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ID :- 7919

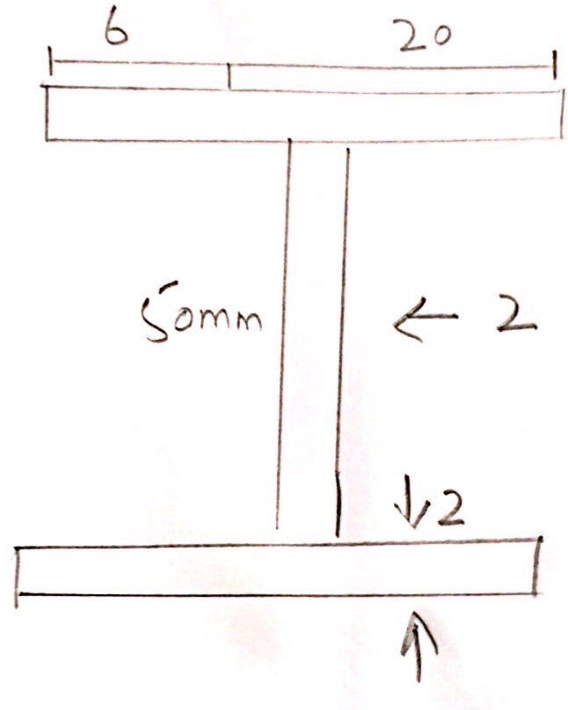
SECTION :- A

SUBJECT :- MOS II

SUBMITTED TO :- ENG SAQIB

Question : 1 (1)

(A) Determine the location of the shear centre of the beam having the cross sectional dimension .... Centre dimensions



Required:- location of shear centre

Solution:- As we know that $e = \frac{t_f h^2 b^2}{4I}$

and (2)

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

$$= \left[\frac{26(2)^3}{12} + (20\times12)(25)^2\right] + \left[\frac{2(50)^3}{12} + 0\right]$$

$$I = 50034.66 + 20833$$

$$I = 70867.99 \text{ mm}^4$$

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

So Shear Centre $e = 11.02$ mm

— x ——— x ——— x

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(3)

Q No 1

Part (B)

Data:-

$H = 26\ ft$

$D = 22\ ft$

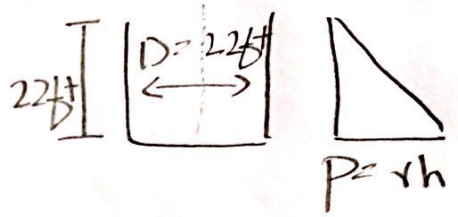
=> tangential stress = 6000 psi

=> Specific weight of water tank = $62.4\ lb/ft^3$

we have to find the thickness = ?

Solution:- The pressure develope by water $P = \gamma h$

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



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

(4)

$$t = \frac{\gamma h D}{64 \times 2}$$

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

$$t = 0.24''$$

——X ——X ——X

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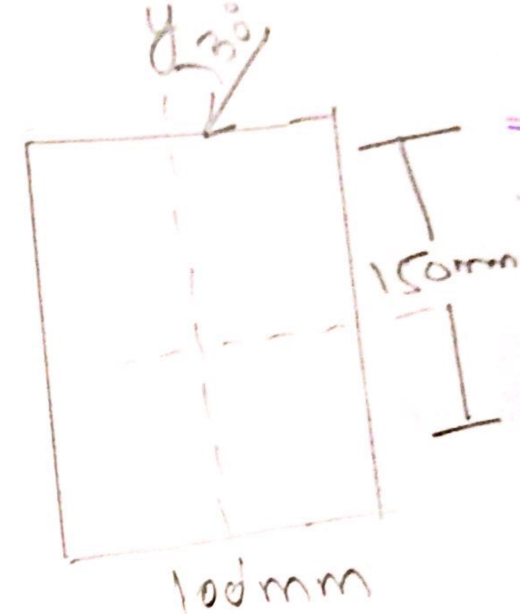
Q No 2 (5)

