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I.D : 7497

Subject : MOS II

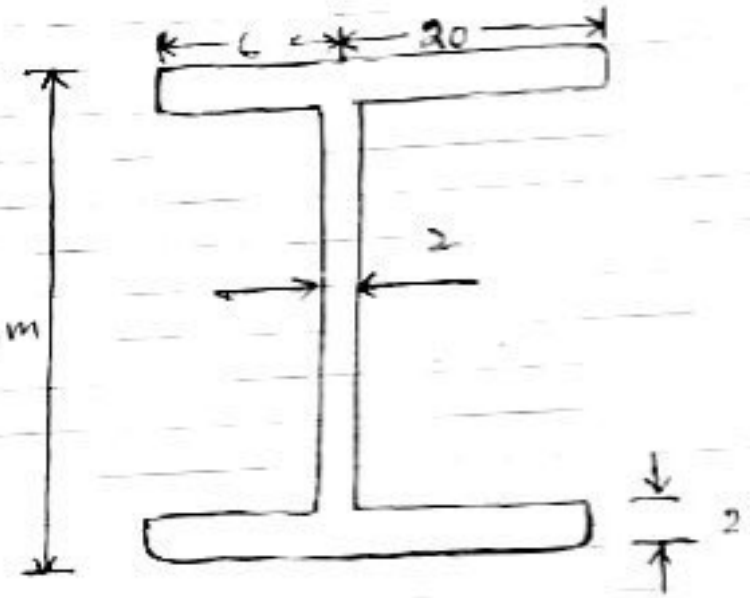
Semester : 10th

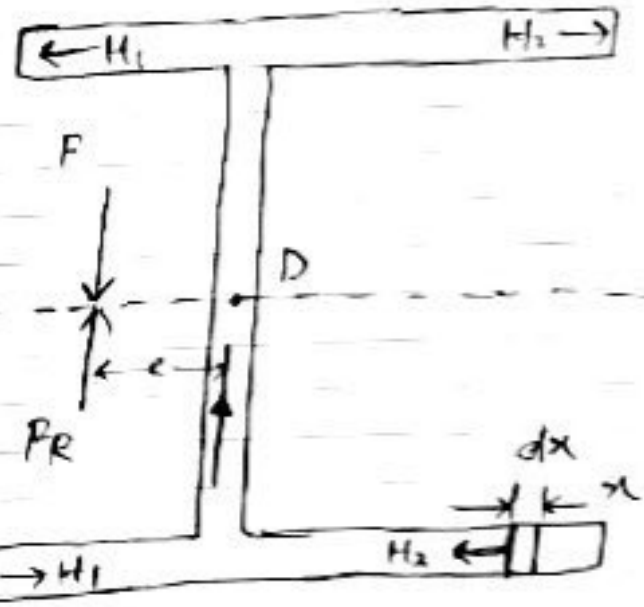
Teacher : Engr. Saqib

(4)

(1)

Ans:- (a) shear centre location





$$H_2 = \int q\, dA = \int \frac{F A \bar{y}}{I \cdot t}\, dA$$

$$= \frac{F}{I \cdot t} \int A\bar{y}\, dA$$

13 Thursday 256-109

(15)

$$= \frac{F}{I \cdot t} \int_0^{20} 2(20-x) \times (240 \times 2)\, dx$$

$$= \frac{F}{I \times 2} \left[19200 \right]$$

$$= 9600 \frac{F}{I}$$

$$H_1 = \frac{F}{2I} \int_0^{6} 2(6-x) \times 240 \times 2\, dx$$

$$\Rightarrow H_1 = \frac{F}{2I} \times 1728$$

$$H_1 = 864 \frac{F}{I}$$

Taking moment about point D

$$F_R \times e = 2(H_1 - H_2) \times 240$$

$$= 2\left(864 \times \frac{F}{I} - 96{,}000 \frac{F}{I}\right) \times 240$$

$$=$$

$\Rightarrow F_R \times e = [illegible] - \frac{419328F}{I}$

Here $F_R = F$

$\Rightarrow e = -\frac{419328}{I} \longrightarrow (A)$

$I = 2\left[\frac{26 \times 8^3}{12} + 52 \times 25^2\right] + \frac{2 \times 46^3}{12}$

$I = 86561.33 \text{ mm}^4$

$\Rightarrow e = -\frac{419328}{86561.33}$

$e = -4.84 \text{ mm}$

As the value is negative, it indicates that our assume direction of e is wrong and it is 4.84 mm to the right side.

