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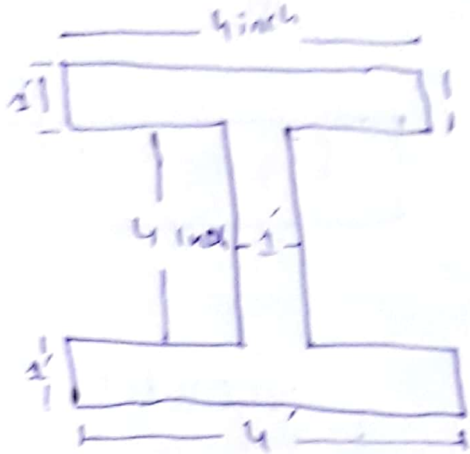
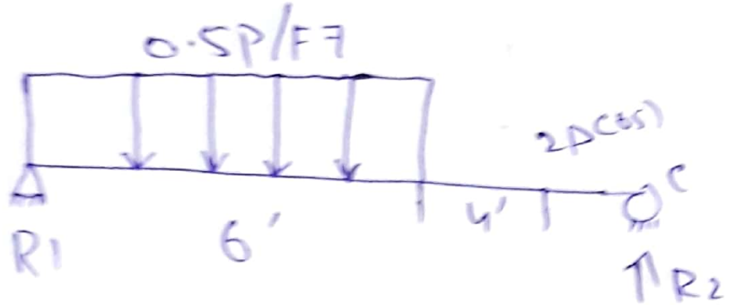
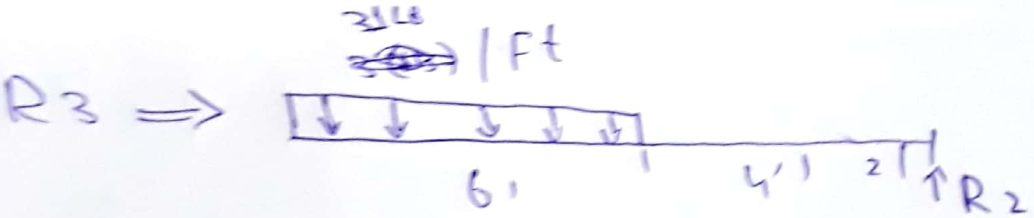
ID	7962
Section	B
exam	mid term
Assignment	MOS = 2





