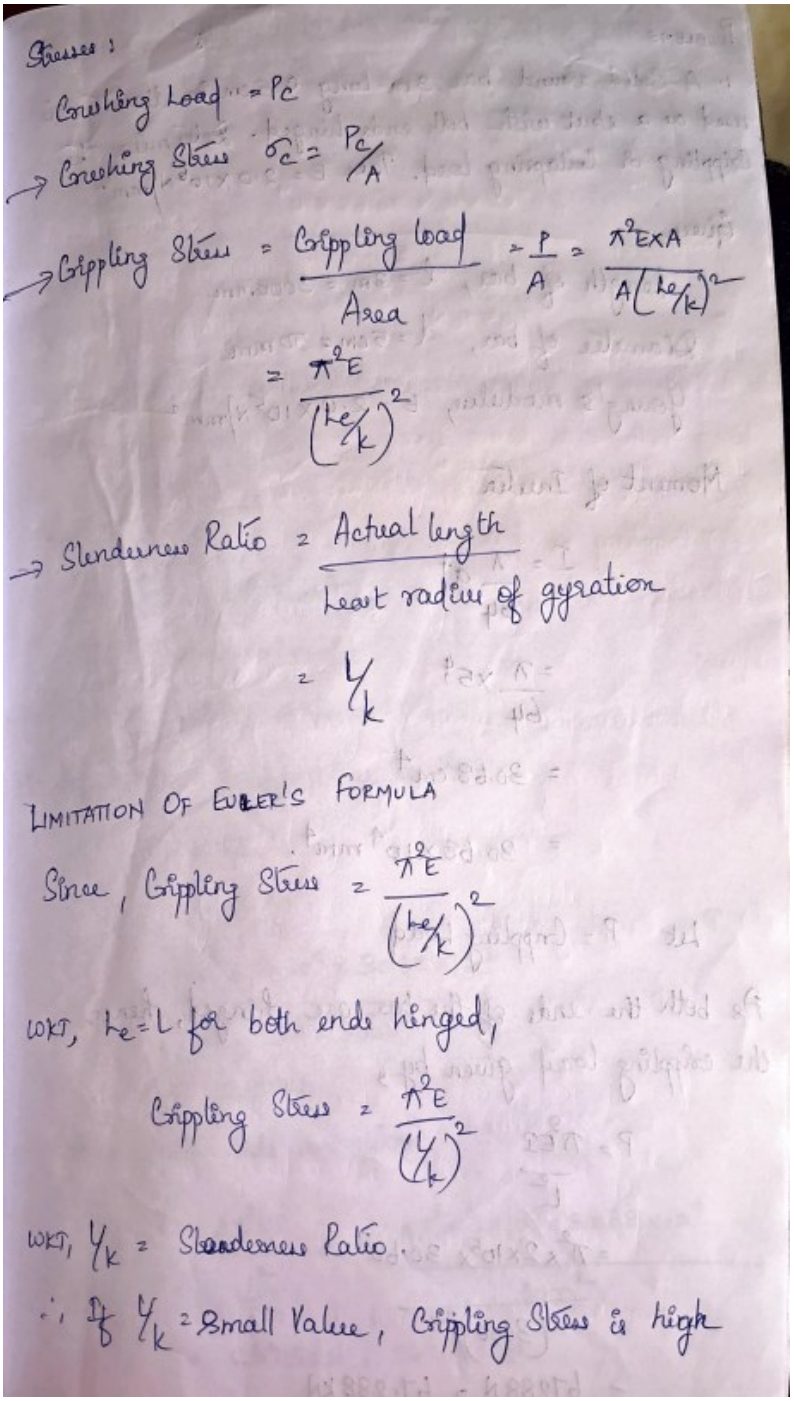
SNS COLLEGE OF TECHNOLOGY

DEPARTMENT OF AGRICULTURAL ENGINEERING

23AGT205-STRENGTH OF MATERIALS FOR AGRICULTURAL ENGINEERING

NOTES UNIT IV



PROBLEMS

1. A Solid round bar 3m long & 5cm in diameter used as a strut with both ends hinged. Determine the Crippling or Collapsing load. Take $E = 2.0 \times 10^5 N/mm^2$.

Given:

Length of bar, $l = 3m = 3000mm$

Diameter of bar, $d = 5cm = 50mm$

Young's modulus, $E = 2.0 \times 10^5 N/mm^2$

Moment of Inertia

$$I = \frac{\pi}{64} d^4$$

$$= \frac{\pi}{64} \times 5^4$$

$$= 30.68 cm^4$$

$$= 30.68 \times 10^4 mm^4.$$

Let P = Crippling Load

As both the ends of the bar are hinged, hence the crippling load given by,

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

$$= \frac{\pi^2 \times 2 \times 10^5 \times 30.68}{(3000)^2}$$

$$= 67288 N = 67.288 kN$$

2. For above Problem determine the crippling load, when the given Strut is used with following condition

(i) One end of the strut is fixed & the other end is free

(ii) Both the ends of Strut are fixed.

(iii) One end is fixed & other is hinged.

Data from Previous Problem

Given

$L = 3000\ mm$

$d = 50\ mm$

$E = 2.0 \times 10^5\ N/mm^2$

$I = 30.68 \times 10^4\ mm^4$

Let P = Crippling load

(i) One end is Fixed & other is Free

$$P = \frac{\pi^2 EI}{4L^2}$$

$$= \frac{\pi^2 \times 2 \times 10^5 \times 30.68 \times 10^4}{4 \times 3000^2}$$

$$= 16822\ N$$

(ii) When Both ends are fixed

$$P = \frac{4\pi^2 EI}{L^2} = \frac{4\pi^2 \times 2 \times 10^5 \times 30.68 \times 10^4}{3000^2}$$

$$= 269152\ N = 269.152\ kN$$

(iii) One end is fixed & other end is hinged

$$P = \frac{2\pi^2 EI}{l^2}$$

$$= \frac{2\pi^2 \times 2 \times 10^5 \times 30.68 \times 10^4}{3000^2}$$

$$= 134516N$$