Q1

Ans. (b)

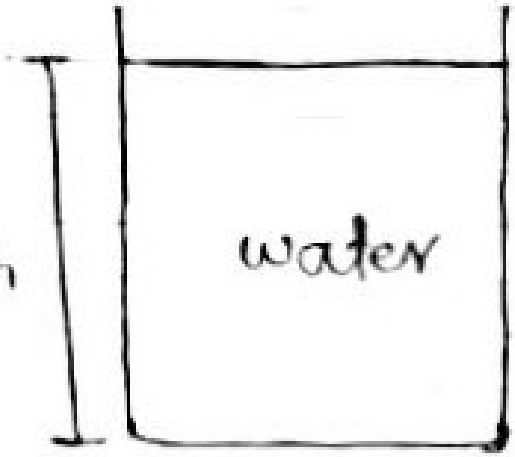
Given data

$h = 26\ ft = 312\ in$

$\sigma_t = 6000\ psi$

$\gamma_w = 62.4\ lb/ft^3 = 0.036\ lb/in^3$

Required, thickness $= t = ?$



As we know the

$p = \gamma h$ (for water)

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

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

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

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

$\Rightarrow \boxed{t = 9.38 \times 10^{-4} D} \rightarrow (i)$

Since D is not given in the Question, so t depends on D.

For Different value of D we would have different values of t.

e.g let take D = 22 ft

= 22 × 12

= 264 in

So $t = 9.38 \times 10^{-4} \times 264$

$t = 0.248$ inches

Also we can take any value of D & consequently calculate t.

Thursday 20

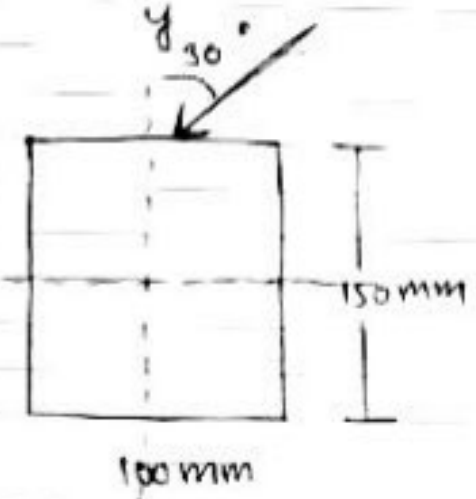
(2)

Ans:- (a)

Given data

$w = 4$ KN/m

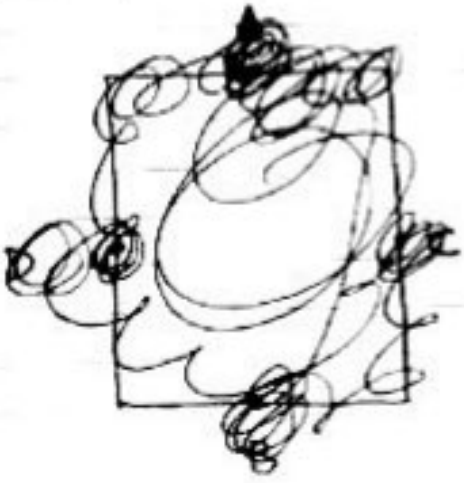
$L = 3$ m

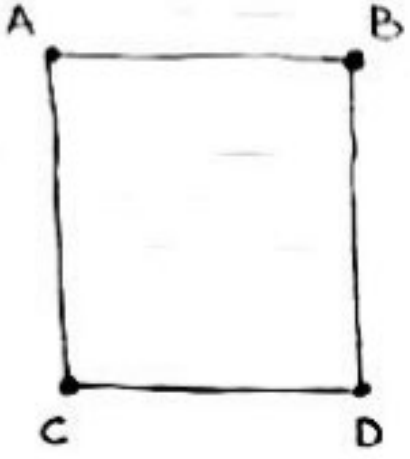


Required:-

Maximum Bending Stress = ?