Now put the value of $P = 62$



To find unknow Reaction at the Support Apply equilibrum eq

$\Sigma F_x = 0 \quad$ i.e $R_3 = 0$

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

$R_1 + R_2 = (31)(6)\ Lb + 124\ Lb$

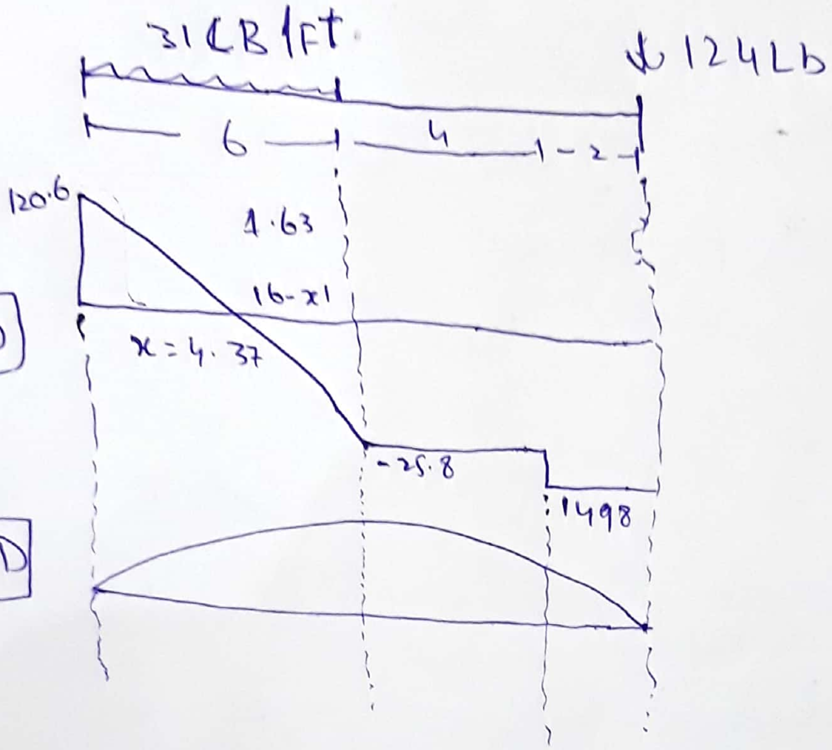
$R_1 + R_2 = 310 \rightarrow$ ①

Next $\Sigma M_A = 0 \quad$ G+↻

$R_2 \times 12 - 10 \times 124 - (31 \times 6) \times 6/2 = 0$ ②

$12 R_2 = 1240 + 558$

$$\boxed{R_2 = 149.8 \text{ Lb}}$$



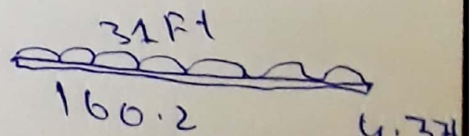
S·F·D

B·M·D

$$\frac{x}{120.6} = \frac{6 - x}{25.8}$$

$$\boxed{x = 4.37}$$

Now determine the value of moment at 4.37 ft



$M_{4.37ft} - 160.2 \times 4.37 + (31 \times 4.37) \times \left(\frac{4.37}{2}\right) = 0$

$M_{4.37ft} = 700.0074 + (135.477)(2.185)$

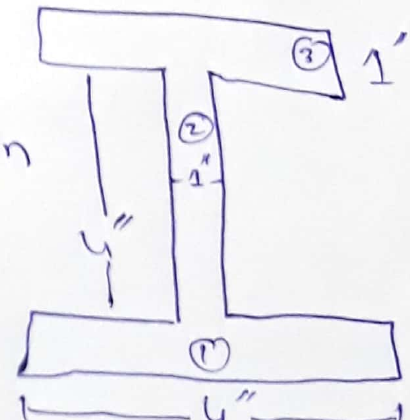
$$\boxed{M_{4.37\,ft} = 404.072\ LBft}$$

For Shear stress we have

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

$I = ?$

As the given figure is symmetrical along the both axis.



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

i.e $(\bar{x}, \bar{y})$ (center of gravity)

Area point ① $= 4 \times 1 = 4in^2$

Area point ② $= 4 \times 1 = 4in^2$

Area point ③ $= 4 \times 1 = 4in^2$

Moment of inertia about x-axis (Centrodial) I_{xx}

Determine distance b/w C.G of the whole reaction and the corresponding parts.

P 4

Let

G_1, G_2, G_3 be the center of gravity of Point ①, ②, ③ and k_1, k_2, k_3 be the distence b/w $\bar{y}$ and y_1, y_2, y_3 respectively

So

$$k_1 = \bar{y} - y_1 = 3 - 0.5 = 2.5 \text{ in}$$

$$k_2 = \bar{y} - y_2 = 3 - 3 = 0 \text{ in}$$

$$k_3 = \bar{y} - y_3 = 3 - 0.5 = 2.5 \text{ in}$$

So

$$I_{xx} = \frac{b_1 h_1^3}{12} + a_1 k_1^2 + \frac{b_2 h_2^3}{12} + a_2 k_2^2 + \frac{b_3 h^3}{12} + a_3 k_3^2$$

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

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

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

$$\boxed{I_{xx} = 56 \text{ in}}$$

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

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

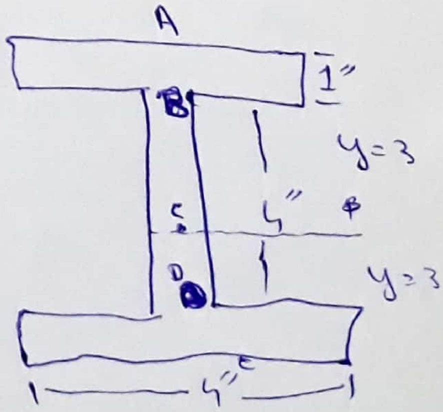
$$I_{yy} = \frac{64}{12} + \frac{4}{12} + \frac{64}{12}$$

