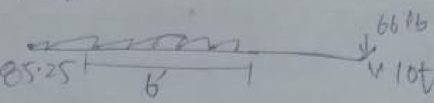
(4)

$\Sigma F_y = 0 \; +\uparrow$:-



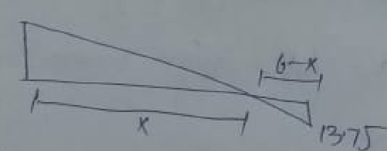
$85.25 - 16.5 \times 6 - 66 - V_{10ft} = 0$

$V_{10ft} = -79.75 \text{ lb}$

Point of maximum Bending moment...

As. we know that, the point where shear force is minimum, the bending moment is maximum so, from point of zero shear corresponding point will have maximum Bending moment...

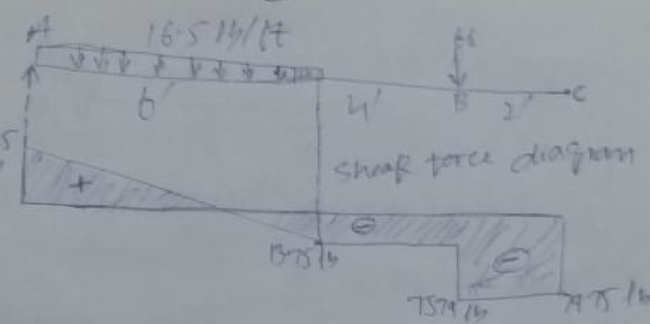
From the given diagram, we have...

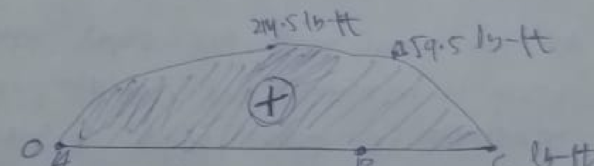


We know that

$$\frac{85.25}{x} = \frac{13.75}{6 \cdot x}$$

$$(6-x)85.25 = 13.75x$$





Bending moment diagram.

=> Now shear force at change point of beam

at 6 ft

= shear force at 6ft from lenth support

$\Sigma F_y = 0 \quad \uparrow + \quad \downarrow -$

$= 85.25 - 16.5 \times 6 - V_{6ft} = 0$

$= V_{6ft} = 13.5$ lb

=> Now shear force at 10ft

= $\Sigma fx = 0$ which $R_3 = 0$

= $\Sigma fy = 0$ where $\uparrow(+)$ $\downarrow(-)$

= $R_1 + R_2 = (16.5 \times 6)$ lb $+ 66$ lb

= $R_1 + R_2 = 99 + 66$

= $R_1 + R_2 = 165 \longrightarrow (A)$

=> Now submisson of $\Sigma M_A = 0$ $(+ -)$

=> $R_2 * 12 - 10 \times 66 - (16.5 \times 6) \times 6/2 = 0$

= $12R_2 = 660 + 297$

= $12R_2 = 957$ lb.ft

= $\boxed{R_2 = 79.75 \text{ lb}}$

= $R_1 + R_2 = 165$

= $R_1 = 165 - R_2$

= $R_1 = 165 - 79.75$

= $R_1 = 85.25$ lb

= Now we will draw a diagram shearforce, and banding moment...

Name= MUBARA·K Shah

I·D = 7955

subject= "B" MOS II

section ="B"

Dated= 18-4-2020

⑤

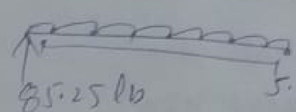
$= 511.5 - 85.25x = 13.75x$

$= 511.5 = 13.75x + 85.25x$

$= 99x = 511.5$

$= \boxed{x = 5.166\ ft}$

= Now determine the value of moment at 5.166 ft



$= M_{5.166} - 85.25 \times 5.166 + (16.5 \times 5.166) \times \left(\frac{5.166}{2}\right) = 0$

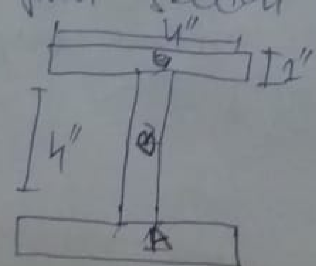
$= M_{5.166ft} - 440.4015 + 215.50 = 0$

$= M_{5.166ft} = 224.899\ lb\text{-}ft$

= Now for the shear force we have

= so, first we determine moment of Inertia I

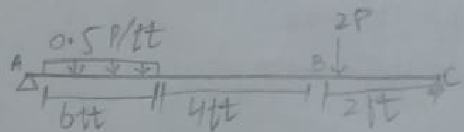
so, the given section of Beam is.



