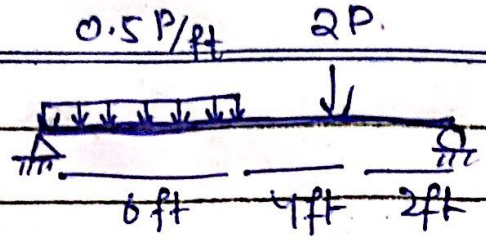
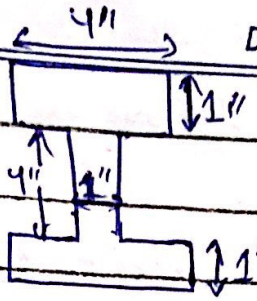
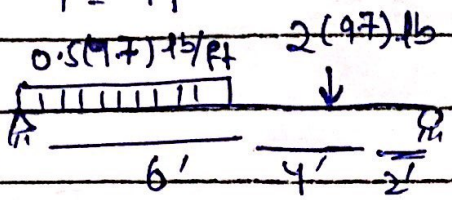
Name : Syed Khaleed Shah
I.D : 7497
Teacher : Engr Saqib
Subject : Mechanics of
Solid II

Date:
Day: M T W T F S S



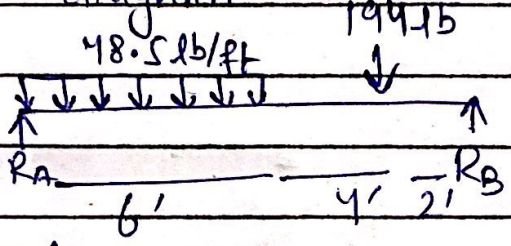


P = 97



solution:

Finding reaction shear force & bending moment diagram.



$\Sigma f_y = 0 \uparrow +$

$R_A + R_B - (48.5 \times 6) - 194 = 0$

$R_A + R_B = 485\ lb$

$\Sigma M_A = 0 \circlearrowleft +$ Anticlockwise is positive

$R_B(12') - 194 \times 10 - 48.5 \times 6 \times 3 = 0$

$R_B \times 12 = 1940 + 873$

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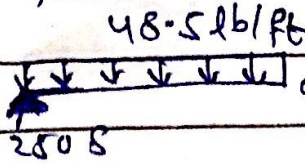
$R_B = 2813\ lb/12$

$\boxed{R_B = 234.5\ lb}$

$R_A = 485 - 234.5$

$\boxed{R_A = 250.5\ lb}$

Now shear force at charge point of beam



Day: M T W T F S S

Shear force at 6' from left support

$\Sigma f_y = 0 \uparrow +$

$-V + 250.5 - (48.5 \times 6) = 0$

$V = -40.5$

Shear force at 10'

$\Sigma f_y = 0 \uparrow +$

$250.5 - (48.5 \times 6) - 194 - V = 0$

$V = -234.5 \text{ lb}$

moments at change point

$\frac{250.5}{x} = \frac{40.5}{6-x}$

$\Rightarrow 250(6-x) = 40.5x$

$\Rightarrow 1503 - 250.5x = 40.5x$

$\Rightarrow 291x = 1503$

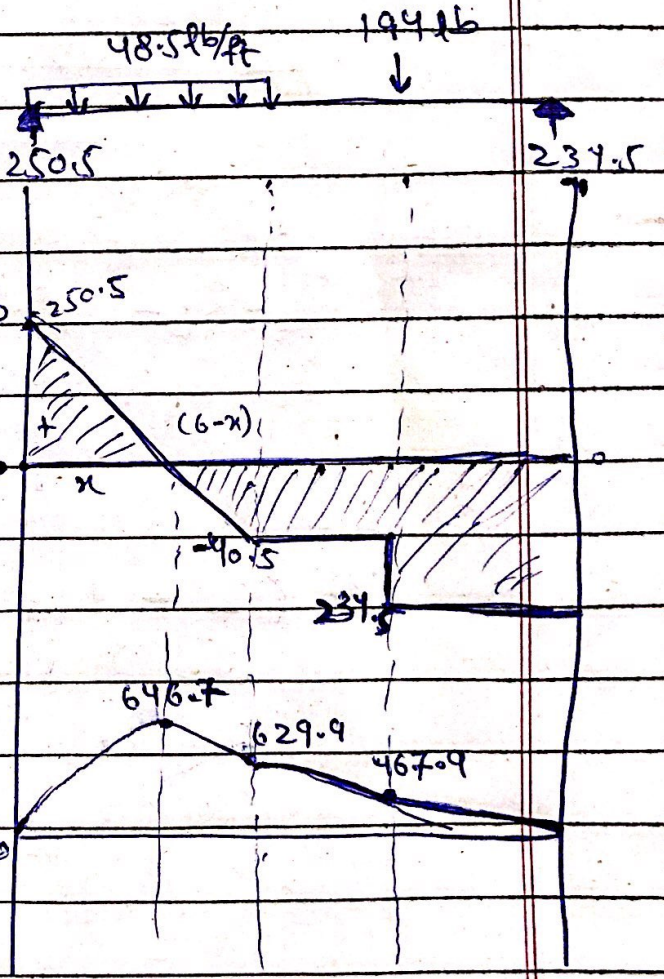
$x = 5.164$

Maximum moment

$M_{max} = \frac{1}{2} bh$

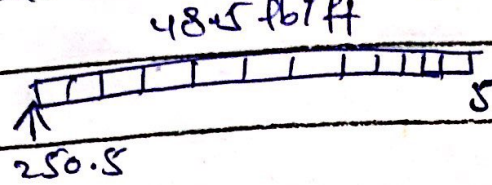
$M_{max} = \frac{5.164 \times 250.5}{2}$

$M_{max} = 646.791$



Day: M T W T F S S

Determine value of moment at 5.166 ft

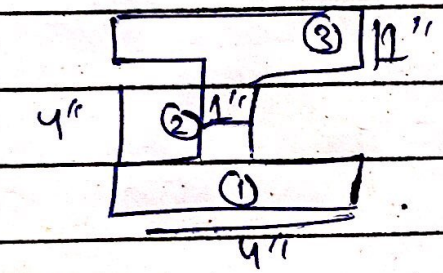


$M_{5.166} - 250.5 \times 5.166 + (48.5 \times 5.166) \times \left(\frac{5.166}{2}\right) = 0$

$M_{5.166} - 1294 + 647 = 0$

$M_{5.166} - 1294 + 647 = 647$

For shear stress we have $I = \frac{VQ}{Ib}$



$\bar{x} = 4/2 = 2in$

$\bar{y} = 6/2 = 3in$

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

from extreme left & bottom

Area of Point ① $= 4 \times 1 = 4in^2$

" ② $= 4 \times 1 = 4in^2$

" ③ $= 4 \times 1 = 4in^2$

Moment of Inertia about x-axis (centroidal) I_{xx}

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Distances between C.G of the whol section and its corresponding parts

Let G_1, G_2, G_3 be the centre of gravity of Point (1), (2) & (3) and k_1, k_2, k_3 be the distances b/w $\bar{y}$ and y_1, y_2, y_3 respectively

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

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

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

$$I_{xx} = \frac{bh_1^3}{12} + a_1k_1^2 + \frac{b_2h_2^3}{12} + a_2k_2^2 + \frac{b_3h^3}{12} + a_3k_3^2$$

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

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

$I_{xx} = 56 in$

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

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

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

$I_{yy} = 64 + 4 + 64$

$I_{yy} = 132 in$