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

$$\boxed{I_{yy} = 11\ in^4}$$

Find the shear stress at various Point we know that $\tau = \frac{VQ}{It}$

(1) shear stress at Point A



If the top Fiber

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

Sol $\tau = \frac{149.8(0)}{67(4)} = Q = \bar{y} \cdot A$

Here $a = 0$ Because no Area of the section exist above point i.e $Q = A\bar{y} = 0(\bar{y}) = 0$

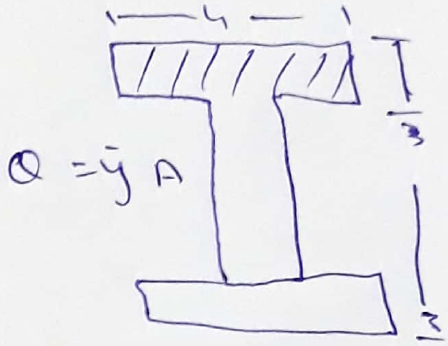
$\tau = 0$

Shear stresses at point B

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

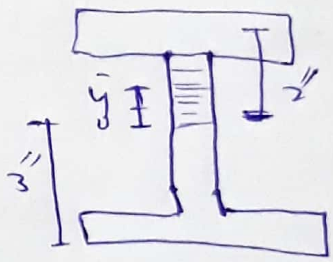
$$\tau = \frac{(149.8)\times(4\times1)(3-0.5)}{67\times4}$$

$$\tau = 5.57\ LB/in^2$$



Shear stress at point c i.e at

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



$$= \frac{149.5\left[4\times1(3-0.5)+(1\times2)(2\times\frac{1}{2})\right]}{67\times1}$$

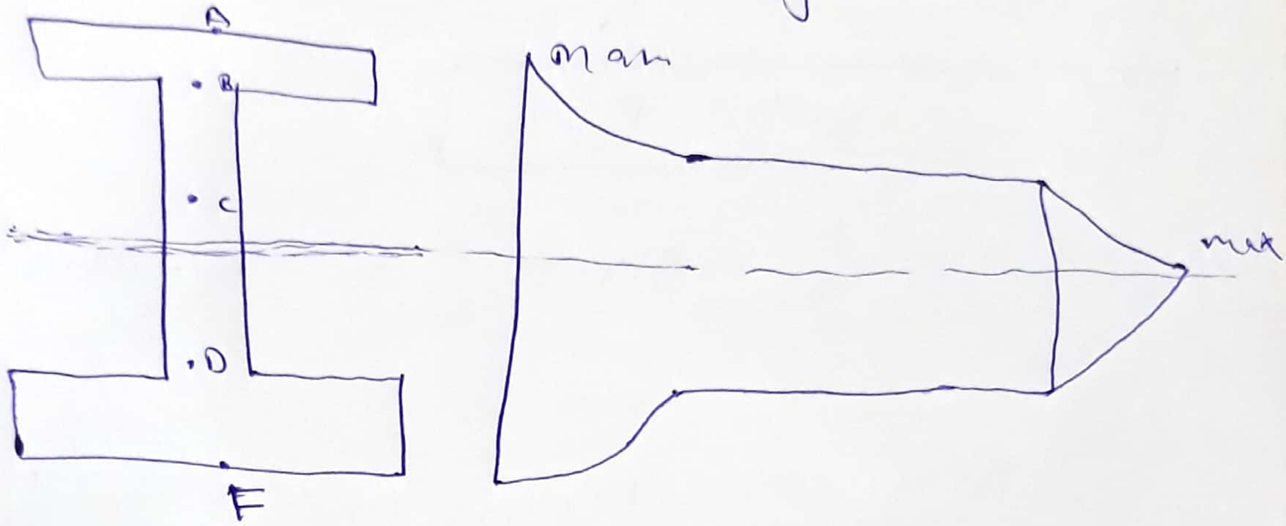
$$\tau = \frac{149.5\times12}{67}$$

$$\tau = 26.776\ LB/in^2$$

(iv) Shear stress at point D and E will the same because of symetry.

Note The max shear stress value accure at the neutral axis and minimum value at the top of the section.

Shear Stress Diagram.