①

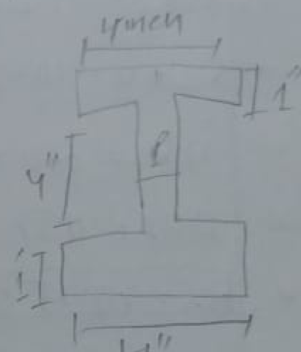
= Assignment No # 03

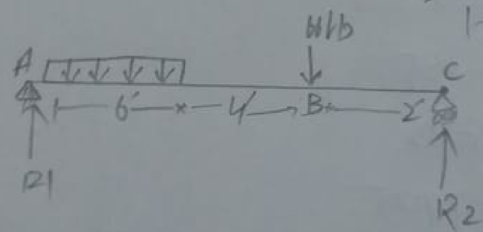
=> A situation is given that ?



=> P = 55

=> then,





=> Now to find the unknown Reaction, support, we will have to apply equilibrium equation.

=

= | ΣA = / $\Sigma A y = 0$ + A . (4)

(6)

= If the given figure is symetrical along Both the axis

= So, $\bar{x} = 4/2 = 2''$, $\bar{y} = 6/2 = 3$ in which is

= $(\bar{x}, \bar{y}) = (2, 3)$ center of gravity

= From extrem left and bottom

= Area $A = 4 \times 1 = 4 \, Inc^2$

= Area $B = 4 \times 1 = 4 \, Inc^2$

= Area $C = 4 \times 1 = 4 \, Inc^2$

= moment of Inertia about x-axis (centrode)

=> Now we will determine Distances between C.G of the whole section and the correspading point.

= let, G_1, G_2, G_3 of the center of gravity of point (1), (2), (3) and K_1, K_2, K_3 be the distance of $\bar{y}$ and y_1, y_2, y_3 respectively

$= \Big| \Sigma + \quad = \Big/ \Sigma fy = 0 \; + \uparrow$. ④

⑦

$= K_1 = \bar{y} - y_1 = 3 - 05 = 2.5 \, in$

$= K_2 = \bar{y} - y_2 = 3 - 3 = 0 \, inch$

$= K_3 = \bar{y} - y_3 = 3 - 05 = 2.5 \, in$

$=$ So, $I_{xx} = \frac{b_1 h_1^3}{12} + a_1 K_1^2 + \frac{b_2 h_2^3}{12} + a_2 K_2^2 + \frac{b_3 h_3^3}{12} + a_3 K_3^2$

$= I_{xx} = \frac{(4)(1)^3}{12} + 4(2.5)^2 + \frac{(1)(4)^3}{12} + a_2(0) + \frac{4(1)^3}{12} + 4(2.5)^2$

$= I_{xx} = 4/12 + 25 + 64/12 + 4/12 + 25$

$= I_{xx} = \frac{4 + 12(25) + 64 + 4 + 12(25)}{12}$

$= I_{xx} = 56 \, Inc^2$

$=$ Now I_{yy} to find it..

$= I_{yy} = \frac{b_1^3 h_1}{12} + \frac{b_2^3 h_2}{12} + \frac{b_3^3 h_3}{12}$

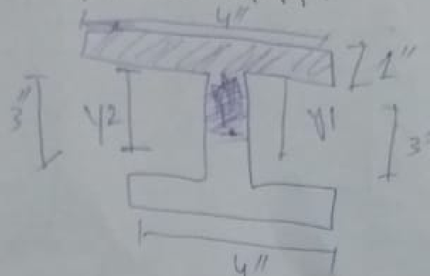
$= I_{yy} = \frac{(4)^3(1)}{12} + \frac{(1)^3(4)}{12} + \frac{(4)^3(1)}{12}$

$= I_{yy} = \frac{64}{12} + 4/12 + 64/12$

$= I_{yy} = \frac{64 + 4 + 64}{12} \boxed{= 11 in^2}$

⑨

$\Rightarrow$ Now the shear stress at point "C"
i.e. point N.A.



