CHAPTER NINE

9.0 THE ELLIPSE

It is the locus of a point which moves so that the sum of its distances from two fixed points is a constant. It longest diameter is called the MAJOR AXIS, while its shortest diameter is called the MINOR AXIS. These two axes bisect each other at right angles. The constant is the major axis of the ellipse while the two fixed points are called focal points (foci).

Methods of constructing Ellipse include:

i Concentric circles method
ii The focal point method
iii The rectangular method.
iv The trammel method
v The intersecting arc method

The concentric circle method

Procedure:

i Draw two concentric circles of radii equal to the major and minor diameter of the ellipse respectively. (They are called concentric because both have the same centre).
ii Divide the circles into twelve equal parts i.e the angle in each division should be 30°.
iii A typical radius of the bigger circle is OBA, from B, draw a horizontal line which meets the vertical drawn from A at C. Repeat this simple method for the remaining seven radii as shown in the fig.7.1
iv All the meeting points of both the horizontals and verticals are joined to form the ellipse.
v PQ is the MAJOR AXIS while.
vi X Y is the MINOR AXIS of the ellipse.

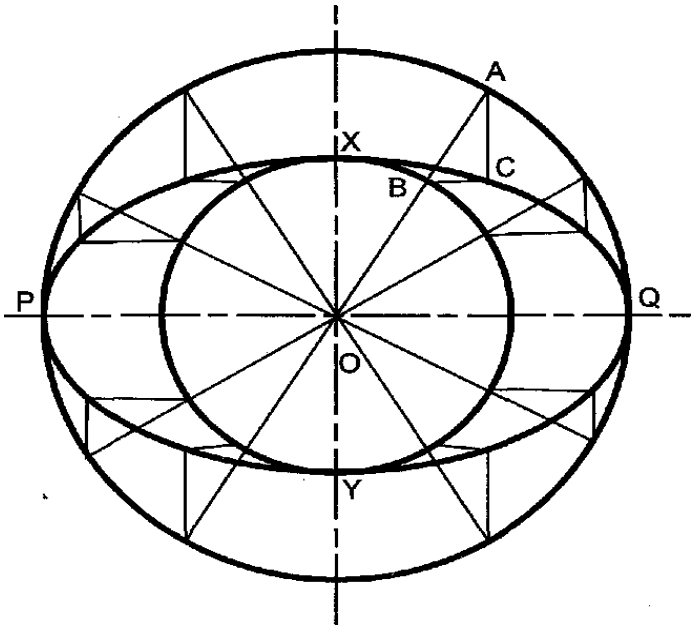


fig. 9.1 Concentric circle method of drawing an ellipse

Focal point method

(i) Draw AB and CD, the given axes.

(ii) With C as centre, radius half the major axis, draw an arc cutting AB at the foci F_1 and F_2 into a number of equal parts, numbering as shown .

(iii) With F_1 as centre, radius A_1 A_2 , A_3, etc; draw arcs above and below AB. With F_2 as centre , radius B_1 B_2 , B_3, etc; draw arcs to intersect those struck from F_1. Join these point s of intersection with a smooth curve to obtain the required ellipse .

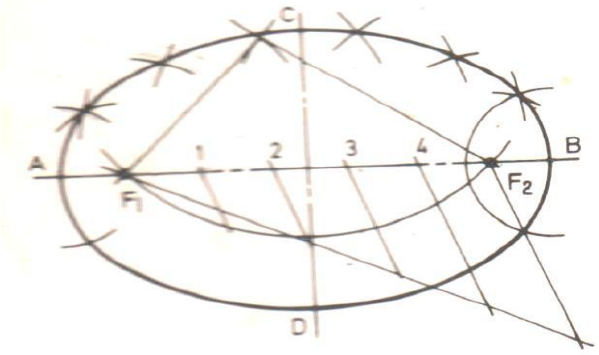


Fig. 9.2. Focal Point Method for Drawing an Ellipse

Rectangle method.

Procedure

i Draw the given rectangle EFGH.

ii Bisect EF and FG to give the minor and major axis DC and AB which meet at the centre O.

iii Divide OB, FB and BG into four equal parts, numbering as shown.

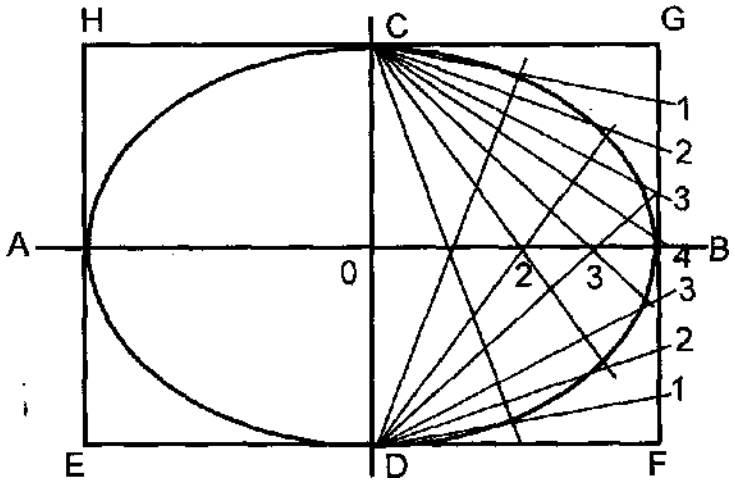
iv From C, draw lines to pass through points 1 to 4on OB and BG.

v From D, draw lines to pass through points 1 to 4 on OB and FB.

vi The intersections of these lines will give points on the circumference of half the required ellipse.

vii Repeat the construction to the left of CD for the complete figure.