Solution:- As the bending moment is maximum at extremes. So we would find Stresses at, A, B, C, & D. (as shown)





November 2018

Septem

WEEK 48

21 Friday

(4)

As we know

$$\sigma = \frac{M_{xy}}{I_x} + \frac{M_{yx}}{I_y}$$

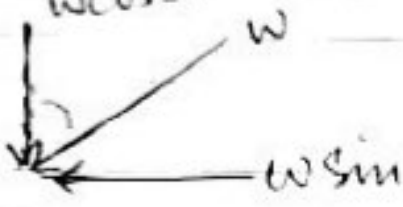
we have to find Mx & My

As per Question the Mx & My should be found at the mid.

As for Simply Supported we have

$$M_{mid} = \frac{wl^2}{8} \longrightarrow (1)$$

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



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

8.00 am

$$\Rightarrow \quad Mx = \frac{(4 \times 20\sin 30) \times 3^2}{8}$$

8.30

9.00

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

9.30

10.00 Now

$$My = \frac{(4 \times 5\sin 30) \times 3^2}{8}$$

10.30

11.00

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

11.30

Noon

12.30 Mx is causing compression at A & B tension at C & D

1.00

1.30 My is causing compression at B & D tension at A & C

2.00

2.30

3.00 Now Ix & Iy

3.30

$$Ix = \frac{bh^3}{12} = \frac{0.1 \times 0.15^3}{12} = 2.815 \times 10^{-5} \text{ m}^4$$

4.00

4.30

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

6.30

7.00 pm

Now stresses at extreme fibers

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

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

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

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

NOW (taking tension +↑)

Stress at A $= \frac{M_{xy}}{I_x} + \frac{M_{yx}}{I_y}$

$= -10390.7 + 9000$

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

at B $= \frac{M_{xy}}{I_x} + \frac{M_{yx}}{I_y}$

$= -10390.7 - 9000$

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

Now

Stresses at C = $\frac{Mxy}{Ix} + \frac{Myx}{Iy}$

= 10390.7 + 9000

= 19390.7 kN/m² (Tension)

Stresses at D = $\frac{Mxy}{Ix} + \frac{Myx}{Iy}$

= 10390.7 − 9000

= 1390.7 kN/m² (tension)

So the maximum stresses are on B & C.

B is under compression of 19390.7 kN/m

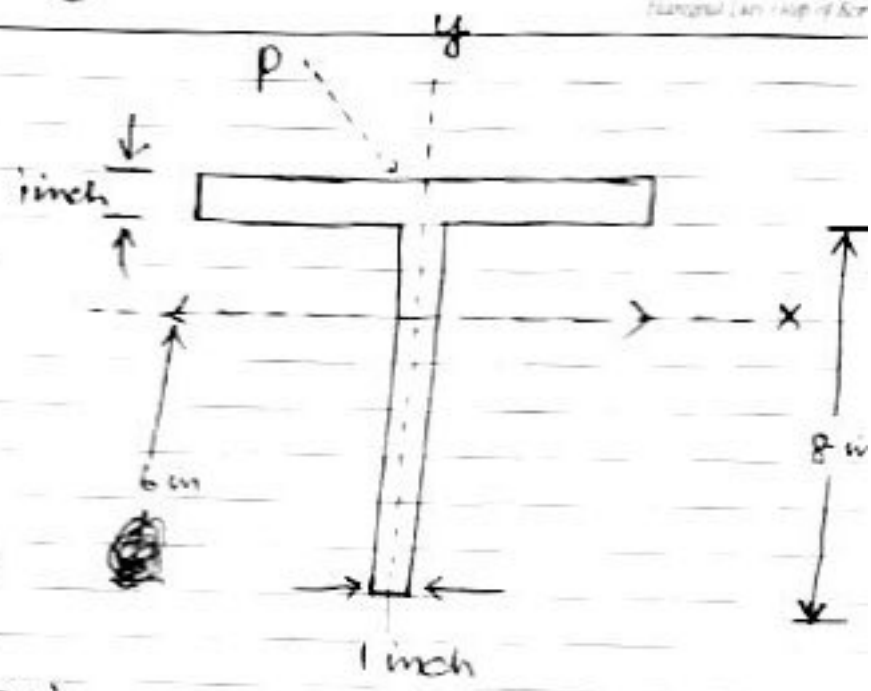
& C is under tension of the same value.

