Final term paper

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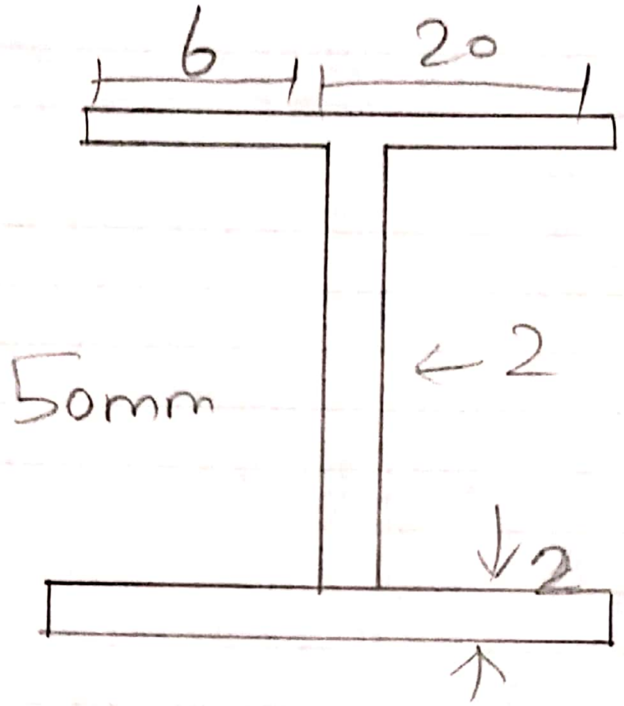
Subject :- MOS II

Question # 1
(a)

Sol:-



location of shear Centre

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

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

$$I = 50034.66 + 20833$$

$$I = 70867.99\ mm^4$$

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

$$e = 11.02\ mm$$

So, Shear Centre is

$$= 11.02\ mm$$

Question No #1

(b)

Determine the thickness of wall of a water tank .... 6000psi the specific weight of water is 62.4 lb/ft³?

Sol:-

Height, H = 26 ft

Diameter, D = 22 ft

Tangential Stress = δt = 6000 psi

Specific weight of water tank = 62.4 lb/ft³

We have to find the thickness = ?

The pressure develope by water = P = rh

4

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

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

$$2t \times \sigma_t = rhD$$

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

$$t = \frac{rhD}{\sigma_t \times 2}$$

$$t = \frac{\dfrac{(62.4)\times(26\times 12)\times(22\times 12)}{(12)^3}}{6000 \times \cancel{1}2}$$

$$t = 0.24 \text{ in}$$

Scanned with CamScanner

Question # 2

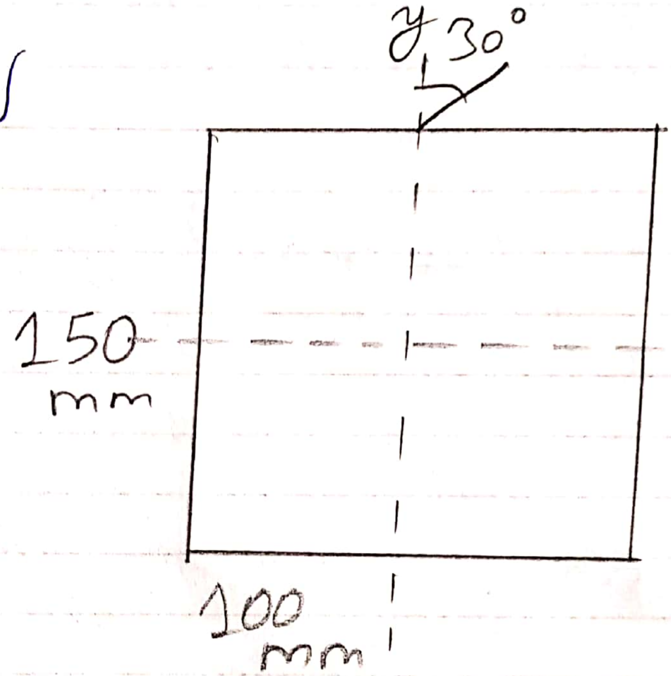
(a)

Sol:-

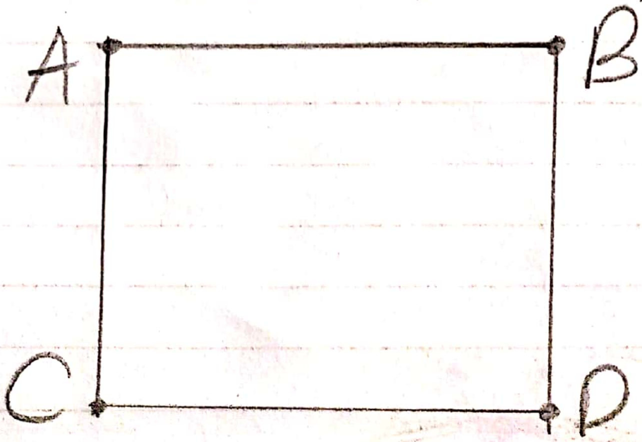
$W = 4\,KN$

$L = 3m$

Maximum Bending Stress = ?