PART (A) :-

Given data

w = 4 kN/m

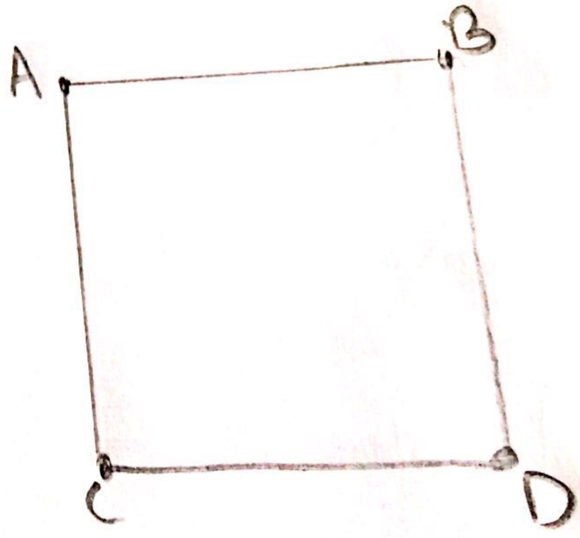
L = 3 m



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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(6)

As we know

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

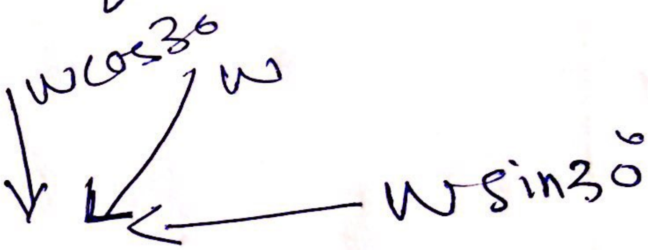
we have to find M_x & M_y

As per Question the M_x & M_y should be found at the mid.

As for simply supported we have

$$M_{mid} = \frac{Wl^2}{8} \rightarrow (1)$$

Now we have to find the exponents of W in x and y direction



So $M_x = \frac{(W\cos 30) \times 12}{18}$

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$\Rightarrow \quad M_x = \frac{(4 \times \cos 30) \times 3^2}{(7)}$

$$\boxed{M_x = 3.9 \text{ KN-m}}$$

Now

$$M_y = \frac{(4 \times \sin 30) \times 30^2}{8}$$

$$\boxed{M_y = 2.25 \text{ KN-m}}$$

M_x is cousing compression at A and B tention at C & D. M_y is causing compression at B and D tention at A and C

Now I_x and I_y

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

$$\Rightarrow 2.815 \times 10^{-5} \text{ m}^4$$

$$I_y = \frac{hb^3}{12} = \frac{0.15 \times 0.13}{12}$$

$$\Rightarrow 1.25 \times 10^{-5} \text{ m}^4$$

Now (8)

Stresses at extreme fibers

$$\sigma_x = \frac{M_x y}{I_x} = \frac{3.9 \times 0.075}{2.815 \times 10^{-5}}$$

$$\boxed{\sigma_x = 10390.7 \text{ KN/m}^2}$$

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

$$\boxed{\sigma_y = 9000 \text{ KN/m}^2}$$

Now (taking tension +ve)

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

$$= -10390.7 + 9000$$

$$= -1390.7 \text{ KN/m}^2 \text{ (comp)}$$

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

$$= -10.390.7 - 9000$$

$$\boxed{\sigma \text{ at } B = -19390.7 \text{ KN/m}^2} \text{ Comp}$$

Now

(9)

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

$= 10390.7 + 9000$

$= 19390.7$ KN/m² (Tension)

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

$= 10390.7 - 9000$

$= 139.7$ KN/m² (Tension)

So the maximum stresses are B & C

B is under compression of 19390.7 KN/m² and C is under tension of the same value

QNo2 10

PART o-(b)

