K J Somaiya College of Engineering, Mumbai-77

(Constituent college of Somaiya Vidyavihar University)

Module 3 : Centroid of Wires and Laminas

Presented by:

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Centroid of wires/rods, Centroid of plane laminas: Plane lamina consisting of primitive geometrical shapes.

Centroid of composite areas/lines or wires

(a) For Areas

$$\bar{x} = \frac{A_1 x_1 + A_2 x_2 + A_3 x_3 + \ldots}{A_1 + A_2 + A_3 + \ldots} = \frac{\Sigma A_i x_i}{\Sigma A_i} \qquad \bar{y} = \frac{A_1 y_1 + A_2 y_2 + A_3 y_3 + \ldots}{A_1 + A_2 + A_3 + \ldots} = \frac{\Sigma A_i y_i}{\Sigma A_i}$$

Here $A_1, A_2, \ldots =$ Areas of individual components.

$x_1, x_2, \ldots =$ Distance of individual centroid from y-axis.

$y_1, y_2, \ldots =$ Distance of individual centriod from x-axis.

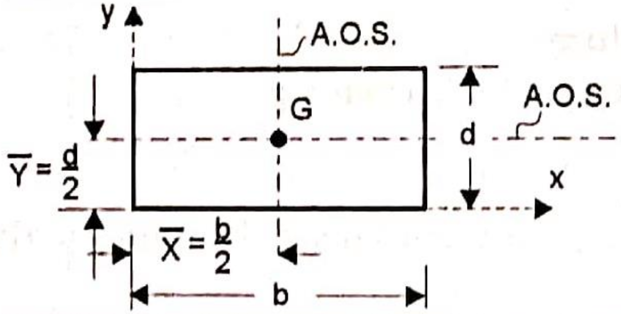
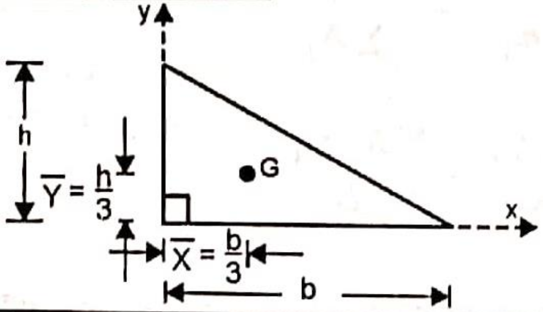
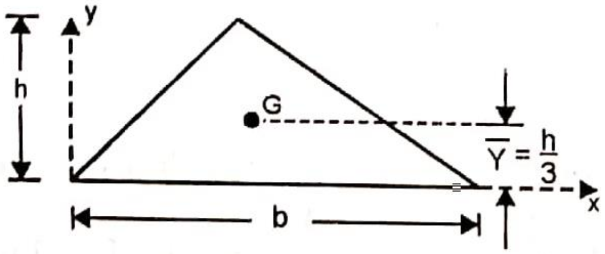
(b) For Lines

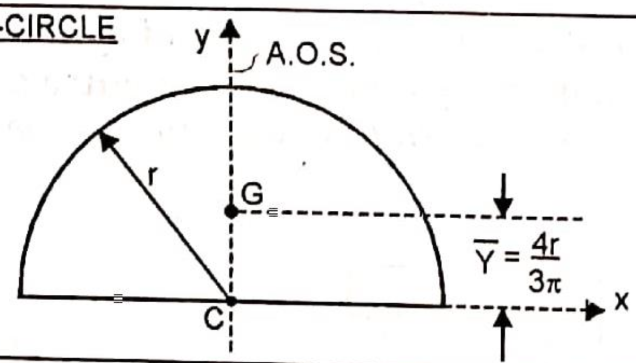
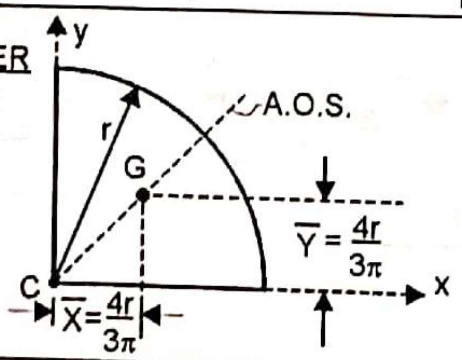
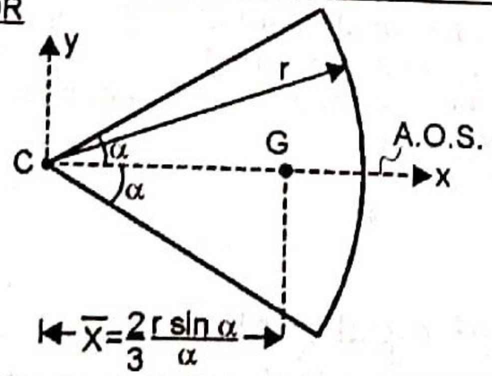
$$\bar{x} = \frac{l_1 x_1 + l_2 x_2 + l_3 x_3 + \ldots}{l_1 + l_2 + l_3 + \ldots} = \frac{\Sigma l_i x_i}{\Sigma l_i} \qquad \bar{y} = \frac{l_1 y_1 + l_2 y_2 + l_3 y_3 + \ldots}{l_1 + l_2 + l_3 + \ldots} = \frac{\Sigma l_i y_i}{\Sigma l_i}$$

$$\bar{z} = \frac{l_1 z_1 + l_2 z_2 + l_3 z_3 + \ldots}{l_1 + l_2 + l_3 + \ldots} = \frac{\Sigma l_i z_i}{\Sigma l_i}$$

Here $l_1, l_2, \ldots =$ Length of individual rods.

