UNIT - II

PROPERTIES OF SURFACES & SOLIDS

CENTRE OF GRAVITY:

The centre of gravity of a body is defined as the point through which the entire weight of the body acts.

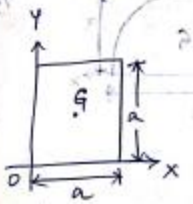
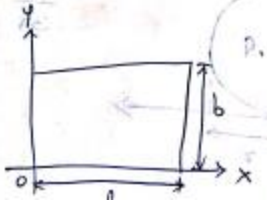
CENTROID:

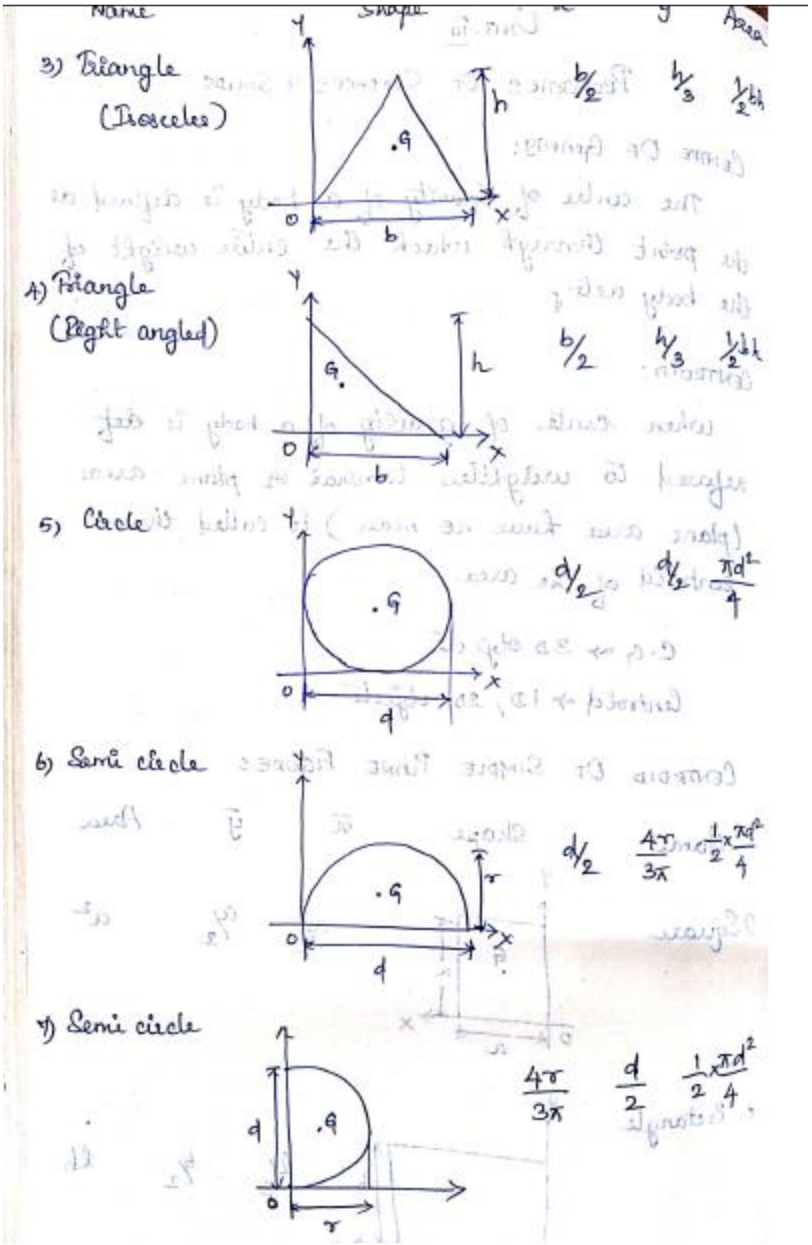
When centre of gravity of a body is ~~def~~ refered to weightless laminar or plane areas (plane area have no mass) is called the centroid of the area.

