Name :- M. Zahoor

I.D # 7902

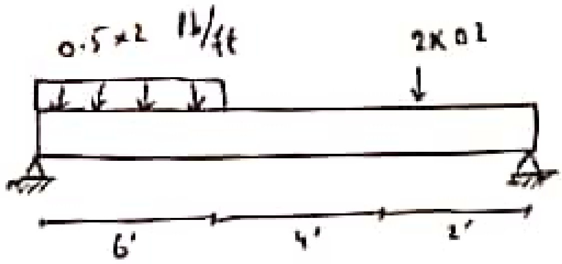
Section :- A

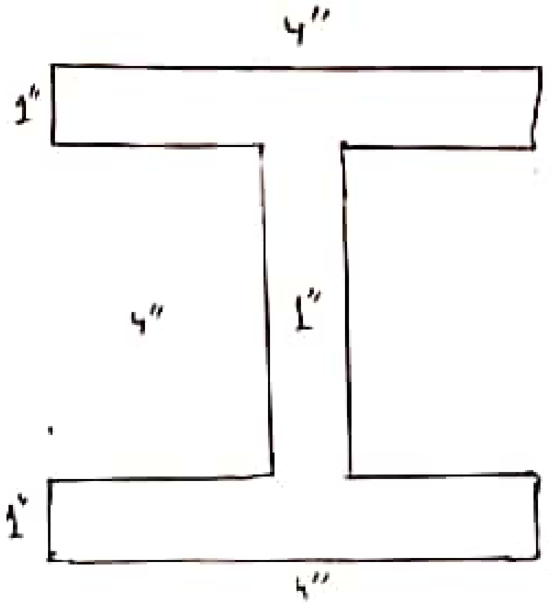
Paper :- MOS II

Date :- 18-4-2020

Question No 1 :-

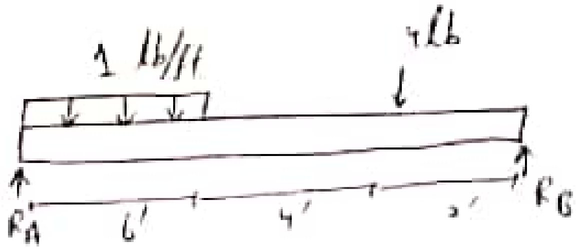
Ans:-





$\Rightarrow \quad 2P = 2 \times 02 = 4$

$\Rightarrow \quad 0.5\ p/ft = 0.5 \times 2 = 1$



Support Rections:-

As

$$\Sigma F_Y = 0 \quad \uparrow^{+} \quad \downarrow^{-}$$

$$R_A + R_B = 4$$

$$\Sigma M = 0 \quad \circlearrowright^{+} \quad \circlearrowleft^{-}$$

$$(R_B \times 12) - (4 \times 10) - (1 \times 3) = 0$$

$$12 R_B = 43 \qquad R_B = \frac{43}{12} \Rightarrow \boxed{R_B = 3.583}$$

As

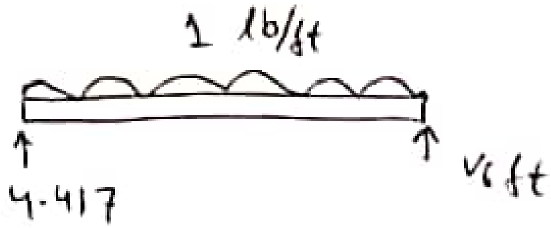
$$R_A + R_B = 8$$

$$R_A + 3.5833 = 8$$

$$R_A = 8 - 3.5833$$

$$\boxed{R_A = 4.417}$$

Now shear Force at change Point.