$\Rightarrow \tau = \frac{V Q}{I t}$

$\Rightarrow \tau = 79.75 \times [4 \times 1 \times (3-0.5) + (1 \times 2)(2-1)]$

$\Rightarrow \tau = 79.75 \times 12$

$\Rightarrow \tau = 14.28 \ lb/in^2$

iv) Now shear stress at point D, and E will be same because symmetry

$\Rightarrow$ Note:

The maximum shear stress value occure at the nuetral axis and minimum value at the top of the section.

(16)

=> Now to draw mohr's circle

= To draw mohr's circle

= co-ordinate

$(h,k) = \left(\frac{6x+6y}{2}, 0\right)$

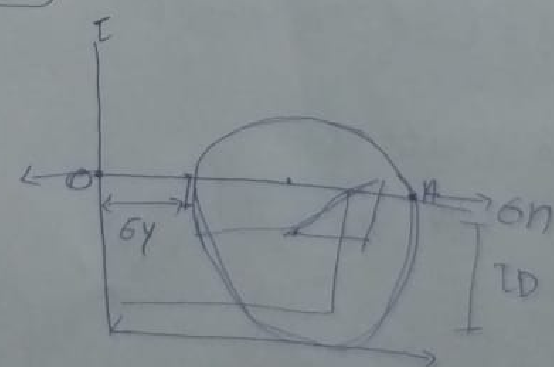
$= \left(\frac{-6.71+0}{2}, 0\right)$

$= (-3.355, 0)$

= Radius of mohrs circle

$= r = \sqrt{\left(\frac{6x-6y}{2}\right)^2 + \tau_{xy}^2} = \sqrt{\left(\frac{-6.71-0}{2}\right)^2 + (14.28)^2}$

$\boxed{r = 215.1684}$



=> <u>principal stress</u>

= First find $\theta p = ?$

$= \tan 2\theta p = \dfrac{\tau xy}{(\sigma x - \sigma y)/2}$

$= \tan 2\theta p = \dfrac{14.28}{(-6.71-0)/2}$

$= \tan 2\theta p = 4.25$

$= 2\theta p = \tan^{-1}(-4.25)$

$\theta p = -38.37$

Now put in the general equation---

$= \sigma max.. = -\dfrac{6.71+0}{2} + \dfrac{-6.71+0}{2} \cos 2(38.37)$

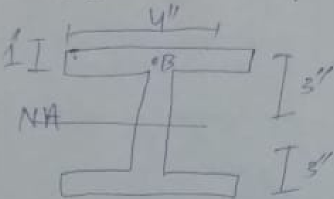
$= \sigma p max = -3.355 - 3.355 (0.2293)$

$= \sigma p max = -3.355 - 0.7693$

$= \sigma p max = -4.1243$

$= \boxed{\sigma x = -6.71}$

= Flexure stress at point B

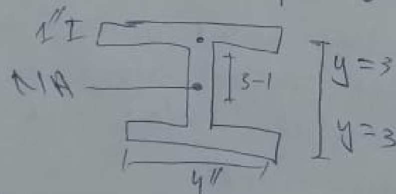


$= \delta = \frac{My}{I}$

$= \delta = \frac{224.899 \times (3-0.5)}{67}$

$= \delta = 8.39 \ lb/in^2$

= Flexure stress at point "c"

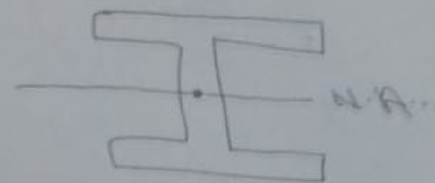


$= \delta = \frac{My}{I}$

$= \delta = \frac{224.899 \times (3-1)}{67}$

$= \delta = 6.71 \ lb/in^2$

= Flexure stress at nuetral axis (N.A)



= $\delta = \frac{my}{I}$

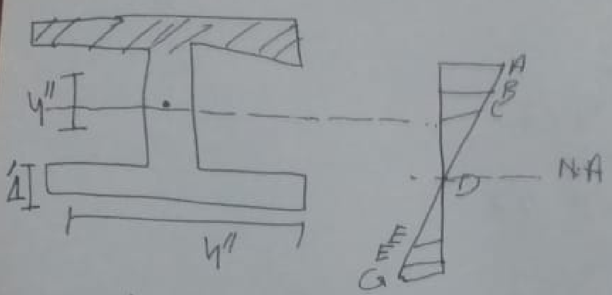
= $\delta = \frac{224.899 \times 0}{67}$

= $\delta = 0\ lb/in^2$

= Flexure stress value at point E,F and g Remain the same because of symetrical the upper portion above the N.A shows tention and below the N.A shows the comparision

= **Note:** the flexure stress value is max.. at extrem top and bottom fiber at zero and at N.A..

