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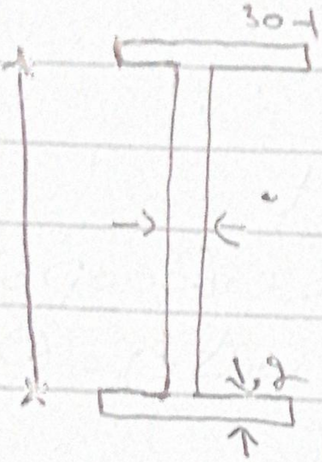
Section B

Subject MOS-II

Q.no1: (a).



Solution:

$$I = 2\left\{\frac{bh^3}{12} + Ay^2\right\} + \left[\frac{bh^3}{12} + Ay^2\right]$$

$$I = 2\left[\frac{86(2)^3}{12} + (20)(25)^2\right] + \left[\frac{2(50)^3}{12}\right]$$

5034.66

= ~~2(26.666+1000)~~ + 20833.33

~~(1026.67)~~

= 70867.99 mm^4

~~(= 21868 = 1n^4)~~

$$= \frac{t_f h^2 b^2}{4I}$$

$$e = \frac{(9) \times (50)^2 \times (26)^2}{\cancel{4((2 \times 862)} \; 4(70867.99)}$$

~~$e = \frac{3380000}{37448}$~~

$e = 11.09$

~~$= 38.65154$~~

Ans:
(a)-

Moment of inertia.

$$I_z = \frac{bh^3}{12} = \frac{0.1(0.15)^3}{12}$$

$$I_z = 2.8125 \times 10^{-5}$$

Now:

$$I_y = \frac{bh^3}{12} = \frac{(0.15)(0.3)^3}{12}$$

$$I_y = 1.25 \times 10^{-5}$$

$$\sigma = 8886772 \, N/m^2$$

$$\sigma = \frac{M_z y}{I_z} + \frac{M_y z}{I_y}$$

$$\sigma = \frac{M\cos\theta}{I_z} + \frac{M\sin\theta}{I_y}$$

$$= 12\cos 30^\circ$$

$$M_z = 1.7510$$

$m\sin\theta - P\sin\theta = m_y$

$= 12\sin 30^\circ$

$m_y = -11.3563$

$$\sigma = \left(\frac{m_z}{I_z}\right) + \left(\frac{m_y}{I_y}\right)$$

$$\sigma = \frac{1.351}{9.312\times10^{-5}} + \left(\frac{-11.3563}{1.25\times10^{-5}}\right)$$

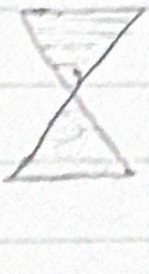
$$\sigma = 332173\ N/m^2$$

Compression -> Negative

Tension -> Positive

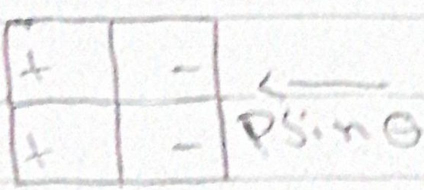
(Beam is simply supported).

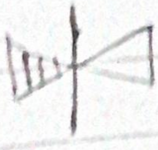
2	1
3	4



Quadrant 1, 2 -ive

" 3, 4 +ve





Q. 1, 4 -ive

Q. 2, 3 +ve

In case:

$$\sigma = \frac{M\cos 1y}{I_x} + \frac{M\sin\theta z}{I_y}$$

In this case NA passes through g, 4

$$\sigma = \frac{M\cos\theta y}{I_z} + \frac{M\sin\theta z}{I_y}$$

* Bending stress due to $P\cos\theta$ is compressive.

* Bending stress due to $P\sin\theta$ is Tensile.

$$= -\frac{M\cos\theta y_A}{I_z} - \frac{M\sin\theta z_A}{I_y}$$

$$\frac{y_A}{z_A} = \frac{I_z \sin\theta}{I_y \cos\theta}$$

$$\tan\alpha = \frac{I_z}{I_y}\tan\theta$$

$$\tan x = \frac{I_z}{I_y}\tan 30$$

$$= \frac{9.8125 \times 10^{-5}}{1.95 \times 10^{-5}}\tan 30$$

Qno8:

(B) -

Given:

$L = 16 ft$

$I_x = 112.6$

$I_y = 18.7 in^4$

$S_c = 12000 Psi$

$S_t = 5000 Psi$

Solution:

$$P_{cr} = \frac{n \pi^2 E I}{Le^2}$$

put values.

$= 1638.6 lb.$

Q no 8:

Given:

$L = 10ft$

$B = 0.75''$

$H = 2''$

Factor of safety = 2

$E = 10.3 \times 10^6$

Required: $P_{safe} = ?$

Solution:

$I = I_x = (3/4)(2)^3 = 0.5 in^4$

L_e = (Hinged ended column).

$$P_{cr} = \frac{n^2 E I \pi^2}{L_e^2}$$

$$P_{cr} = \frac{(1)^2 (10.3 \times 10^6)(0.5)(\pi^2)}{(10 \times 12)^2}$$

$P_{cr} = 3526.7$

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

$$= \frac{3526.7}{2} = 1768.08$$

Case 2:

As:

$$I = I_y = \frac{(2)(0.75)^2}{2}$$

$$I_y = 0.07 \, in^4$$

$$P_{cr} = \frac{n^2 E I \pi^2}{L_e}$$

$$P_{cr} = \frac{(1)^3 (10.3 \times 10^6)(0.07)(3.14)^2}{(120/2)}$$

$$P_{cr} = 1974.65 \, lb$$

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

$$= \frac{1974.54}{2}$$

$$= 987.32$$

$$P_{safe} = 987.32 < 1763.07.$$