Flexural Stress Determation

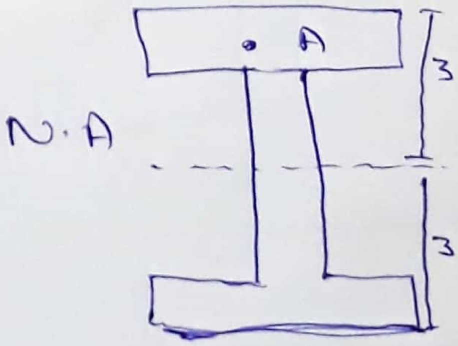
$$S = \frac{My}{I}$$

Flexural stress at the top Fiber point (A)

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

$$S = \frac{404.072 \times 3}{67}$$

$$\boxed{S = 18.09 \, Lb/in^2}$$



F stress at point B

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

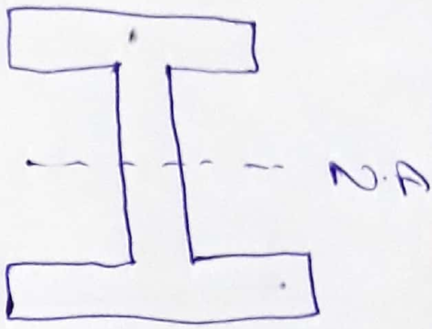
S/= My.

$$S = \frac{404.072 \times (3-1)}{67}$$

$$\boxed{S = 1206\ LB/in^2}$$

Flexural stress at Neutral axis

$$S = \frac{My}{I} = \frac{404.072 \times 0}{67}$$



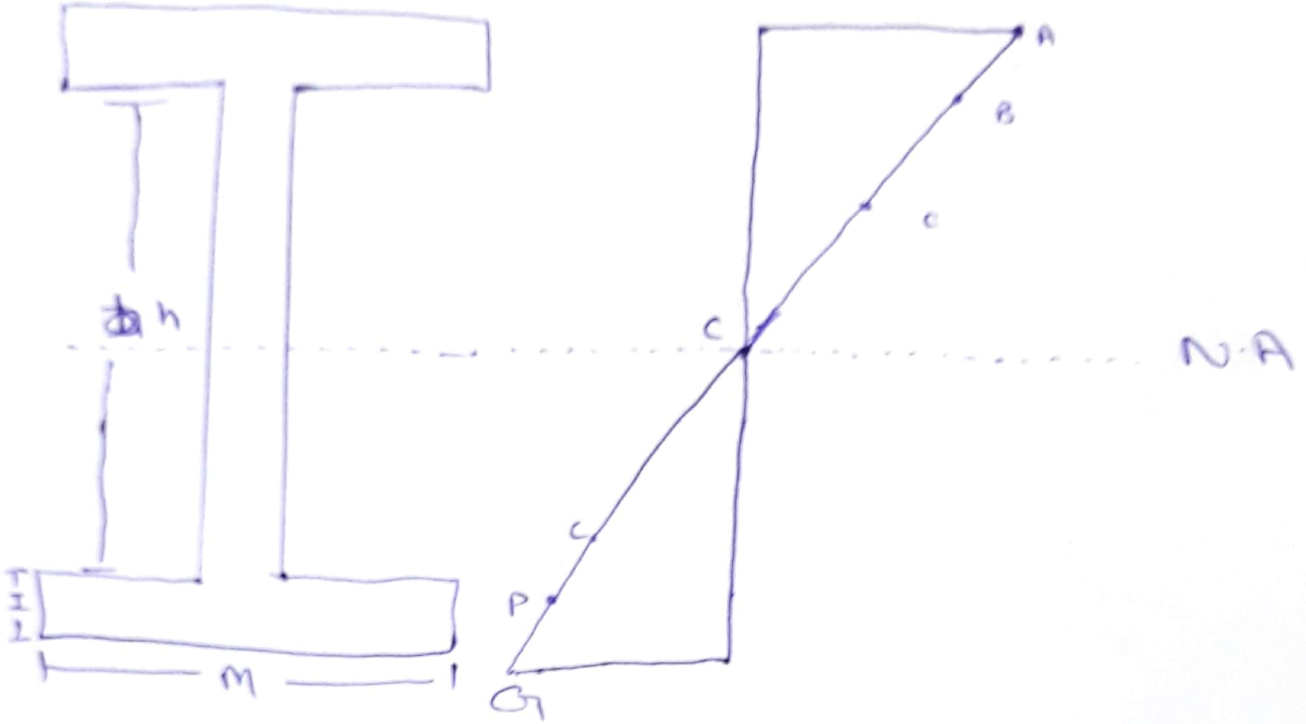
$S = 0\ Lb/in$

Flexural stress value at point E, F and G Remain the same because of symetry

The upper portion above N.A shows tension and below the N.A shows compressions

<u>Note</u>

The flexural stress values is maximum at extreme top and bottom fiber at zero at N.A