As we know the bending moment is maximum at extreme. So we would find Stresses at A, B, C, D



As we know

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

We have to find M_x & M_y

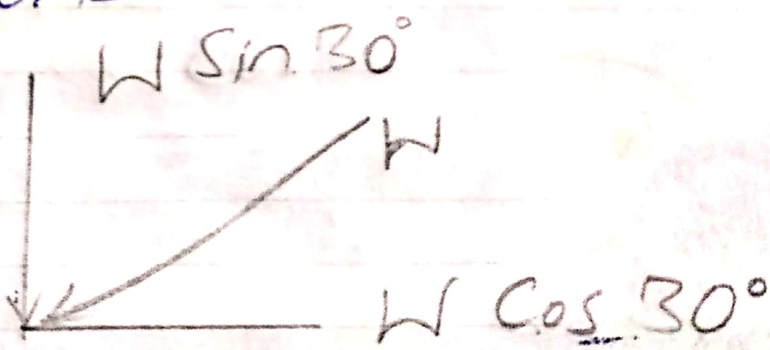
As per Question the M_x & M_y Should be found at the mid

As for Simply Supported we have

$$M_{mid} = \cancel{\frac{Wl}{8}} \rightarrow (i)$$

$$\frac{Wl^2}{8}$$

Now we have to find the components of W in x & y directions



So

$$Mx = \frac{(W \cos 30) \times l^2}{8}$$

$$Mx = 3.9 \text{ KN}$$

Now,

$$My = \frac{(4 \times \sin 30) \times 3\cancel{0}^2}{8}$$

$$My = 2.25 \text{ KN}$$

Mx is causing Compression at A & B tension at C & D

My is causing Compression at B & D tension at A & C

Now Ix & Iy

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

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

$$Iy = \frac{hb^3}{12} = \frac{0.15 \times 0.1^3}{12} = 1.25 \times 10^{-5} \text{ m}^4$$

Now Stresses at extreme fibers

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

$$\delta x = 10390.7 \ KN/m^2$$

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

$$\delta y = 9000 \ KN/m^2$$

Now (taking tension +ve)

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

$= -1390.7 \ KN/m^2$ (Comp)

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

$= -10390.7 - 9000$

$= -19390.7 \ KN/m^2$ (Comp)

Now

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

$= 10390.7 + 9000$

$= 19390.7 \text{ KN/m}^2$

(Tension)

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

$= 10390.7 - 9000$

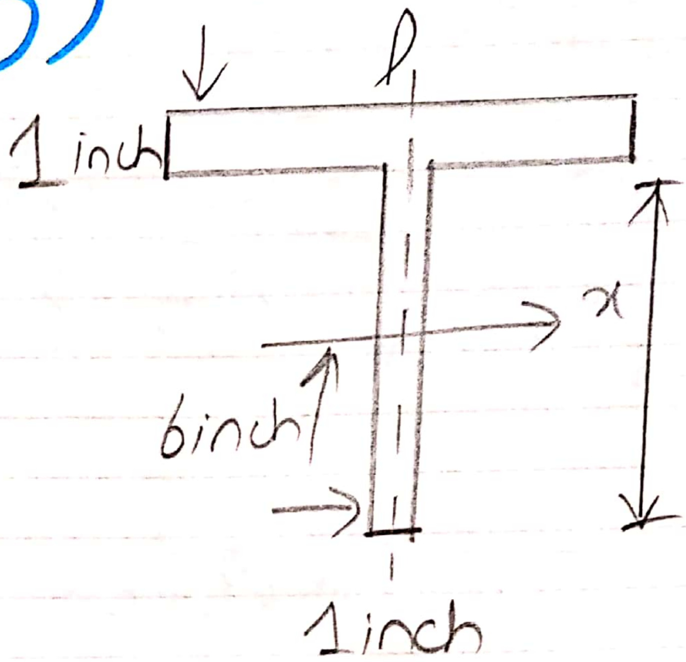
$= 1390.7 \text{ KN/m}^2$

(Tension)

So the maximum stresses are on B & C
B is under compression of 19390.7 KN/m^2 & C is under tension of the same value.

Question #2

(b)



Sol:-

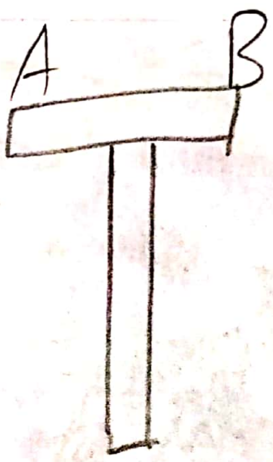
$L = 16\ ft$

$I_x = 112.6\ inch^4$

$I_y = 18.7\ in^4$

$\delta e = 12000\ Psi$

$\delta t = 5000\ Psi$



By looking

Figure we can Judge

that maximum Compression would accure on d and maximum tension c at B There will tension as well a compression which will reduce that effect of each other So we will Calculate Stress at A and C

So,

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

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

Now

M_x and 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,

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

$$12000 = \frac{48\,P\cos 60^\circ \times 3.07}{112.6} + \frac{48\,P\sin 60 \times 3}{18.7}$$

Solving Equation

$$P = 1638.6\ lb$$

Now,

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

$$5000 = \frac{48\,P\cos 60 \times 5.93}{112.6} + \frac{48\,P\sin 60 \times 0.5}{18.7}$$

Solving Equation

$$P = 2104.9\ lb$$

So,

The maximum load applied should be

$= 1638.6\ lb$

Question # 3

Sol:-

length, $L = 10ft$

Breadth, $b = 0.75''$

height, $h = 2''$

Factor of Safety $= 2$

$E = 10.3 \times 10^6$ Psi

Safe load $= ?$

Case I

Strut Column act as a hinged column about an axis perpendicular to the 2inch dimension.

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

$L_e = L$ (For hinged ended column)

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

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

$$P_{cr} = 3526.17$$

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

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

$$P_{safe} = 1763.08$$

Case II

Column act as a fixed end about axis parallel in 2inch dimension

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

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

Now,

$$L_e = L/2$$

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

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

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

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

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

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

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

$$P_{safe} = 987.32 < 1763.08$$