$\Sigma F_y = 0$ $\uparrow^{+}$ $\downarrow^{+}$

$$V_{6ft} - 4.417 + 1 \times 6 = 0$$

$$V_{6ft} - 4.417 + 6 = 0$$

$$V_{6ft} = 4.417 - 6$$

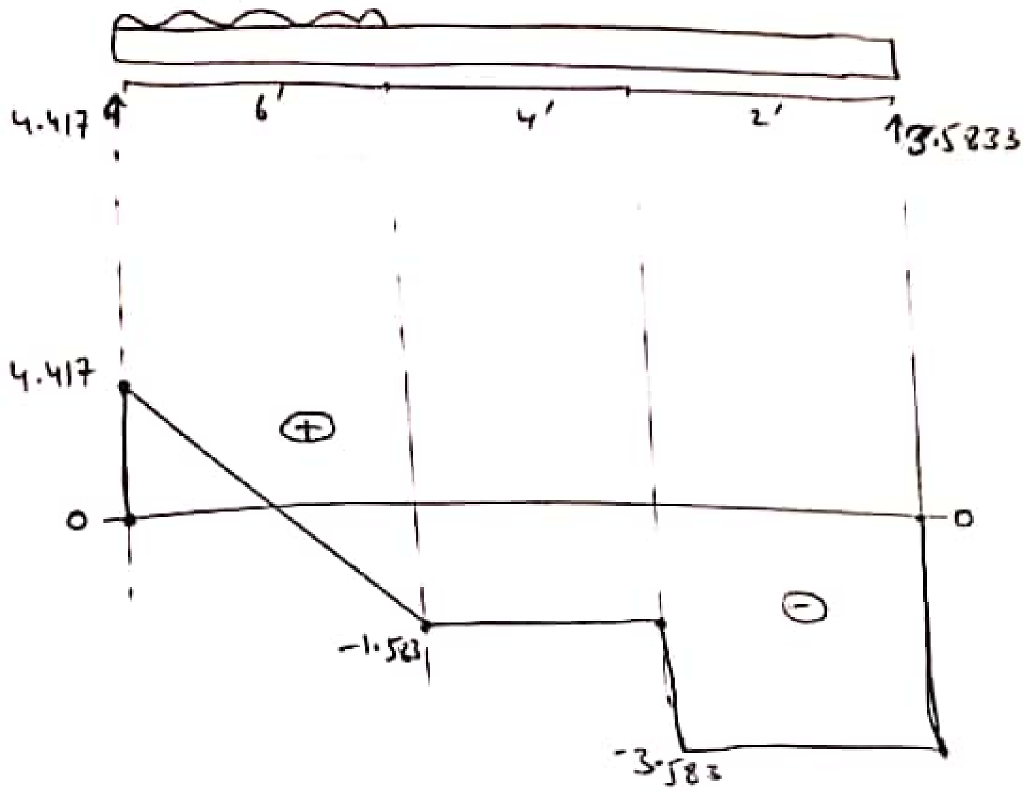
$$\boxed{V_{6ft} = -1.583}$$

Now shear force at Point V_{10ft}.

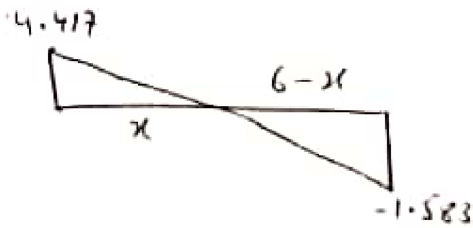
$$-4.417 + 6 + 4 + V_{10ft} = 0$$

$$V_{10ft} = 4.417 - 6 - 4$$

$$\boxed{V_{10\,ft} = -5.583}$$



Now moment at change point
Find zero shear force.



$$\frac{4.417}{x} = \frac{1.583}{6-x}$$

$$4.417(6-x) = 1.583x$$

$$26.502 - 4.417x = 1.583x$$

$$26.502 = 1.583x + 4.417x$$

$$\frac{26.502}{6} = \frac{\cancel{6}x}{\cancel{6}}$$

$$\boxed{x = 4.417}$$

Now moment at 4.417.

