



**SNS COLLEGE OF TECHNOLOGY**  
(An Autonomous Institution)  
**DEPARTMENT OF AEROSPACE ENGINEERING**



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

TOPIC: **8. Bending stresses in beams of symmetric sections with skew loads**

**Step : 1**

**Element table:**

ELE	A	X	Y	AX	AY	AX <sup>2</sup>	AY <sup>2</sup>	AXY	I <sub>CX</sub>	I <sub>CY</sub>
	Cm <sup>2</sup>	cm	cm						Cm <sup>4</sup>	Cm <sup>4</sup>
1	0.78	-1.15	1.95	-0.897	1.521	1.031	2.965	-1.749	0.00585	0.4394
2	1.08	0	0	0	0	0	0	0	0	0
3	0.78	1.15	-1.95	-0.897	1.521	1.031	2.965	-1.749	0.00585	0.4394
Σ	2.64	0	0	0	0	2.062	5.93	-3.498	1.1781	0.8869



### Section 1

$$I_{cx} = \frac{bd^3}{12} = 0.00585 \text{ Cm}^4$$

$$I_{cy} = \frac{db^3}{12} = 0.4394 \text{ Cm}^4$$

### Section 2

$$I_{cx} = \frac{bd^3}{12} = 1.1664 \text{ Cm}^4$$

$$I_{cy} = \frac{db^3}{12} = 0.0081 \text{ Cm}^4$$

### Section 3

$$I_{cx} = \frac{bd^3}{12} = 0.00585 \text{ Cm}^4$$

$$I_{cy} = \frac{db^3}{12} = 0.4394 \text{ Cm}^4$$

Step : 2



Step : 3

$$I_{xx} = \Sigma I_{cx} + \Sigma AY^2 - \Sigma a \bar{Y}^2$$
$$= 7.11 \text{ Cm}^4$$

$$I_{yy} = \Sigma I_{cy} + \Sigma AX^2 - \Sigma a \bar{X}^2$$
$$= 2.9489 \text{ Cm}^4$$

$$I_{xy} = \Sigma AXY - \Sigma A\bar{X}\bar{Y}$$
$$= -3.498 \text{ Cm}^4$$

Step : 4

$$\sigma = \frac{\bar{M}_x}{I_{xx}} y + \frac{\bar{M}_y}{I_{yy}} x$$

$$M_x = -4.905 \times 64 = -313.92 \text{ Ncm} ; M_y = 0$$

$$\bar{M}_x = \frac{M_x - M_y \frac{I_{xy}}{I_{yy}}}{1 - \frac{I_{xy}^2}{I_{xx} I_{yy}}}$$



$$=97.5406\text{N-cm}$$

Step : 5

$$\sigma = \frac{M_x}{I_{xx}} y + \frac{M_y}{I_{yy}} x$$

$$\sigma = 33.078x - 27.885 y$$