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Section :- B

Subject :- MOS - II

Q8:-

Problem ⇒ 1

Given data

$$Le = 6\,ft$$
$$E = 10.3 \times 10^6\ psi$$
factor of safety = 2

Required; Safe central load = ?

Solution:- $$P_{cr} = \frac{\pi^2 E I}{Le^2}$$

$$P_{cr} = \frac{\pi^2 E A r^2}{Le^2} \longrightarrow \text{eq (i)}$$

Now $$r = \sqrt{\frac{I}{A}}$$

$$\Rightarrow \quad r = \sqrt{\frac{\frac{hb^3}{12}}{bh}}$$

$$r = \sqrt{b^2/12}$$

$$r = \frac{b}{2\sqrt{3}} \Rightarrow \frac{3/4}{2\sqrt{3}}$$

So $r = 0.216\,in$

Now

$$P_{cr} = \frac{\pi^2 E A}{(l_e/r)^2}$$

$$P_{cr} = \frac{(3.14)(10.3\times10^6)(1.5\,in^2}{\left(\frac{0.7\times l}{r}\right)^2}$$

$$P_{cr} = \frac{9.8596\times15.45\times10^6}{\left(\frac{0.7\times2}{0.216}\right)^2}$$

$$P_{cr} = \frac{152.33}{54444.4}$$

$$P_{cr} = 2.798\times10^3\ psi$$

$$P_{cr} = 2.798\ ksi$$

for P safe =-

$$P_{safe} = \frac{P_{cr}}{\text{factor of safety}}$$

$$P_{safe} = \frac{P_{cr} = 2.798}{2}$$

$$= 1.3989\ ksi$$

Q 2:- Problem :— 2

Given data:-

load = 20 kips = 2.4×10^5 psi

length = L = 10 ft

$E = 29 \times 10^6$ psi

required = length of each side = ?

Solution

AS we know that

$$le/r = \frac{\pi^2 E}{hp}$$

$$le/r = \frac{(3.14)^2 \times (2.9 \times 10^6)}{2.4 \times 10^5}$$

$$le/r = 1.19 \times 10^3$$

$$le/r = 34.5$$

$$r = le/34.5$$

$$r = \frac{10 \times 12}{34.5}$$

$$r = \frac{120}{34.5} = 3.4 \text{ in}$$

Now

1st

$$r = \frac{b^2}{12}$$

$$r^2 \times 12 = b^2$$

$$b^2 = (3.4)^2 \times 12$$

$$\boxed{b = 12.04 \text{ in}}$$

2nd

$$I = Ar^2$$

$$A = I/r^2$$

$$h^2 = h^4/12/r^2$$

$$1 = h^2/12r^2$$

$$h = 12r^2$$

$$\boxed{h = 11.77}$$

Q3

Problem no- 4:-

Given data = 310 × 40mm
Column = 3ϕ0 × 40mm
$E = 200 \times 10^9$ pa
$6F = 240 \times 10^6$ pa
L = 12 m
Factory OF safety = 2.5
Requaired,
a → cmin = ?
b → P safe = ?

solution
→ As we that

$6p = E\pi^2/(Le/r^2)$

$Le/r = E\pi^2/p$

$Le/r = \sqrt{(3.14)^2 \times (200 \times 10^9)/240 \times 10^9}$

Le/r = 90.64

now → $r = \sqrt{b^2/12}$

→ $r = \sqrt{45/12}$

r = 12.99 m

now Le = 90.64 × 12.99

Le = 1177.44 mm

now For pin hinge

L = Le

Lmin → 1177.44mm

Part B → $P_{cr} = \pi^2 ear^2/Le^2$

$P_{cr} \rightarrow (3.14)^2 (200 \times 10)^9 (13950)(12.99)/(12 \times 100)$

P_{cr} = 32.323 G.N Now →

For P safe = Pcr/ factor of sat

Psafe = 32.322/2.5

P safe = 12.92 G.N.