Given data

$L = 16ft$

$I_x = 112.6 in^4$

$I_y = 18.7 in^4$

$\sigma_c = 12000 psi$

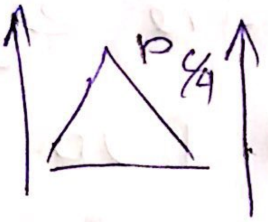
$\sigma_T = 5000 psi$

Solution- By looking to the figure to we can Judge that max compression would occur on A and P max tension at c and B there will be tension as compression which will reduced that effects of each other calculate stress A and c

$$\sigma A = \frac{M_x y}{I_x} + \frac{M_y x}{I_y} \text{ (comp)}$$

$$\delta = \frac{M_x y}{I_x} + \frac{M_y x}{I_y} \quad \text{(Tention)}$$

Now M_x & M_y



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

$M_y = 48 P\sin 60$

Now

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

$$1200 = \frac{48 P\cos 60 \times 30.07}{112.6}$$

$$\frac{48 P\sin 60^\circ \times 3}{18.7}$$

Solving the equation Now

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

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$$5000 = \frac{48\overset{(12)}{P}\cos 60 \times 5.93 + 48P\sin 60 \times 0.5}{18}$$

Solving the equatim

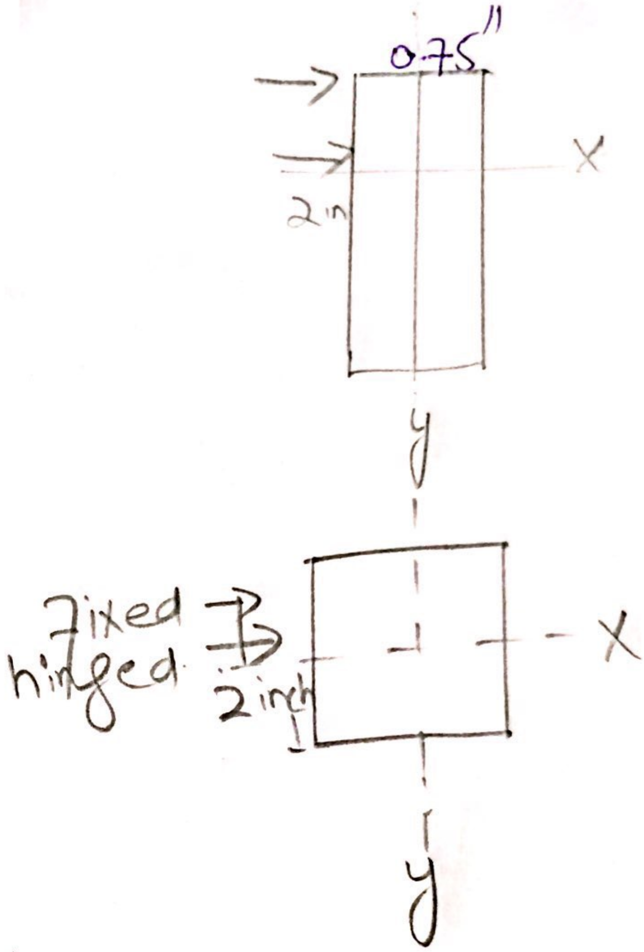
$P = 2104.9\,lb$

So the maximum load "p" applied should be 1638.6 lbs

— x ———— x ———— x

Q3 :-

13



Given DATA:

Length, L = 10 ft

Breath, b = 0.75"

height, h 2"

factor of safety = 2

E = 10.3 x 10^6

Required DATA:

Safe load = Psafe = ?

Solution :- 14

CASE 1 :

Struct column act as a hinged column about an axis perpendicular to the 2in dimension then

$I = I_x = (3/4)(2)^3 = 0.5 \, in^4$

$l_e = L$ (for hinged ended column)

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

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

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

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

$$\Rightarrow P_{safe} = 1763.08$$

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CASE II

Coloumn act as fixed end about axis parrelel in 2in ie y axis

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

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

Now for fixed ended

$$L_e = L/2$$

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

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

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

For P safe,

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

$P_{safe}^{(16)} = \frac{1974.65}{2}$

$\Rightarrow P_{safe} = 987.32$ lb

IN both case ~~with~~ we take smaller value P_{safe}

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