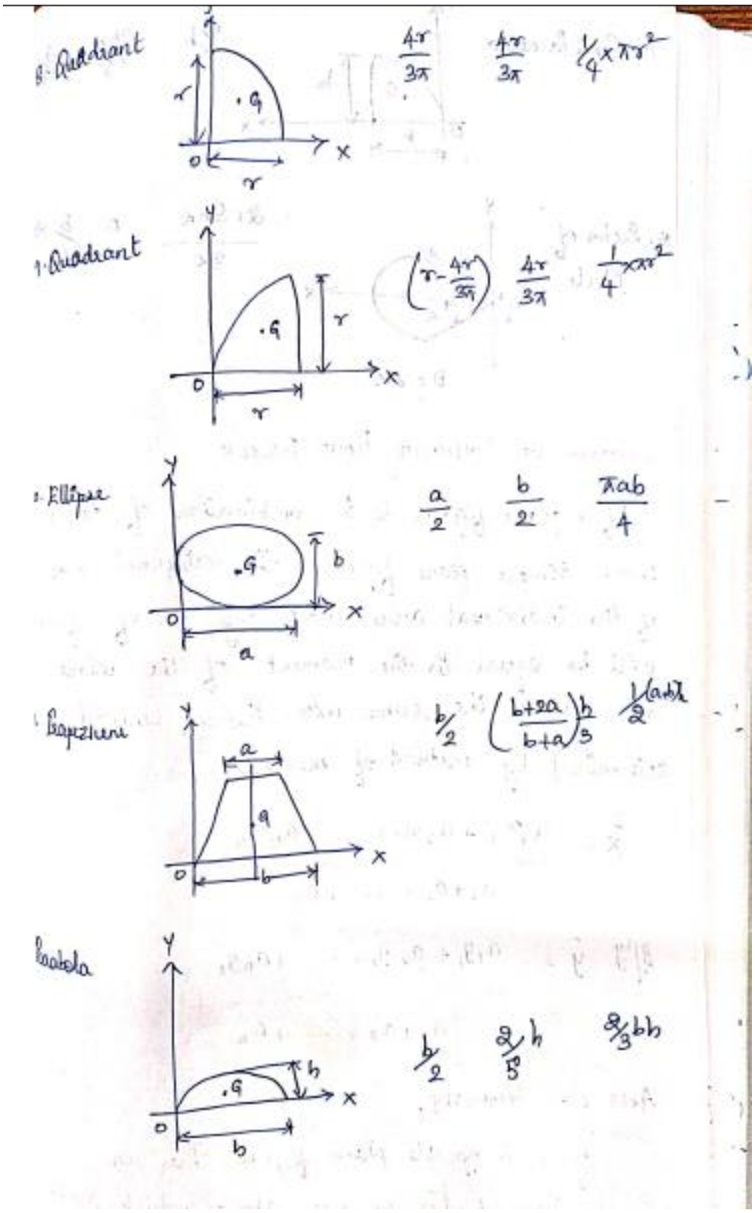
C.G → 3D objects

Centroid → 1D, 2D objects

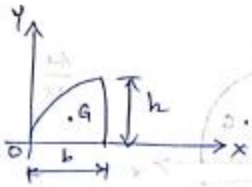
CENTROID OF SIMPLE PLANE FIGURES

Name	Shape	$\bar{x}$	$\bar{y}$	Area
Square		$a/2$	$a/2$	a^2
Rectangle		$l/2$	$b/2$	lb


Name
Shape
Area
3) Triangle
(Isosceles)
b/2
h/3
1/2 bh
h
G
O
X
b
4) Triangle
(Right angled)
b/2
h/3
1/2 bh
h
G
O
X
b
5) Circle
d/2
d/2
πd²/4
G
O
X
d
6) Semi circle
d/2
4r/3π
1/2 x πd²/4
r
G
O
X
d
7) Semi circle
4r/3π
d/2
1/2 x πd²/4
d
G
O
r

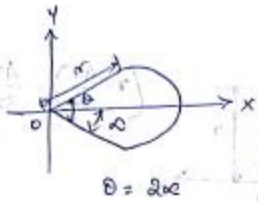

8. Quadrant
4r/3π
4r/3π
1/4 × πr²
r
G
O
X
r
1. Quadrant
(r - 4r/3π)
4r/3π
1/4 × πr²
Y
r
G
O
X
r
Ellipse
a/2
b/2
πab/4
Y
b
G
O
X
a
Triangle
b/2
((b+2a)/(b+a)) h/3
1/2 (a+b) h
Y
a
G
O
X
b
Parabola
b/2
2/5 h
2/3 bh
Y
h
G
O
X
b

13. Semi Parabola



$\frac{5}{8}b$ $\frac{2h}{5}$ $\frac{2}{3}bh$

14. Sector of Circle



$\frac{2r\sin\alpha}{3\alpha}$ $\theta = 2\alpha$ $\frac{\theta}{360} \times \pi r^2$

CENTROID OF COMPOSITE PLANE FIGURES

If a plane figure is a combination of two or more simple plane figures, the algebraic sum of the individual areas about any axis of reference will be equal to the moment of the whole area about the same axis. Hence, centroid is determined by method of moments.

$$\bar{x} = \frac{a_1x_1 + a_2x_2 + \dots + a_nx_n}{a_1 + a_2 + \dots + a_n}$$

$$\text{And } \bar{y} = \frac{a_1y_1 + a_2y_2 + \dots + a_ny_n}{a_1 + a_2 + \dots + a_n}$$

AXIS OF SYMMETRY.

If a compound plane figure has an axis of symmetry (i.e., an axis about which similar