This is known as the rectangle method of construction.


H
C
G
1
2
3
A
0
2
3
4
B
3
2
1
E
D
F

CHAPTER TEN

10.0 PROJECTIONS IN SOLID GEOMETRY

10.1 ISOMETRIC PROJECTION

Isometric Projection shows the three views of an project very clearly although with some distortions, for example, a circle appears as an ellipse.

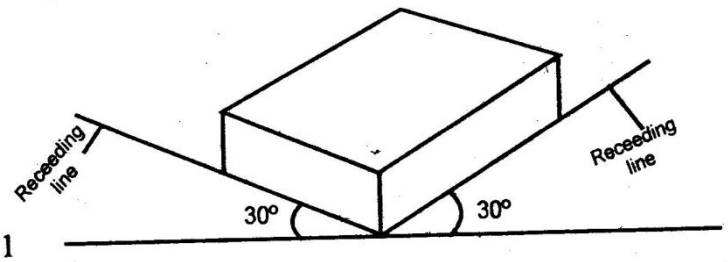


Fig. 10.1

To draw a rectangular block for example, in isometric projection, first draw a horizontal line and the vertical line and at the point of intersection draw two lines (receeding lines), One to the right and the other to the left at an angle of 30° to the horizontal. The actual lengths of the three sides are marked and the remaining views are completed by drawing lines parallel to the receding lines through the marked points.

It should be noted that all lines to the left are parallel to the receeding line to left and lines to the right are parallel to the receeding lines to the right. (See. Fig. 10.1).

10.2 OBLIQUE PROJECTION

In oblique projection one face is drawn horizontal while the other is inclined at 45 to the horizontal

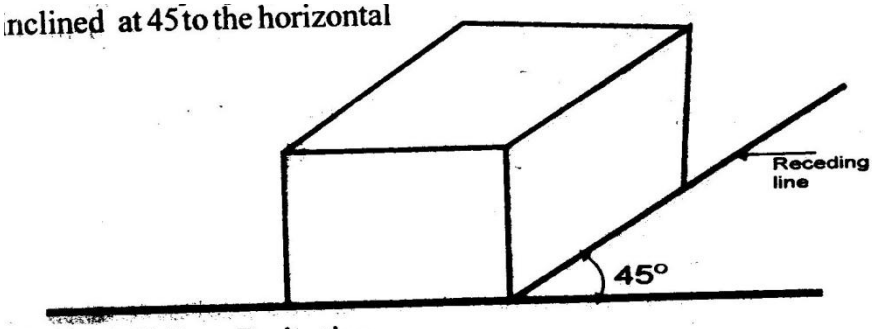


Fig. 10.2 Oblique Projection.

This gives a view that is pictorial in appearance because the horizontal face is projected in its true size and shape and the edge perpendicular to the picture plane are projected in their length. For example a circle is not distorted on the front view as in the case of isometric projection.