$\Sigma M_{4.417} = 0$ $+$ $-$

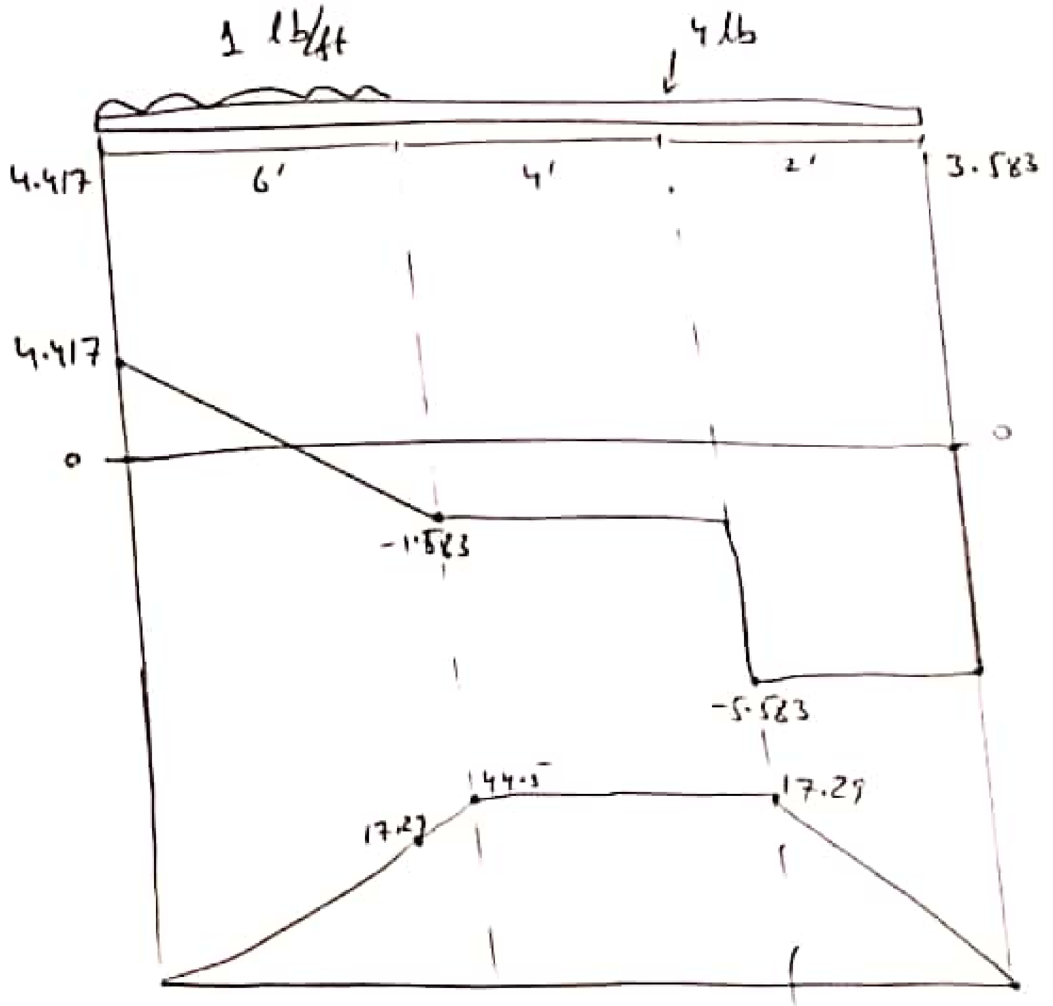
$$M_{4.417} + 4.417 \times 4.417 - 1\left(\frac{4.417}{2}\right) = 0$$

$$M_{4.417} + 19.50 - 2.2085$$

$$M_{4.417} = 2.2085 - 19.50$$

$$\boxed{M_{4.417} = 17.29}$$

$$\boxed{M_{6ft} = 44.5}$$



Now shear stress :-

$$\tau = \frac{VQ}{I\,t}$$

$$\tau = \frac{(4.417)(10)}{(55.9)(4)}$$

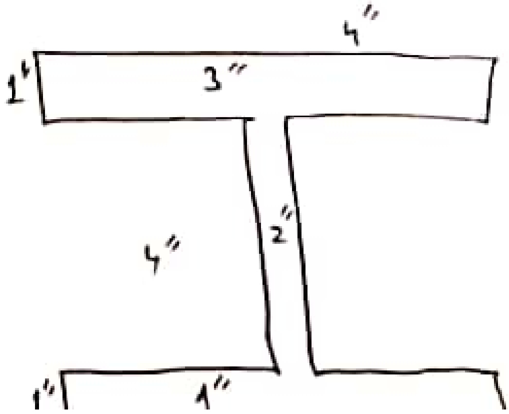
$$\boxed{\tau = 0.197}$$

Now Flextral stress :-

$$\delta = \frac{M\,r}{F}$$

$$\delta = \frac{44.5 \times 2}{55.976}$$

$$\boxed{\delta = 1.589 \text{ psi}}$$



As we know that to find centroied we have the following formula.

