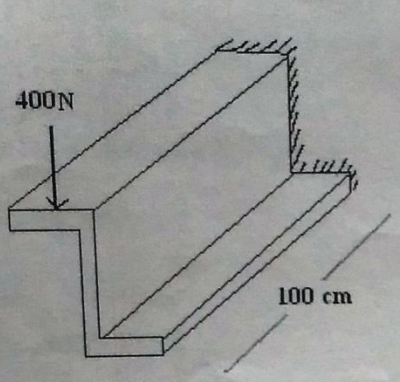
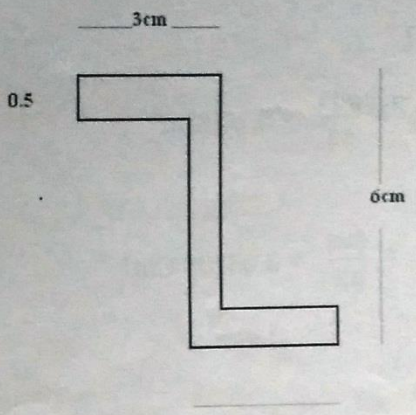
Subject Code & Name**: 23AST205-Aerospace Structures**

TOPIC:**7. Bending stresses in beams of symmetric sections with skew loads**

Bending stress in section due to skew loads





Step : 1

Element table:

E	A Cm^2	X cm	Y cm	AX	AY	AX^2	AY^2	AXY	I_{cx} Cm^4	I_{CY} Cm^4
1	1.5	-1.25	2.75	-1.875	4.125	2.343	11.343	-5.156	0.03125	1.125
2	2.5	0	0	0	0	0	0	0	5.208	0.05208
3	1.5	1.25	-2.75	1.875	-4.125	2.343	11.34	-5.15	0.03125	1.125
Σ	5.5	0	0	0	0	4.656	22.686	-10.312	5.2705	2.302

Section 1

$$I_{cx} = \frac{bd3}{12} = = 0.03125 Cm^4$$

$$I_{cy} = \frac{db3}{12} = 1.125\ Cm^4$$

Section 2

$$I_{cx} = \frac{bd3}{12} = 5.208 Cm^4$$

$$I_{cy} = \frac{db3}{12} = 0.05208\ Cm^4$$

Section 3

$$I_{cx} = \frac{bd3}{12} = 0.03125 Cm^4$$

$$I_{cy} = \frac{db3}{12} = 1.125\ Cm^4$$

Step : 2

Step : 3

$$I_{xx} = \Sigma I_{cx} + \Sigma AY^2 - \Sigma a\,\bar{Y}^2$$

$$= 27.95 Cm^4$$

$$I_{yy} = \Sigma I_{cy} + \Sigma AX^2 - \Sigma a\,\bar{X}^2$$

$$= 6.98 Cm^4$$

$$I_{xy} = \Sigma AXY - \Sigma A\bar{X}\bar{Y}$$

$$= -10.312 Cm^4$$

Step : 4

$$\sigma = \frac{\bar{M}x}{Ixx} y + \frac{\bar{M}y}{Iyy} x$$

$M_x = -400 \times 100 = -40000$; $M_y = 0$

$$\bar{M}x = M_x - M_y \frac{Ixy}{Iyy}$$

$$\overline{M}_y = \frac{My - Mx\frac{Ixy}{Ixx}}{1 - \frac{Ixy^2}{IxxIyy}}$$

$$= -32434.685 \text{N- cm}$$

Step : 5

$$\sigma = \frac{Mx}{Ixx} y + \frac{My}{Iyy} x$$

$$\sigma = -3145.78\ y - 4646.8\ x$$