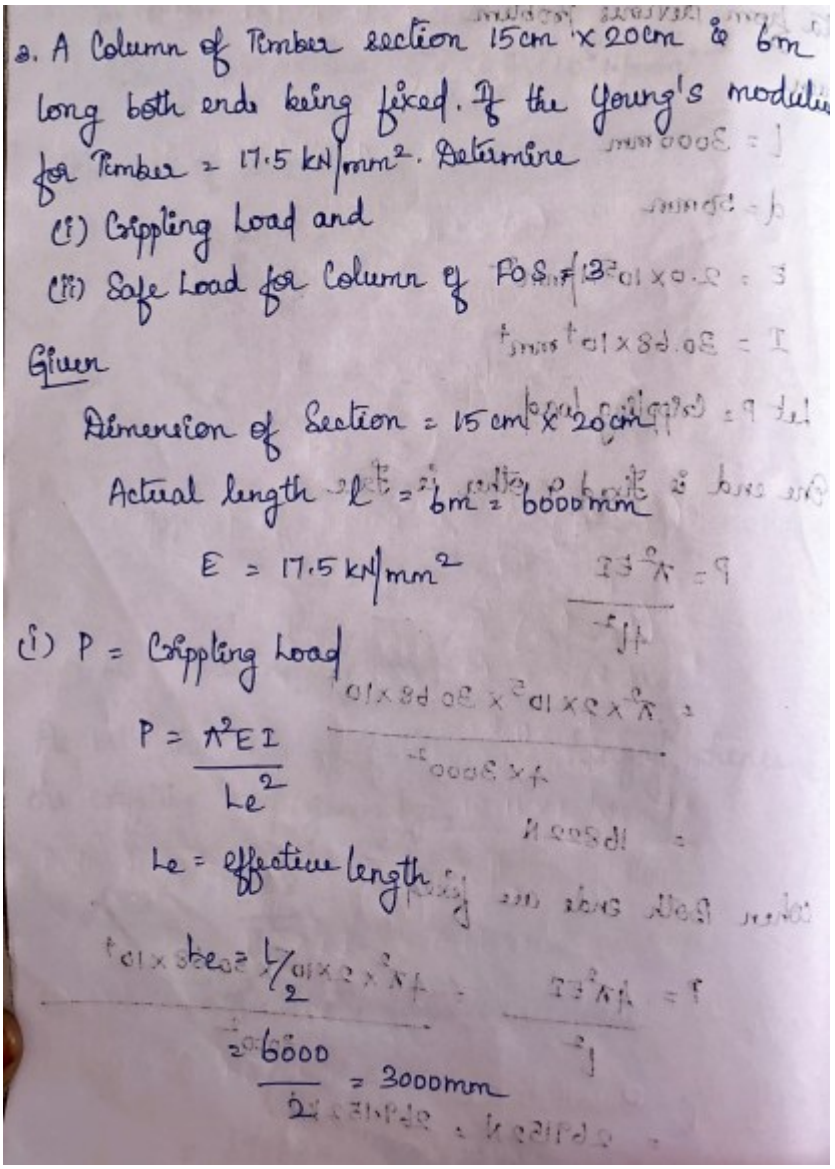
SNS COLLEGE OF TECHNOLOGY

DEPARTMENT OF AGRICULTURAL ENGINEERING

23AGT205-STRENGTH OF MATERIALS FOR AGRICULTURAL ENGINEERING

NOTES UNIT IV



a. A Column of Timber section 15cm x 20cm & 6m long both ends being fixed. If the young's modulus for Timber = 17.5 kN/mm². Determine