⇒ Flexure stress diagram:



⇒ Find it principal stress

$= \sigma x = 6.71$

$= \sigma y = 0$

$= \tau_{xy} = 14.28$

= principal stress equation.

$= \sigma_{1,2} = \frac{\sigma x + \sigma y}{2} \pm \sqrt{\left(\frac{\sigma x - \sigma y}{2}\right)^2 + \tau_{xy}^2}$

$= \sigma_{1,2} = \frac{-6.71 + 0}{2} \pm \sqrt{\left(\frac{-6.71}{2}\right)^2 + (14.28)^2}$

$= \sigma_{1,2} = -3.355 \pm \sqrt{11.25 + 203.91}$

$= \sigma_{1,2} = -3.355 \pm \pm 14.66$

$\sigma y = \sigma_1 = -3.355 + 14.66 = 11.305$

$\sigma x = \sigma_2 = -3.355 - 14.66 = -18.015$

=> max... in plane shear stress:

=> In this case

$= \tan 2\theta_s = \dfrac{-(\sigma_x - \sigma_y)/2}{\tau_{xy}}$

$= \tan 2\theta_s = \dfrac{-(-6.71 - 0)/2}{(14.28)}$

$= \tan 2\theta_s$

$= \theta_s = 6.67$ → Anticlockwise...

=> put this in the equation....

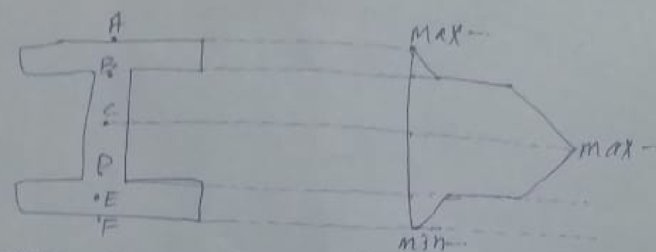
$= \tau_{x'y'} = -\left[\dfrac{\sigma_x - \sigma_y}{2}\right] \sin 2\theta + \tau_{xy} \cos 2\theta$

$= \tau_{x'y'} = -\dfrac{(-6.71 - 0)}{2} \sin 2(6.67)$

$= 14.28 \cos 2(6.67)$

$= \tau_{xy} = 14.66$ PSI

= Shear stress diagrame.

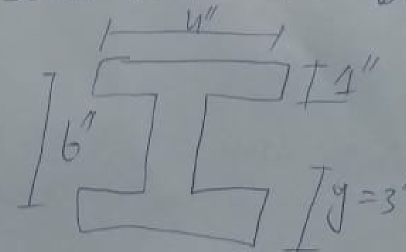


= Flexure stress determination

= $\delta = \frac{mr}{I}$

v) Flexure stress at the top fiber point (A)

= $\delta = \frac{my}{I}$



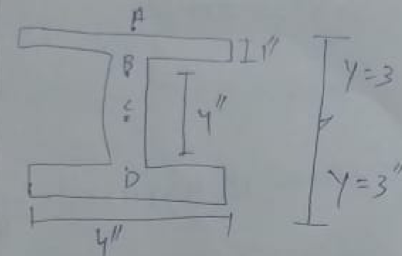
= $\delta = \frac{224.899 \times 3}{67}$

= δ 1007 lb/in^2

8

= Now we will find shear stress and

$\tau = \frac{VQ}{Ib}$

= 

= shear stress of point A

$\tau = \frac{VQ}{Ib}$ ∴ $Q = A\bar{Y}$

$V_{max} = 79.75\ lb$

$I = 67\ in^2$

= so, $\tau = \frac{79.75(0)}{67(4)}$

Here, A=0 Because no area of the section exist above point A ie $Q = A\bar{y} = 0(\bar{y}) = 0$

= Now the shear stress of point "B"

= $\tau = \frac{VQ}{Ib}$

= $\tau = \frac{79.75\times(4\times1)(3-05)}{67\times4}$

= $\tau = 2.97\ lb/in^2$ $Q = A\bar{Y}$