9 Tuesday

(8)

(2)

Ans:- (b)



Given

$L = 16$ ft

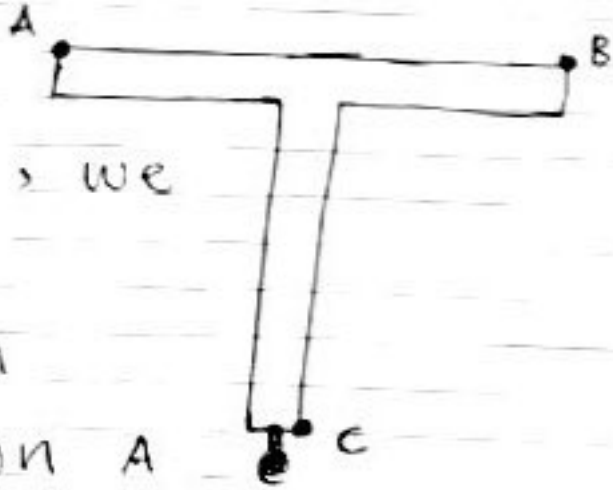
$I_x = 112.6$ in^4

$I_y = 18.7$ in^4

$\sigma_c = 12000$ psi

$\sigma_t = 5000$ psi

Sol:-



By looking to the figure, we can judge that maxim compression would occur on A & maximum tension at C at B there will be tension as well as compression, which will reduce the effect of each other. so we will calculate stresses

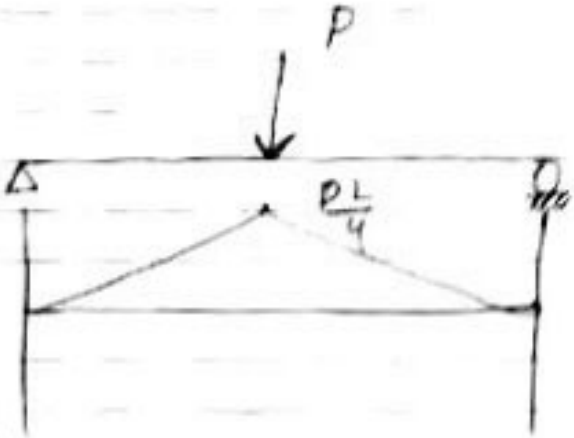
at A & C.

So

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

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

Now M_x & M_y



So

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

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

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

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

Now

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

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

Solving the equation

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

Now

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

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

Solving the equation

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

So the maximum load P applied should be 1638.6 lb

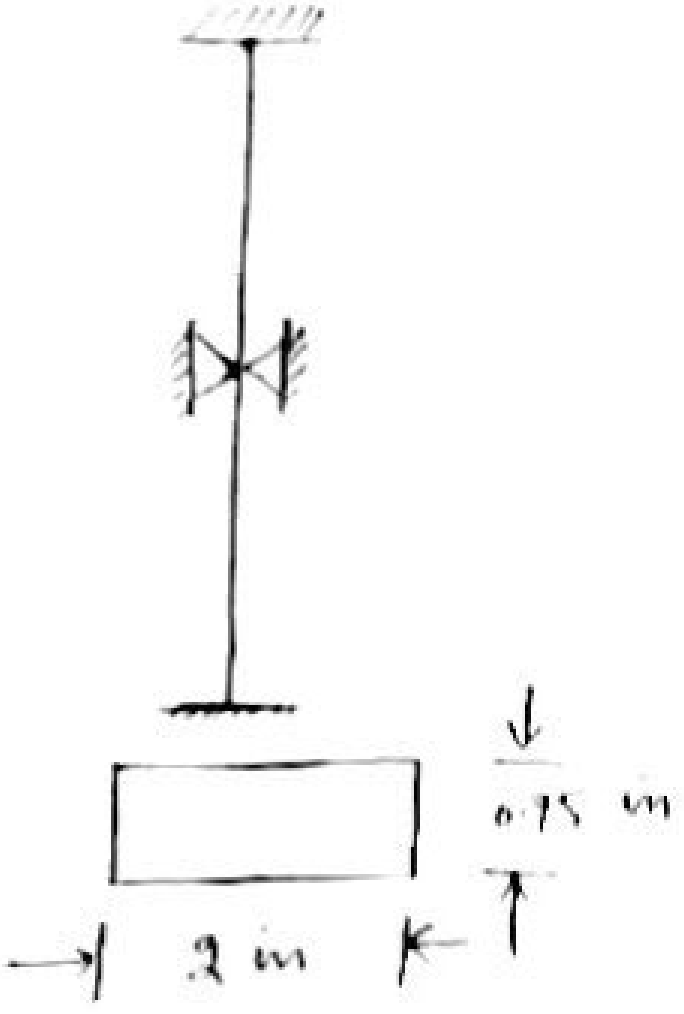
(3)

