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ASSIGNMENT :- MOS II

SUBMITTED TO :- Engr SIR SAQIB

Date:

Q 1

GIVEN DATA :-

$l_e = 6ft$ $\qquad l_e = 0.7L$

$E = 10.3 \times 10^6 Psi$

factor of safety = 2

REQ :- $\qquad b = 3/4 in, h = 2in$

Safe central load = ?

Sol :-

$$P_{cr} = \frac{\pi^2 EI}{l_e^2}$$

$$P_{cr} = \frac{\pi^2 EA\gamma^2}{l_e} \longrightarrow (1)$$

Now

$$\gamma = \sqrt{\frac{I}{A}}$$

$$\gamma = \sqrt{\frac{b^2}{12}}$$

$$\gamma = \frac{b}{2\sqrt{3}}$$

$$\gamma = \frac{3/4}{2\sqrt{3}}$$

$$\gamma = \frac{0.75}{3.46}$$

$$\boxed{\gamma = 0.216 in}$$

Now

$$P_{cr} = \frac{\pi^2 EA}{(l_e/\gamma)^2}$$

Date:

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

$$P_{cr} = \frac{(3.14)^2 (10.3 \times 10^6)(1.5\ in^2)}{\left(\frac{0.7 \times L}{r}\right)^2}$$

$$P_{cr} = \frac{9.8596 \times 15.45 \times 10^6}{\left(\frac{0.7 \times 72}{0.216}\right)^2}$$

$$\frac{l_e}{r} = \sqrt{\frac{(3.14)^2 \times 200 \times 10^9}{240 \times 10^6}}$$

$$\boxed{\frac{l_e}{r} = 90.64}$$

Now

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

$$r = \sqrt{\frac{(45)^2}{12}}$$

$$\boxed{r = 12.99\ mm}$$

Now

$$l_e = 90.64 \times 12.99$$

$$l_e = 1177.44 mm$$

Now for Pin hiye

$$L = l_e \Longrightarrow \boxed{L_{min} = 1177.44\ mm}$$

Date:

Q4

GIVEN DATA:-

Column = 310mm x 450mm
$E = 200 \times 10^9 Pa$
$\sigma P = 240 \times 10^6 Pa$
$L = 12m$
factor of safety = 2.5

REQ:-

a) $L_{min} = ?$
b) $P_{safe} = ?$

Sol:-

As we know that

$$\sigma P = \frac{E\pi^2}{(l_e/r)^2}$$

$$\frac{l_e}{r} = \sqrt{\frac{E\pi^2}{\sigma P}}$$

Part b

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

$$P_{cr} = \frac{(3.14)^2 (200 \times 10^9)(13950)(12.99)^3}{(12 \times 1000)^2}$$

$$P_{cr} = 32.2343 \text{ GN}$$

Now

for safe:

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

Date:

$$P_{safe} = \frac{32.2343\ GN}{2.5}$$

$$\boxed{P_{safe} = 12.8937\ GN}$$

$$P_{cr} = \frac{152.33}{5444.4}$$

$$P_{cr} = 2.7979 \times 10^{3}\ psi$$

$$P_{cr} = 2.7979\ ksi$$

for P_{safe} :-

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

$$P_{safe} = \frac{2.7979}{2}$$

$$\boxed{P_{safe} = 1.3989\ ksi}$$

Date:

Q2

GIVEN DATA:-

load = 20 kips = 2.4×10^5 psi

length = L = 10 ft

$E = 29 \times 10^6$ psi

REQ:-

length of each side = l

Sol:-

As we know that

$$\frac{l_e}{r} = \sqrt{\frac{\pi^2 E}{6}}$$

$$\frac{l_e}{r} = \sqrt{\frac{(3.14)^2 \times (29 \times 10^6)}{2.4 \times 10^5}}$$

$$\frac{l_e}{r} = 34.5$$

$$r = \frac{l_e}{34.5}$$

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

$$r = \frac{120}{34.5}$$

$$r = 3.4 \text{ inch}$$

Date:

1st method :—

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

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

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

$$b^2 = 138.72$$

$$\sqrt{b^2} = \sqrt{138.72}$$

$$b = 11.77$$

2nd method

$$I = Ar^2$$

$$A = \frac{I}{r^2}$$

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

$$1 = \frac{b^2}{12r^2}$$

$$h^2 = 12r^3$$

$$h = 11.77$$

* *

Date:

Q3 :-

GIVEN DATA :-

load = 20 kips = 2.4×10^5 psi

length = L = 10 ft

$\varepsilon = 1.6 \times 10^6$ psi

REQ :-

length of each side = ?

Sol :-

As we know that

$$\frac{le}{\gamma} = \sqrt{\frac{\pi^2 \varepsilon}{6p}}$$

$$\frac{le}{\gamma} = \sqrt{\frac{(3.14)^2 \times 1.6 \times 10^6}{2.4 \times 10^5}}$$

$$\frac{le}{\gamma} = \sqrt{9.856 \times \frac{1.6 \times 10^6 \times 10^{-5}}{2.4}}$$

$$= \sqrt{65.730}$$

$$\frac{le}{\gamma} = 8.107$$

$$\gamma = \frac{le}{8.107}$$

$$\gamma = \frac{120}{8.107}$$

$$\gamma = 14.802 \text{ inch}$$

Date:

1st Method :-

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

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

$$b^2 = (14.802)^2 \times 12$$

$$b^2 = 2629.190$$

$$\sqrt{b^2} = \sqrt{2629.190}$$

$$b = 51.275$$

2nd Method :-

$$I = Ar^2$$

$$A = I / r^2$$

$$A = \frac{h^2}{12} / r$$

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

$$h^2 = 12r^2$$

$$h^2 = 2629.190$$

$$\sqrt{h^2} = \sqrt{2629.190}$$

$$h = 51.275.$$