UMAR HADI

ID # 7974

Section # B

Subject # MOS II

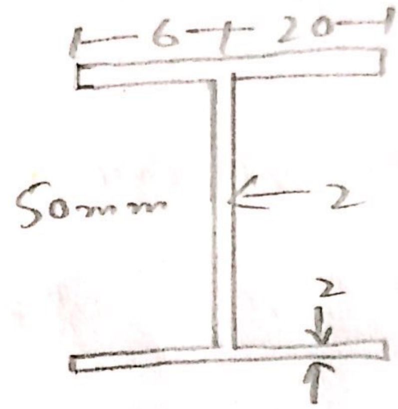
Submitted to # Engg Saqib

Date # 23-06-2020

QUESTION NO# 01

(a)

Ans:-



Required: location of shear stress.

Sol:- We know that

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

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

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

$I = 50034.66 + 20833$

$I = 70867.99 \, mm^4$

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

so shear center

$$\boxed{e = 11.02\, mm}$$

(2) QUESTION NO 1 part (b)

Ans:- (b) ⇒ Given Data :-

Height = 26ft

Stress limitted to = 6000psi

Specific weight of water = 62.4 lb/ft^3

Diameter Assumed 22 ft

⇒ Required :-

⇒ Thickness ?

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Solution:-

As pressure develope by water

$$P = \gamma h$$

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

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

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

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

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

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

$$6000 \times 2$$

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

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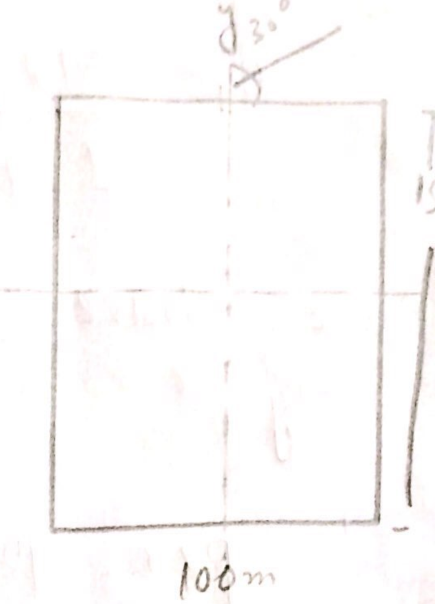
QUESTION # 02

Answer::



Part (a) ⇒

Given Data

$w = 4 KN$

$L = 3m$

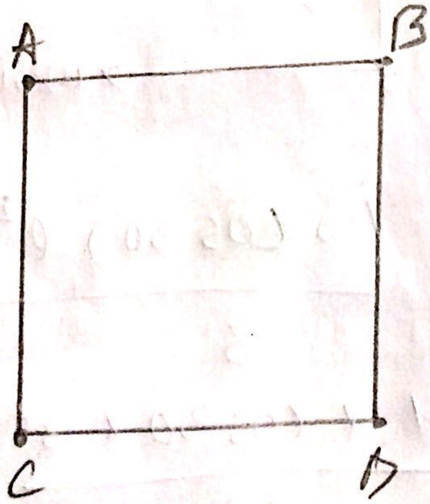
⇒ Required :-

Maximum Bending stress = ?

Solution:-

As the bending moment is maximum at extremes. So we would find stresses at.

A, B, C & D ∴ As shown



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As we know

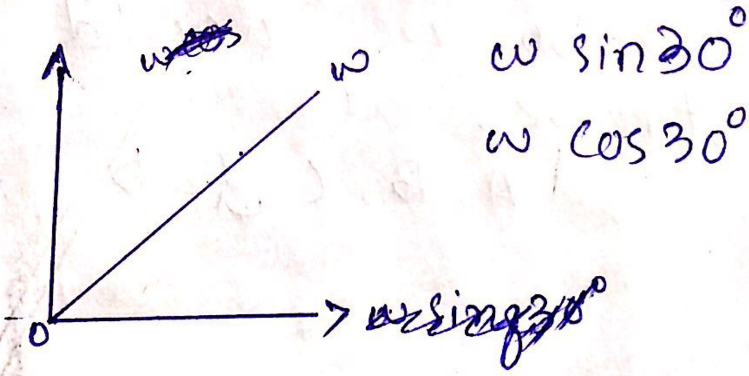
$$\sigma = \frac{M_x y}{I_x} + \frac{M_y x}{I_y}$$

we have to find M_x & M_y

As per question, M_x and M_y should be found at the mid.

we have $= \frac{wl^2}{8}$ — ①

Now find components of w in "x" & "y" directions



so $M_x = \frac{(w \cos 30)\, l^2}{8}$

$$M_x = \frac{4 \times \cos 30 \times 3^2}{8}$$

⑥ $\Rightarrow M_x = 3.9\ KN$

Now $M_y = \dfrac{(4 \times \sin 30) \times 3^2}{8}$

$M_y = 2.25\ KN$

"M_x" is causing compression at A & B and tension at C & D.

Now "M_y" is causing compression at B and D, tension at A and C.

$\Rightarrow$ Now I_y and I_x.