Ans:

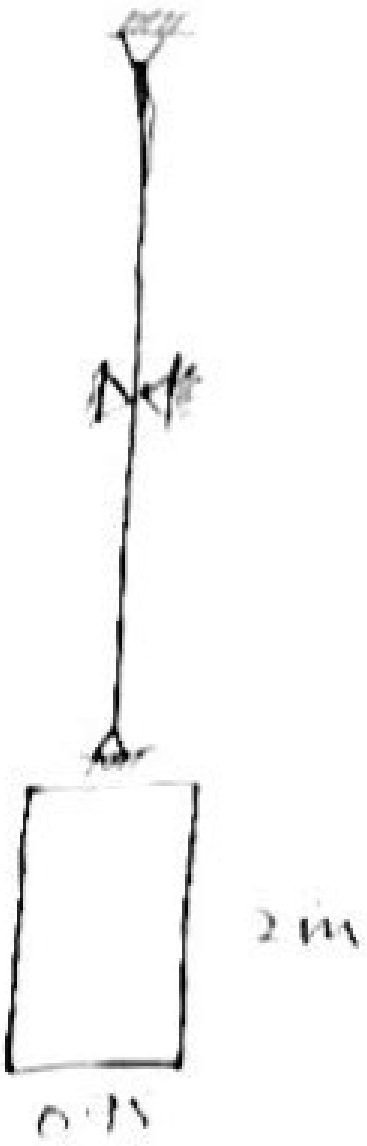
L = 10 ft

Sol: According to the given data & conditions of the supports, it is not clear that in which direction, the column will buckle, so we will Analyse both cases.

Case-I



Case-II



for Case-I

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

Here for case-I

$$n = 2, \quad E = 10.3 \times 10^6 \text{ psi}$$

$$I = \frac{0.75 \times 2^3}{12} = 0.5 \text{ in}^4$$

$$Le = 0.5L = 0.5 \times 16 \times 12$$

$$= 96 \text{ ft}$$

[redacted]

$$\Rightarrow P_{cr} = \frac{2 \times 3.14^2 \times 10.3 \times 10^6 \times 0.5}{96^2}$$

$$\boxed{P_{cr} = 11019.3 \text{ lbs} = 11.01 \text{ kip}}$$

NOW for Case-2

$$n = 1, \quad E = 10.3 \times 10^6 \text{ psi}$$

$$I = \frac{2 \times 0.75^3}{12} = 0.0703 \text{ in}^4$$

$$Le = L = 16 \times 12 = 192$$

$$\Rightarrow \quad P_{cr} = \frac{2 \times 3.14^2 \times 10.3 \times 10^6 \times 0.0703}{192^2}$$

$$\Rightarrow \quad [illegible]$$

$$\Rightarrow \quad \boxed{P_{cr} = 387.8 \text{ lbs} = 0.387 \text{ kips}}$$

SO

$$\boxed{\text{Safe load} = \frac{0.387}{2} = 0.2 \text{ kip}}$$