Centroid of regular plane areas

SR. NO.	FIGURE	AREA	$\bar{X}$	$\bar{Y}$
1.	RECTANGLE 	$b \times d$	$\frac{b}{2}$	$\frac{d}{2}$
2.	RT. ANGLE TRIANGLE 	$\frac{1}{2} \times b \times h$	$\frac{b}{3}$	$\frac{h}{3}$
3.	ANY TRIANGLE 	$\frac{1}{2} \times b \times h$	–	$\frac{h}{3}$

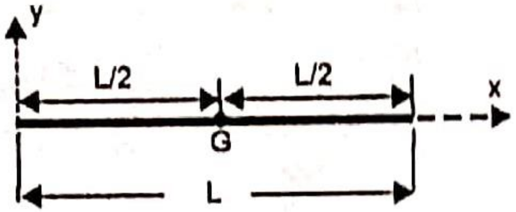
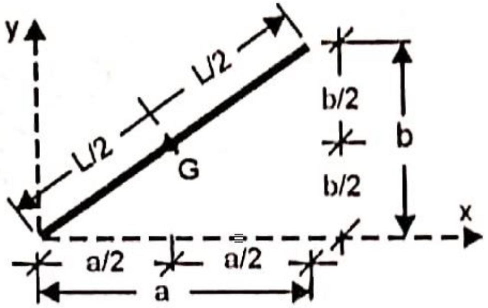
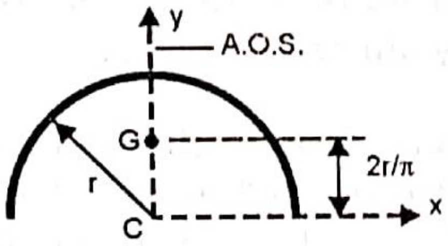
4.	SEMI-CIRCLE 	$\frac{\pi r^2}{2}$	0	$\frac{4r}{3\pi}$
5.	QUARTER CIRCLE 	$\frac{\pi r^2}{4}$	$\frac{4r}{3\pi}$	$\frac{4r}{3\pi}$
6.	SECTOR 	$r^2 \alpha$ *	$\frac{2}{3}\frac{r \sin \alpha}{\alpha^{\#}}$	0

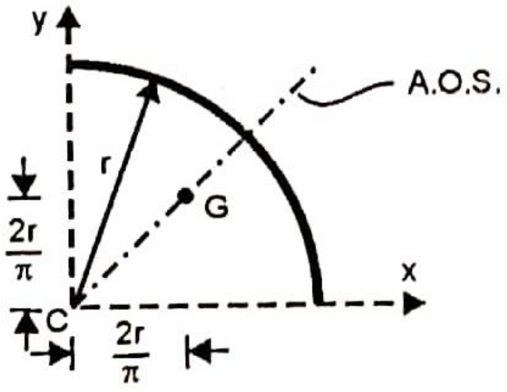
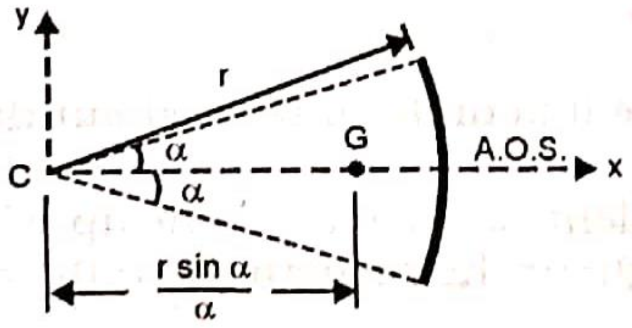
* α is in radians

Table 6.1

\# α in the denominator is in radians

Centroid of Lines/Wires

SR. NO	FIGURE	LENGTH	Co-ordinates	
			X	Y
1.	STRAIGHT HORIZONTAL LINE 	L	$\frac{L}{2}$	0
2.	STRAIGHT INCLINED LINE 	L	$\frac{a}{2}$	$\frac{b}{2}$
3.	SEMI-CIRCULAR ARC 	πr	0	$\frac{2r}{\pi}$

4.	QUARTER-CIRCULAR ARC 	$\frac{\pi r}{2}$	$\frac{2r}{\pi}$	$\frac{2r}{\pi}$
5.	CIRCULAR ARC 	$2 r \alpha^*$	$\frac{r \sin \alpha}{\alpha^{\#}}$	0

* α is in radians

\# α in the denominator is in radians