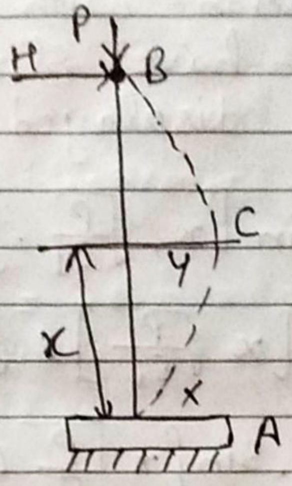
Date:
Page No.

Section-4

Ans-2



As we know that for long column, when one end of the column is fixed end other ~~and~~ end is hinged, we will have following and condition as mentioned here.

At fixed and A of the Column, i.e at $x=0$
Deflection y will be zero and slope dr/dx will also i.e $y=0$ and $dy/dx=0$

At hinged and B of the column i.e at $x=L$
Deflection: x will be zero.

Let us use the first and condition i.e at $x=0$ deflection $y=0$, in above lateral deflection equation for column and use will have value of constant of integration i.e C_1 and it will be as mentioned here $C_1 = (H.L/P)$

Date :
Page No.

Now, we will differentiate at the lateral deflection equation with respect to x and we will have slop for column AB it will be displayed by dy/dx

$$\frac{dy}{dx} = -C_1 \cdot \sin\left[x, \sqrt{\frac{P}{E_I}}\cdot\sqrt{\frac{P}{E_1}} + C_2 \cdot\right.$$

$$\cos\left[x\sqrt{\frac{P}{E_1}}\right]\cdot\sqrt{\frac{P}{E_1}} - H/P$$

$$\frac{dy}{dx} = -C_1\sqrt{\frac{P}{E_1}}\cdot \sin\left[x\sqrt{\frac{P}{E_1}}\right. \cos\left[x\cdot\sqrt{\frac{P}{E_1}}\right] - H/P$$

As we have already discussed that at $x=0$ slope will be zero or $dy/dx = 0$ and therefore now, we will use this end condition in above slope equation in order to secure the value of C_2

After using the value of $x=0$ and $dy/dx = 0$ in above slope eq., we will have value of C_2.

$$C_2 = CH/P\sqrt{E, I/P}$$

Now it's time to analyze the lateral deflection eq. after considering and implementing the value of both constant i.e C_1 & C_2

$$\frac{dy}{dx} = -C\sqrt{\frac{P}{E_1}}\cdot \sin\left[x\sqrt{\frac{P}{E_1}}\right] + C_2\cdot\sqrt{\frac{P}{E_1}} \cos\left[x\sqrt{\frac{P}{E_1}}\right] - HP$$

Date :

Page No.

$$E_1 = -HL/P \cos\left[x\sqrt{\frac{P}{E_1}}\right] + \{M/P \sqrt{E \cdot 1/P} \sin\left[L\sqrt{\frac{P}{E_1}}\right]$$

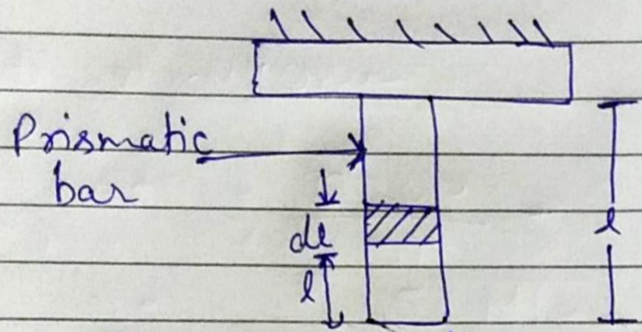
$$\tan\left[L\sqrt{\frac{P}{E}}\right] = L\sqrt{\frac{P}{E_1}}$$

$$L\sqrt{\frac{P}{E_1}} = 4.5 \text{ rad}$$

From here we will have expression for crippling load who and end of column is fixed and other end hinged and we have displayed it in following fig.

$$\left[P = \frac{2\pi^2 EL}{L^2}\right]$$

Strain energy due to self weight.
A bar of uniform stress section and of length l in a vertically many position is considered in fig. further strip of dy at a distance x from the lower and is also considered.



Bar of uniform stress section.

The strip is exerted upon by the weight of the bar of length x.

Let ρ be the density of the material of the bar weight acting on the strip = $(A x X) \times \Delta = \Delta A x$

Strain in the strip of thickness, dx Elongation, in dx

$$\frac{dx \text{ Elongation, in dx}}{dx}$$

where Δx_s is the elongation in dx

Stress in the strip.