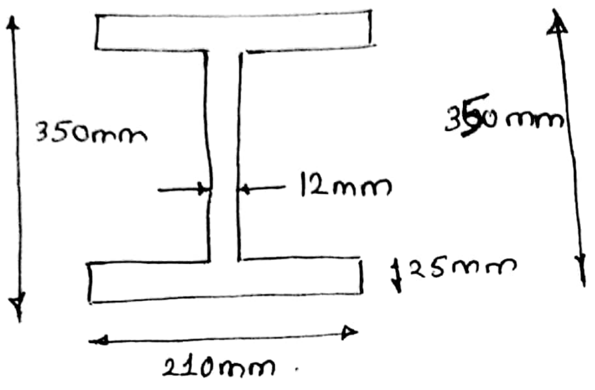
ASSIGNMENT 10

(1)



$$I = \frac{12 \times 300^3}{12} + 2 \times \left[\frac{210 \times 25^3}{12} + 25 \times 210 \times 162.5^2\right]$$

$$= 3.048 \times 10^8 \text{ mm}^4.$$

$$M_{max} = \frac{wL^2}{8} = \frac{40 \times 7.5^2}{8} = 281.25 \text{ KNm}.$$

(2)

$$\frac{281.25 \times 10^6}{3.048 \times 10^8} = \frac{f}{175} \quad \ldots \left[\frac{M}{I} = \frac{f}{y}\right]$$

$$f = 161.47 \text{ MPa}.$$

(3)

$$I = \frac{bh^3}{12}$$

$$= \frac{25 \times 75^3}{12} = 8.789 \times 10^5 \text{ mm}^4.$$

$$M_{max} = 5 \times 0.3 = 1.5 \text{ KN-m}.$$

$$\frac{M}{I} = \frac{f}{y}$$

$$f = \frac{1.5 \times 10^6 \times 37.5}{8.789 \times 105} = 64 \text{ MPa}.$$

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(4) $\frac{1}{\rho} = \frac{M_b}{EI_{yy}}$

$\rho = \frac{EI}{M_b}$

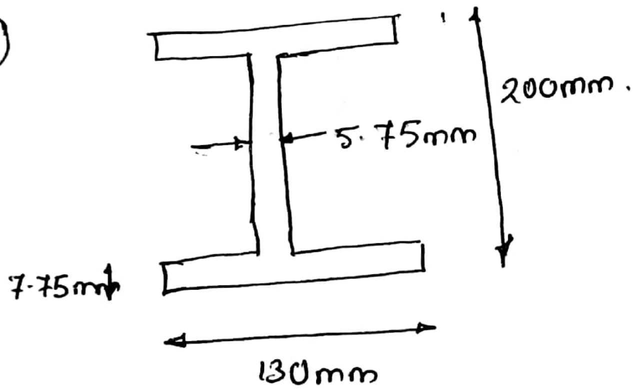
E = 200 GPa .... [∵ Steel Beam].

$= \frac{200 \times 10^3 \times 8.79 \times 10^5}{1.5 \times 10^6}$

= 117.2 m

≃ 120 m.

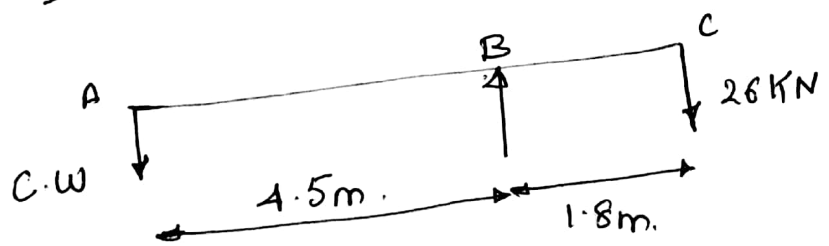
(5)



$I = \frac{5.75 \times 184.5^3}{12} + 2 \times \left[\frac{130 \times 7.75^3}{12} + 130 \times 7.75 \times 96.125^2\right]$

$I = 2.164 \times 10^7 \ mm^4$.

(6)



$\Sigma M_B = 0$

C.W × 4.5 = 26 × 1.8

C.W = 10.4 KN.

$M_{max} = 10.4 \times 4.5 = 46.8$ KNm

$V_{max} = 26$ KN

$$\frac{M}{I} = \frac{f}{y} \qquad \text{... For Tension.}$$

$$I = \frac{b \times b^3}{12} = \frac{b^4}{12} \quad ; \quad y = \frac{b}{2}.$$

$$\frac{46.8 \times 10^6}{\frac{b^4}{12}} = \frac{52}{b/2}.$$

$$b = 175\,mm$$

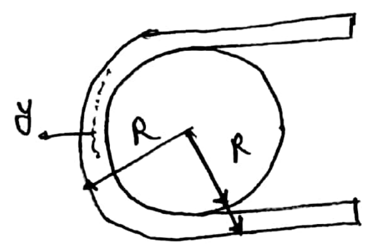
For Shear $\quad \tau_{max} = \frac{3}{2} \frac{V_{max}}{b^2}.$

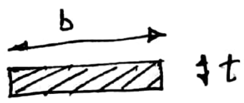
$$b^2 = \frac{3}{2} \times \frac{26 \times 10^3}{10}$$

$$b = 62.4\,mm.$$

So we need a 175mm section.

(7)





$$\text{Max strain} = \frac{y_{max}}{R} = \frac{t/2}{R}.$$

$$\text{Stress} = \frac{E \times y_{max}}{R} = \frac{Et}{2R}. \quad ; \quad R = 0.3 + t$$

$$280 \times 10^6 = \frac{200 \times 10^9 \times t}{2 \times \frac{1}{2} \times (0.3 + t)}$$

$$t = \cancel{4.200}\ 4.206 \times 10^{-4}\,m.$$

(8) $\sigma_{max} = \frac{Et}{2R}$

$\propto t$

$\therefore$ If thickness is halved

σ_{max} for $t/2$ will be $\frac{1}{2} \times 280 = 140$ MPa