EXAM:

MID TERM

(Mechanics OF SOLIDS II)

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SECTION:

B

SIGN:

No OF PAGES:

10

SUBMITTED TO:

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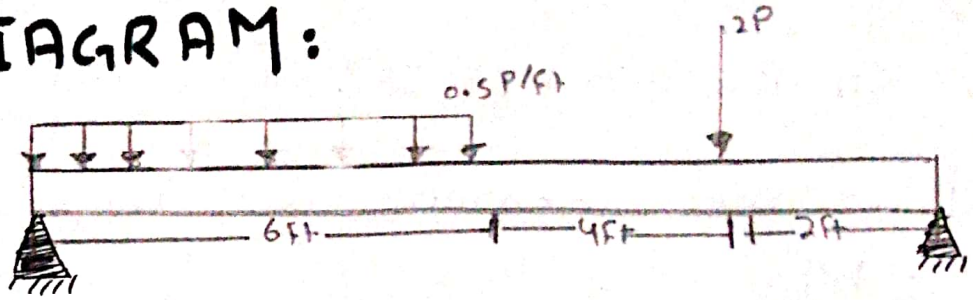
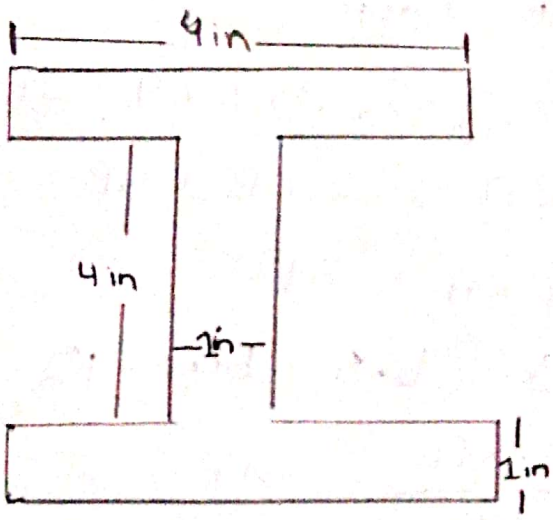
DIAGRAM:

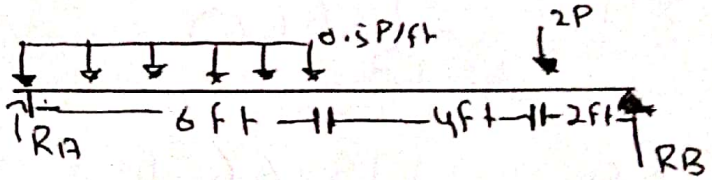




SOLUTION:

P = 68

At first we have to find the reaction forces from F.B.D



$\Sigma fy = 0$

$$R_A + R_b - 0.5 \times P \times 6 - 2 \times P = 0$$

$$R_A + R_b = 3P + 2P$$

$$R_A + R_b = 5P \quad \rightarrow (1)$$

As my "P" value "68", so Puting it in eq (1).