(i) Crippling Load and

(ii) Safe Load for Column of FOS = 3

Given

Dimension of Section = 15cm x 20cm

Actual length = 6m = 6000mm

E = 17.5 kN/mm²

(i) P = Crippling Load

$$P = \frac{\pi^2 E I}{Le^2}$$

Le = effective length

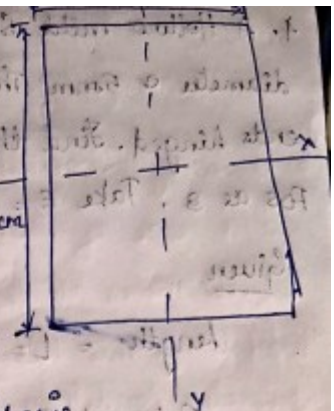
$$= \frac{L}{2} = \frac{6000}{2} = 3000mm$$

Moment of Inertia of Section about x-x axis

$I_{xx} = \frac{bd^3}{12}$

$= \frac{15 \times 20^3}{12} = 10000\ cm^4$

$= 10000 \times 10^4\ mm^4$



Moment of Inertia of Section about Y-Y axis

$I_{yy} = \frac{b^3 d}{12}$

$= \frac{20 \times 15^3}{12} = 5625\ cm^4$

$= 5625 \times 10^4\ mm^4$.

Since I_{yy} is less than I_{xx}, therefore column will buckle in yy direction.

I = least Value $= 5625 \times 10^4\ mm^4$,

$P = \frac{\pi^2 \times 17.5 \times 5625 \times 10^4}{3000}$

$= 1079.48\ KN$

(ii) FoS = 3

$\therefore$ Safe Load $= \frac{\text{Crippling load}}{\text{FoS}}$

$= \frac{1079.48}{3}$

$= 359.8 \approx 360\ KN$

4. A Hollow mild Steel Tube 6m long 4cm internal diameter & 5mm Thick is used as a Strut with both ends hinged. Find the Crippling load & Safe Load taking FOS as 3. Take $E = 2 \times 10^5 N/mm^2$

Given

Length $= L = 6m = 600cm$

Internal Dia $d = 4cm$

$t = 5mm = 0.5cm$

External Dia $D = d + 2t$

$= 4 + 2(0.5)$

$= 5cm$

$E = 2 \times 10^5 N/mm^2$

FOS = 3

Moment of Inertia $I = \frac{\pi}{64}(D^4 - d^4)$

$= \frac{\pi}{64}(5^4 - 4^4)$

$= 18.11 cm^4$

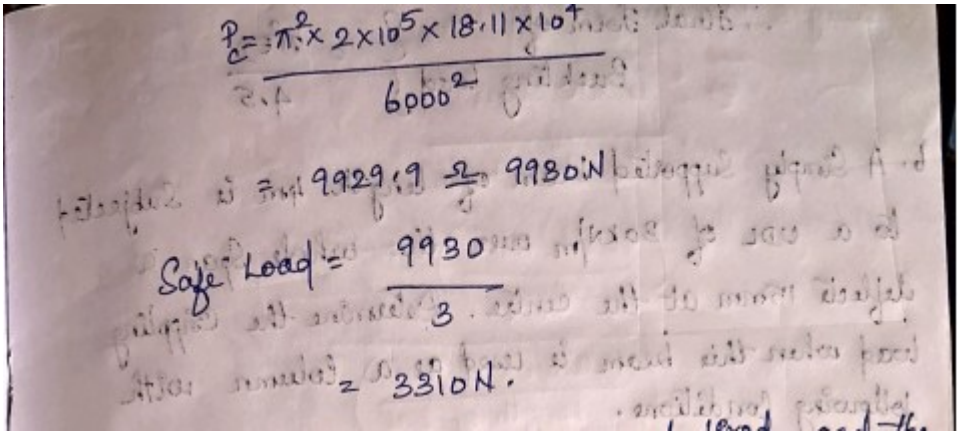
$= 18.11 \times 10^4 mm^4$

Both ends of Strut are hinged,

$P_e = \frac{\pi^2 EI}{L_e^2}$

$L_e = L$

$= 600 cm = 6000 mm$


$P_c = \frac{\pi^2 \times 2 \times 10^5 \times 18.11 \times 10^4}{6000^2}$
= 9929.9 ≈ 9930 N
Safe Load = $\frac{9930}{3}$
= 3310 N.