$$\bar{y} = \frac{A_1 y_1 + A_2 y_2 + A_3 y_3}{A_1 + A_2 + A_3}$$

$A_1 = 4 \times 1 = 4$

$A_2 = 4 \times 1 = 4$

$A_3 = 4 \times 1 = 4$

$$\bar{y} = \frac{(4 \times 0.5) + (4 \times 3) + (4 \times 5.5)}{4 + 4 + 4}$$

$$\boxed{\bar{y} = 3''}$$

Now moment of Inertia.

No	$A\ (in^2)$	$I_x\ (in)$	$d = (\bar{y} - y_1)$ $(\bar{y} - y_1)(\bar{y} - y_2)$
①	4	$\frac{4 \times (1)^3}{12} = 0.333$	
②	4	$\frac{1 \times 4^3}{12} = 5.333$	
③	4	$\frac{4 \times 1^3}{12} = 0.333$	

P-T-O

(Now "d")

1. $d = (\bar{y} - y_1) = (3 - 0.5) = 2.5$
2. $d = (\bar{y} - y_2) = (3 - 3) = 0$
3. $d = (3 - 5.5) = -2.5$

(Now Ad^2)

1. $4 \times (2.5)^2 = 25$
2. $4 \times (0)^2 = 0$
3. $4 \times (-2.5)^2 = 25$

Now

$$I_x = I_x + Ad^2$$

1. $0.333 + 25 = 25.333$
2. $5.333 + 0 = 5.333$
3. $0.333 + 25 = 25.333$

Total

$$I = I_{x_1} + I_{x_2} + I_3$$

$$I = 25.333 + 5.333 + 25.333$$

$$\boxed{I = 55.999 \text{ in}^2}$$

Now we can find the stress state condition :-

$\sigma x = -1.589$

$\sigma y = 0$

$\tau xy = 0.196$

Solution,

For σx

$\sigma' x' = \frac{-1.584}{2} + \left(\frac{-1.584}{2} - 0\right) \cos 2(-20)) + (0.196) \sin 2(-20)$

$\boxed{\sigma' x' = -1.397 \text{ (compression)}}$

Now For $\sigma y'$

$\sigma y' = \frac{-1.584}{2} - \left(\frac{-1.584}{2}\right) \cos 2(-20) - (0.196) \sin 2(-20)$

$\boxed{\sigma y' = -0.184}$

For $x'y'$

$\tau x'y' = -\sigma x' - \sigma y \sin \theta + \tau xy \cos 2\theta$

$= \left(\frac{-1.584}{2}\right) \sin 2(-20) + 0.196 \cos 2(-20)$

$\boxed{\tau x'y' = 0.507}$

To Draw Moh's circle for the given problem:-

The condition A circle.

$$\left(\frac{\sigma_x + \sigma_y}{2} , 0 \right)$$

centre coordinates.

$$(h,k) = \left(\frac{-1.584}{2} , 0 \right)$$

$$= (-0.792 , 0)$$

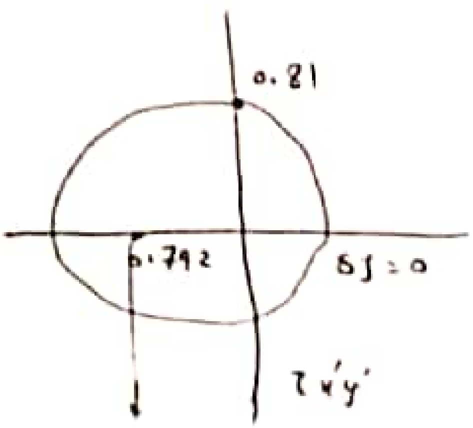
Now Radius

$$r = \sqrt{\left(\frac{\sigma_x + \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

$$r = \sqrt{\left(\frac{-1.584}{2}\right)^2 + (0.196)^2}$$

$$r = \sqrt{0.627 + 0.038}$$

$$\boxed{r = 0.8134}$$



D

This is the centre point