$I_x = \dfrac{bh^3}{12} = \dfrac{0.1 \times 0.15^3}{12}$

$$\boxed{I_x = 2.815 \times 10^{-5}\ m^4}$$

$I_y = \dfrac{hb^3}{12} = \dfrac{0.15 \times 0.1^3}{12}$ $\boxed{= 1.25 \times 10^{-5}\ m^4}$

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Now stresses at Extreme fibers.

$$\sigma_x = \frac{M_x y}{I_x} = \frac{3.9 \times 0.75}{2.815 \times 10^{-5}}$$

$$\sigma_x = 10390.7 \ kN/m^2$$

$$\sigma_y = \frac{2.25 \times 0.05}{1.25 \times 10^{-5}}$$

$$\sigma_y = 9000 \ kN/m^2$$

(lets take Tension positive + ↑)

$$\text{Stress at A} = -\frac{M_x y}{I_x} + \frac{M_y (x)}{I_y}$$

$$= -10390.7 + 9000$$

$$= -1390.7 \ kN/m^2$$

(thats Comp)

$$\text{at B} = \frac{M_x y}{I_x} + \frac{M_y x}{I_y}$$

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(10)

$= -10390.7 - 9000$

σ at $B = -19390.7\ KN/m^2$ (comp

Now

$\Rightarrow$ stresses at $C = \frac{M_x y}{I_x} + \frac{M_y x}{I_y}$

$= 10390.7 + 9000$

$= 19390.7\ \frac{KN}{m^2}$ (Ten

stresses at $D = \frac{M_x y}{I_x} + \frac{M_y x}{I_y}$

$D = 10390.7 - 9000$

$D = 1390.7\ \frac{KN}{m^2}$

(tension)

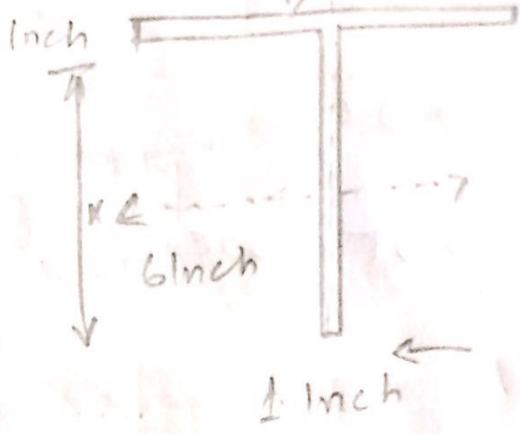
So the maximum stresses are on B and C

B is under expression of the same value.

(11) Part (b) QUESTION # 02

(a)

Given :-



$L = 16 ft$

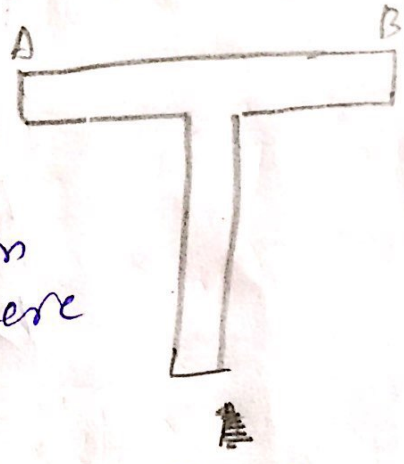
$I_x = 112.6 \ inch^4$

$I_y = 18.7 \ in^4$

$\delta_c = 12000 \ psi$

$\delta_t = 5000 \ psi$

Solution :-



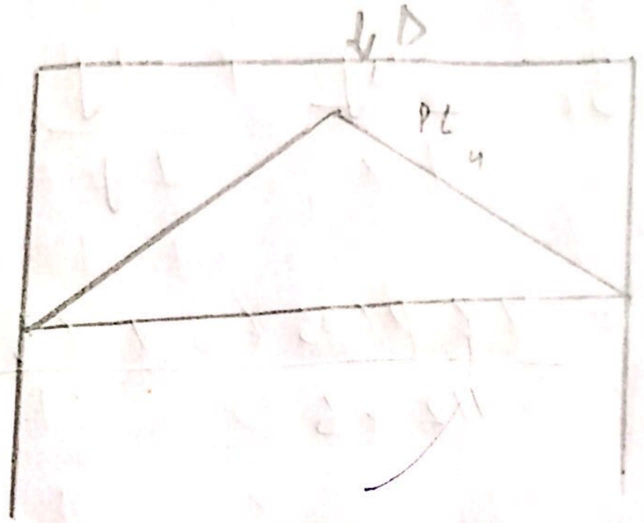
By the figure. maximum compression would occur on A and maximum tension at C and B. so there will be tension and compression as well. which will cross/reduce each other so that will effect we will calculate stresses at A & C

(10)

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

$\sigma_C = \frac{M_x y}{I_x} + \frac{M_y x}{I_y}$ (Tensi

Now M_x & M_y



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

$M_x = 48 P \cos 60$

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

$M_y = 48 P \sin 60$

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

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QUESTION # 03 (11)

A 10ft long strut braced in the middle has a rectangular section of 0.75 in by 2 in. A bolt through each end secures the strut so that it acts as a hinged column about an axis perpendicular to the 2 in dimension .... Determine the safe load P about using a factor P load using factor of safty of 2 and $E = 10.3 \times 10^6$.

Solution *

Given Data :-

$h = 2$ inch

$b = 0.75$ inch

$E = 10.3 \times 10^6$

length = 10ft

factor of safety = 2

⇒ length of strut

Strut :- A compression member act as column. about

on axis perpendicular (2)
to the ~~dim~~ dimension

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

$l_e = L$ ∴ for hinged ended column

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

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

$P_{cr} = 3526.17$

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

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

$P_{safe} = 1763.08 \text{ lb}$

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Case II :-

column act as a fixed end about axis parallel to 2 in

i.e y axis

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

$$I_y = 0.07 \text{ in}^4$$

Now for Fixed ended

$l_e = l/2$

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

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

$\Rightarrow P_{cr} = 1974.65$ lb

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

$$= \frac{1974.65}{2}$$ (14)

$P_{safe} = 987.92$ lb

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

$P_{safe} = 987.32 < 1763.07$

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

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