$R_A + R_B = 5\ (68)$

$R_A + R_B = 340 \rightarrow (I)$

Now for moment we have

$\Sigma M_B = 0$

So we have

$R_A \times 12 - 0.5 \times P \times 6 \times 9 - 2P \times 2 = 0$

$12 R_A = 27P + 4P$

$12 R_A = 31P$

÷ing b.s by 12

$\frac{12 R_A}{12} = \frac{31P}{12}$

$R_A = \frac{31}{12} \cdot P$

Puting the value of P

$R_A = \frac{31}{12}(68)$

$R_A = 175.66$ lb

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Puting value of R_A in eq I

$R_A + R_B = 340$

$R_B = 340 - 175.66$

$R_B = 164.33$

$R_B = 164.33$

VALUES FOR SHEAR FORCE DIAGRAM

Now

$$175.66 - V = 0$$

$$-V = 175.66$$

$$175.66 - 204 - V_{6ft} = 0$$

$$V_{6ft} = -28.34 \text{ lb}$$

$$\rightarrow 175.66 - 204 - V_{10\,ft} - 136 = 0$$

$$V_{10\,ft} = -164.34 \text{ lb}$$

$$\rightarrow 175.66 - 204 - 136 + 164.33 - V_{12\,ft} = 0$$

$$V_{12\,ft} = 0$$

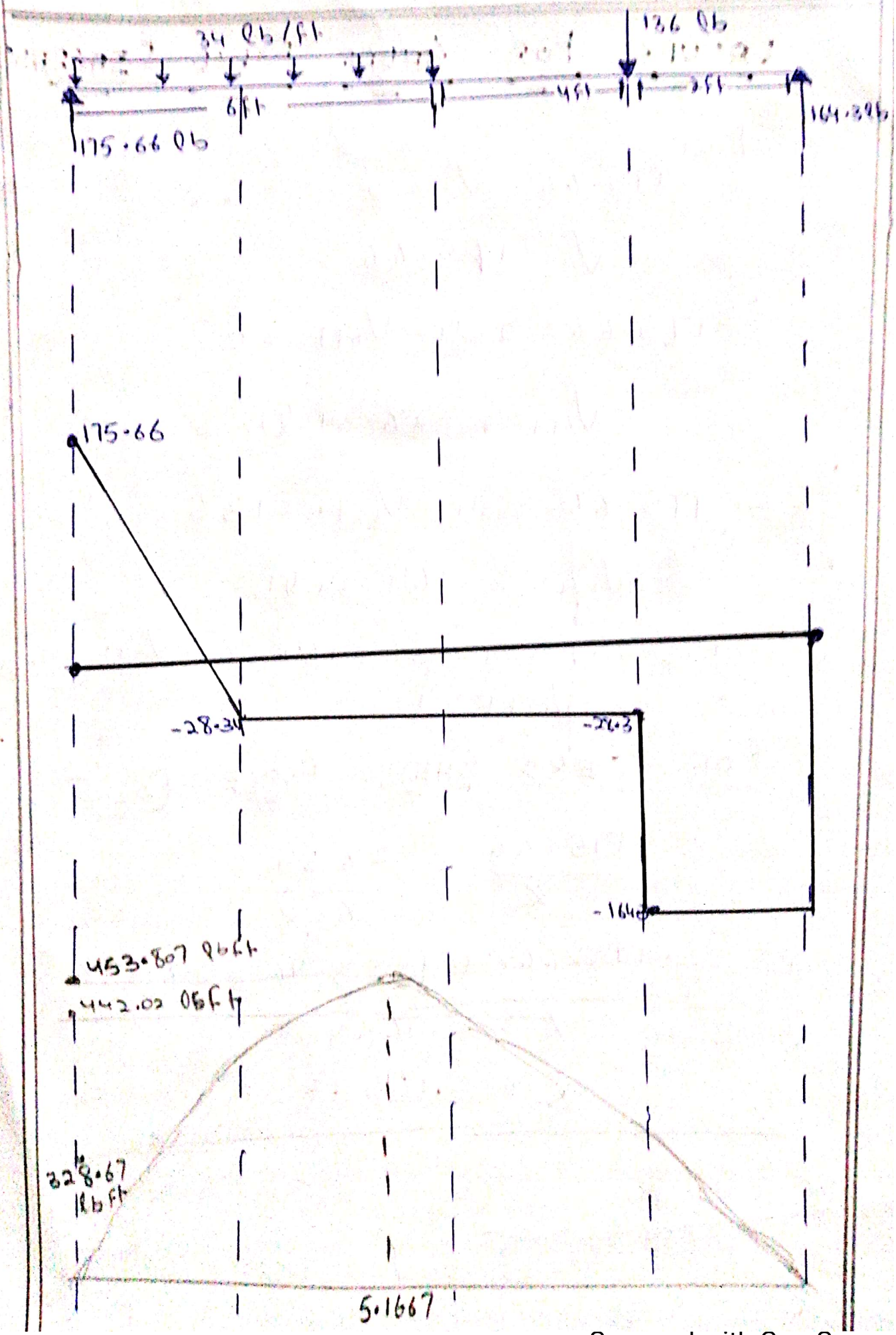
FOR ZERO SHEAR FORCE POINT

$$\frac{175.66}{x} = \frac{28.34}{6-x}$$

$$-175.66x + 1053.96 = 28.34x$$

$$x = 5.1667 \text{ ft}$$

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



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

FROM SHEAR FORCE DIAGRAM

$V_{max} = 175.66$ lb

$$Q = yA \longrightarrow (3)$$

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

$$y = \frac{2 \times 4 + 4 \times 4.5}{4 + 4}$$

$$y' = 3.25 \text{ inch}$$

~~Rolling values of 'y'~~

~~Q = 3.25 × 4~~

Now $I = I_{1c} + I_{2c}$

$$I_{1c} = I_1 + A_1 d_1^2$$

$$I_{1c} = \frac{1}{2} bh^3 + A_1 d_1^2 \longrightarrow (4)$$

$$d_1 = \bar{y} - y_1$$

$d_1 = y' - y_1$

$d_1 = 3.25 - 2$

$d_1 = 1.25$ inch

Puting values in eq (4)