Stress State

Find stress state of a point c element located at 3ft left support 1 inch below from top fiber F stress at point c

$\sigma = 12.06 PSI$

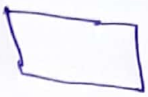
S. stress at point c

$\tau = 26.776$

Consider point ac is a planner element

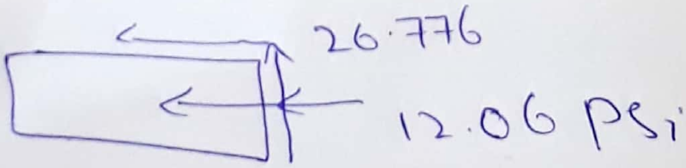
$\tau = 26.28$ psi is compreetive

Because Point c lies in compression
zero of Beam cross seaction



If Point c lies below the centroid then stress would be Tensile

 $\uparrow \tau = 26.776$ psi



Combine stress on 2.D element

Find it prineiple stress.

we have also find

$\sigma x = 12.06$

Scanned with CamScanner

$\sigma y = 0$

$\tau x'y' = 26.776$

Principle stress equation.

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

$$\sigma_{1,2} = \frac{12.06 + 0}{2} \pm \sqrt{\frac{(12.06+0)^2}{2} + (26.776)^2}$$

$= -6.03 \pm \sqrt{36.36 + 716.9}$

$= -6.03 \pm 27.44$

$= -6.03 - 27.44 = -33.47$

$= -6.03 + 27.44 = 21.41$

$\theta p = ?$

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

$$\tan 2\theta p = \frac{20.776}{(12.06 - 0)/2}$$

$$\tan 2\theta p = \frac{26.77}{6.03}$$

$2\theta p = \tan^{-1} 4.43$

$$\theta p = \frac{77.30}{2}$$

$$\boxed{\theta p = 38.65}$$

Put in general equation.

$$\sigma max = \frac{(-12.06+0)}{2} + (-\frac{12.06}{2}\cos(2)(38.39)$$

$$\sigma max = -6.03 - 6.03(0.229) = \cancel{0}$$

$$= -6.03 - 1.382$$

$$\boxed{\sigma max = -7.412} = \boxed{\sigma x = 12.06}$$

Max in Plane Shear stress.

In this case

$$\tan 2\theta s - \frac{(\sigma x - \sigma y)/2}{\tau xy}$$

$$\tan 2\theta s = -\frac{(-12.06-0)/2}{26.776}$$

$$\tan 2\theta s = \frac{6.03}{26.776}$$

$\tan^{-1}(0.22)$

$$\boxed{\theta s = 6.20}$$

Put in these general equation

$$\tau x'y' = -\left[\frac{\sigma x - \sigma y}{2}\right] \sin\theta + \tau xy \cos 2\theta$$

$$\tau x'y' = -\left(\frac{12.06 - 0}{2}\right) \sin 2(12.60)$$

$$26.776 \cos 2(12.06).$$

$$= -6.03 \sin 2(12.06) + 26.776 \cos 2(12.06)$$

$$\boxed{\tau x'y' = 320.18}$$

To draw Mohers circle center coordinate.

$$(h, k) = (\sigma x, \sigma y, 0)$$

$$= \left(\frac{-12.06}{2} + 0, 0\right)$$

$$= (6.04, 0)$$

$$r = \left(\frac{\sigma x \cdot \sigma y}{2}\right)^2 + \tau xy =$$

$$r = \sqrt{\left(\frac{-12.06-0}{2}\right)^2 + (26.776)^2}$$

$$r = \sqrt{7533}$$

$$\boxed{r = 27.44}$$