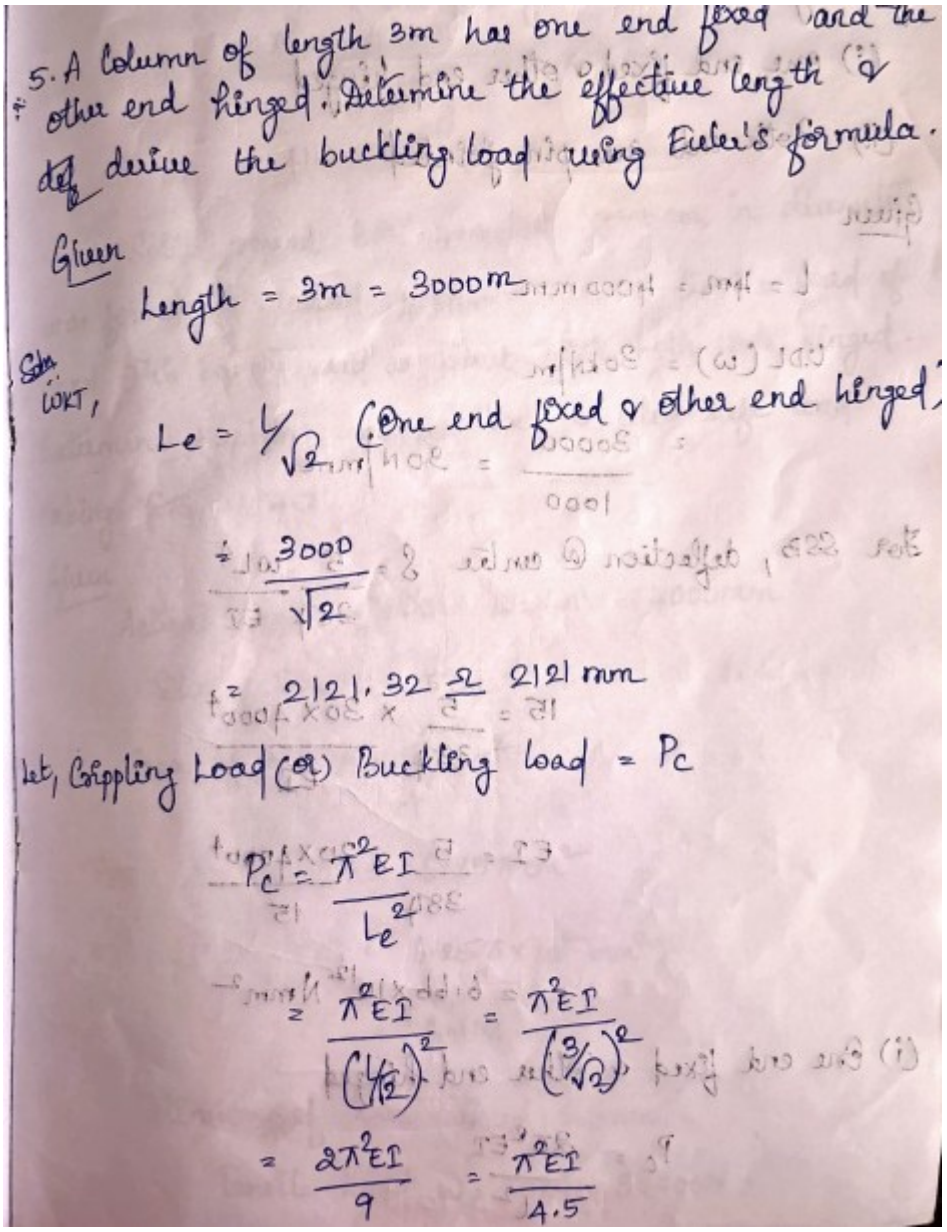
SNS COLLEGE OF TECHNOLOGY

DEPARTMENT OF AGRICULTURAL ENGINEERING

23AGT205-STRENGTH OF MATERIALS FOR AGRICULTURAL ENGINEERING

NOTES UNIT IV



5. A column of length 3m has one end fixed and the other end hinged. Determine the effective length & derive the buckling load using Euler's formula.

Given

Length = 3m = 3000mm

Sol:

WKT,

$L_e = L/\sqrt{2}$ (One end fixed & other end hinged)

$= \frac{3000}{\sqrt{2}}$

$= 2121.32$ mm

Let, Crippling Load (or) Buckling load = P_c

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

$= \frac{\pi^2 EI}{(L/\sqrt{2})^2} = \frac{\pi^2 EI}{(3/\sqrt{2})^2}$

$= \frac{2\pi^2 EI}{9} = \frac{\pi^2 EI}{4.5}$

∴ Final Form of Buckling load $= \frac{\pi^2 EI}{4.5}$

6. A Simply Supported beam of length 4m is subjected to a UDL of 30 kN/m over the whole span and deflects 15mm at the centre. Determine the crippling load when this beam is used as a column with following conditions.

(i) one end fixed & other end hinged

(ii) Both ends are pin jointed

Given

$L = 4m = 4000\ mm$

$UDL\ (w) = 30\ kN/m$

$= \frac{30000}{1000} = 30\ N/mm$

For SSB, deflection @ centre $\delta = \frac{5}{384}\frac{wL^4}{EI}$

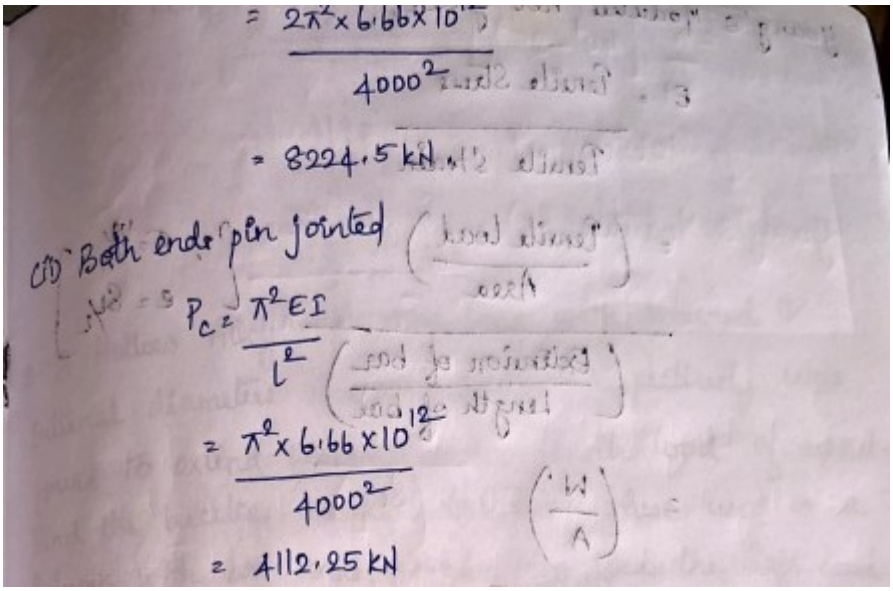
$$15 = \frac{5}{384} \times \frac{30 \times 4000^4}{EI}$$

$$EI = \frac{5}{384} \times \frac{30 \times 4000^4}{15}$$

$$= 6.66 \times 10^{12}\ N mm^2$$

(i) One end fixed & other end hinged

$$P_c = \frac{2\pi^2 EI}{L^2}$$


= 2π² × 6.166 × 10¹²
4000²
= 8224.5 kN
(ii) Both ends pin jointed
P_c = π²EI / L²
= π² × 6.166 × 10¹² / 4000²
= 4112.25 kN