$$I_1C = \frac{1}{2} 4 \times (1)^3 + 4 \times (1.25)^2$$

$I_1C = 6.583$ inch^4

$I_1C = 6.583$ in^4

Now for I_2C

$I_2C = I_2 + A_2 d_2^2$

$= \frac{1}{12} bh^3 + A_2 d_2^2$

$I_2C = \frac{1}{12} \cdot 1 \times (4)^3 + 4 \cdot (d_2)^2 \rightarrow (5)$

For d_2

$d_2 = y_2 - y'$

$d_2 = 4.5 - 3.25$

$d_2 = 1.25$ inch

Puting d_2 in eq (5)

$= \frac{1}{2} \times 1 \times 4^3 + 4 \times 1.25^2$

$I_2C = 11.58$ in^4

$$I_{2C} = 11.58 \text{ in}^4$$

$$I = I_{1C} + I_{2C}$$

↳ Puting values.

$$I = 6.583 + 11.58$$

$$I = 18.163$$

$$I = \frac{1}{12} \times b \times h^3 - \frac{1}{12} \times h \times b^3$$

$$I = \frac{1}{12} \times 4 \times (6)^3 - \frac{1}{12} \times 3 \times (4)^3$$

$$I = 56 \text{ in}^4$$

$$I = 56 \text{ in}^4$$

$$\tau = \frac{V Q}{I B}$$

$$\tau = \frac{17.56 \times (2.25 \times 4)}{56 \times 4} \quad \because Q = YA$$

$$\tau = 7.0577 \text{ Psi}$$

Now To Find FLUXURAL STRESS

$$\sigma = \frac{My}{I} \quad \rightarrow (7)$$

Now FROM BENDING Bo MOMENT DIAGRAM

$M = 453.807$ lb ft

$y = 1.75$

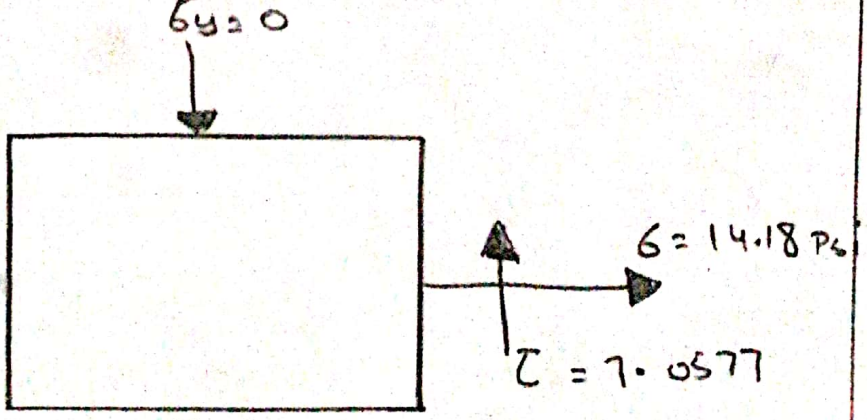
$I = 56$

puting values in eq (7)

