

For P_{safe} :-

$$P_{safe} = \frac{P_{cr}}{\text{factor of safety}}$$

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

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

In both case we take smaller value of P_{safe}

$P_{safe} = 987.32 < 1763.08$

The END