$$\sigma = \frac{453.807 \times 1.75}{56}$$

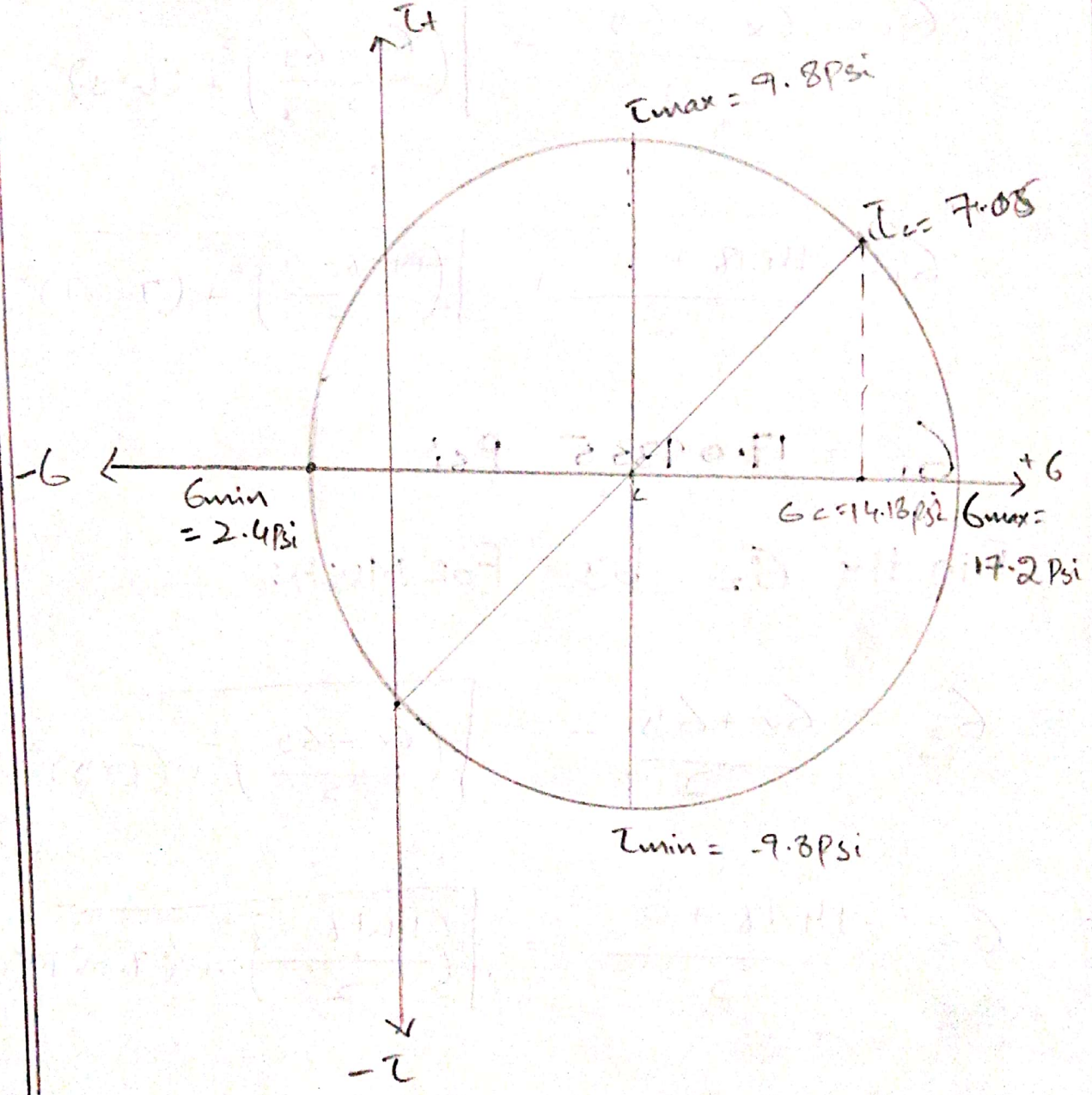
$\sigma = 14.18$ Psi

Now showing the FLUXURAL and SHEAR stress on Point "C"



How To Draw Mohor's Circle

Let 2 psi = 1 cm



Now Finding σ_1 by FORMULAS:

$$\sigma_1 = \frac{\sigma x + \sigma y}{2} + \sqrt{\left(\frac{\sigma x - \sigma y}{2}\right)^2 + (\tau xy)^2}$$

$$\sigma_1 = \frac{14.18 + 0}{2} + \sqrt{\left(\frac{14.18 - 0}{2}\right)^2 + (7.057)^2}$$

$$\sigma_1 = 17.09335 \text{ Psi}$$

Finding σ_2 by FORMULA:

$$\sigma_2 = \frac{\sigma x + \sigma y}{2} - \sqrt{\left(\frac{\sigma x - \sigma y}{2}\right)^2 + (\tau xy)^2}$$

$$\sigma_2 = \frac{14.18 + 0}{2} - \sqrt{\left(\frac{14.18 - 0}{2}\right)^2 + (7.057)^2}$$

$$\sigma_2 = -2.9135 \text{ Psi}$$