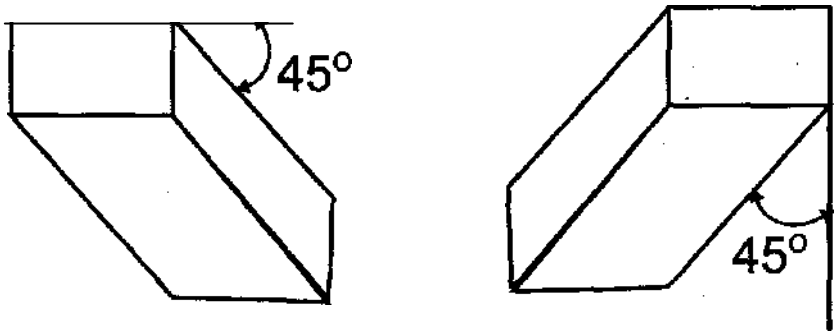
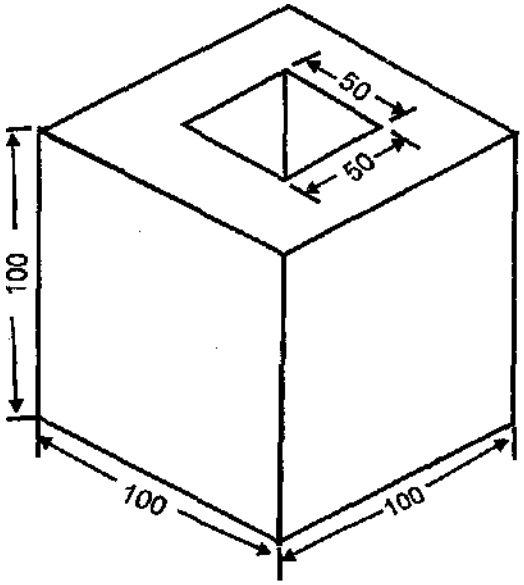
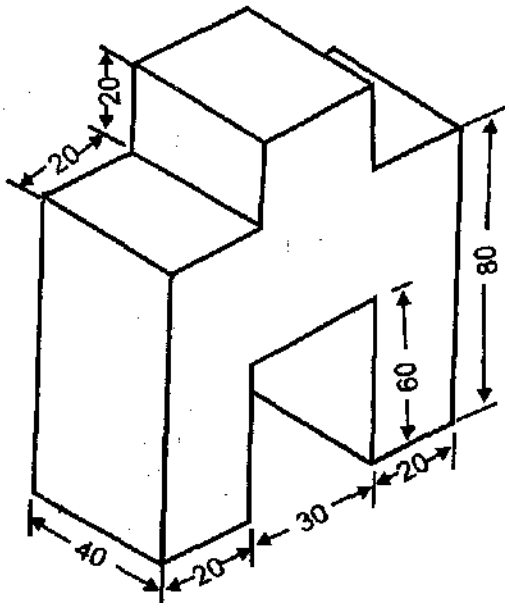


Fig. 10.3 Possible Positions of the Receeding Axis.



Fig



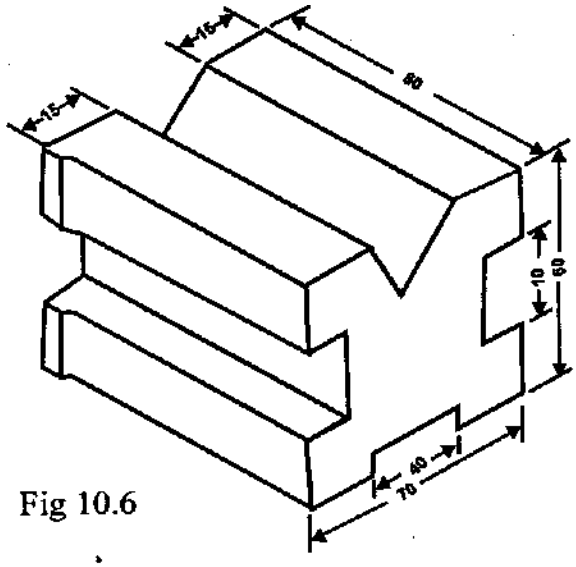


Fig 10.6

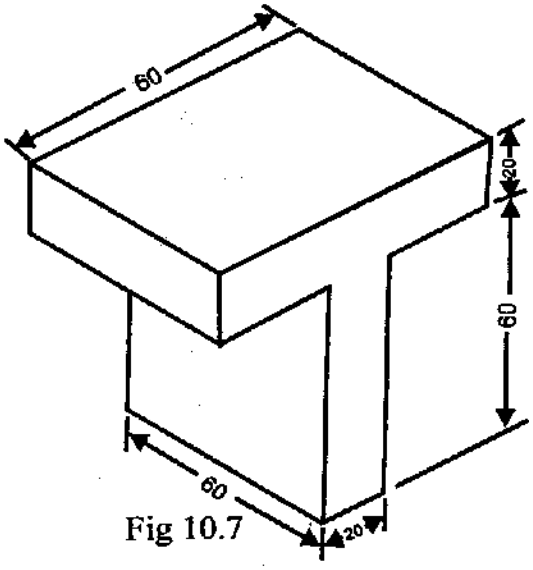
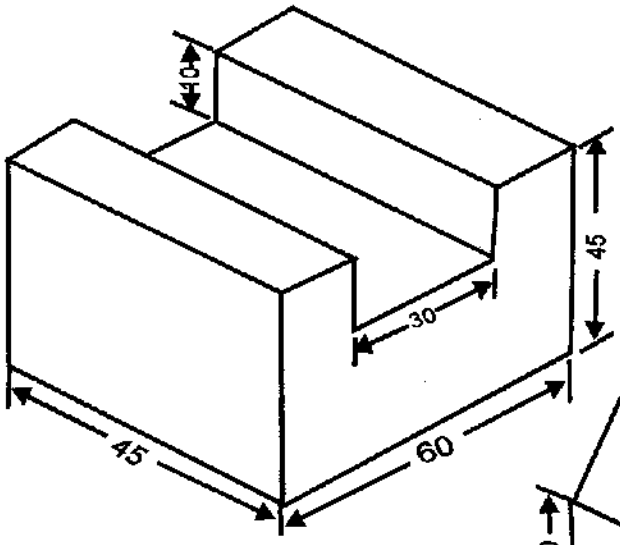
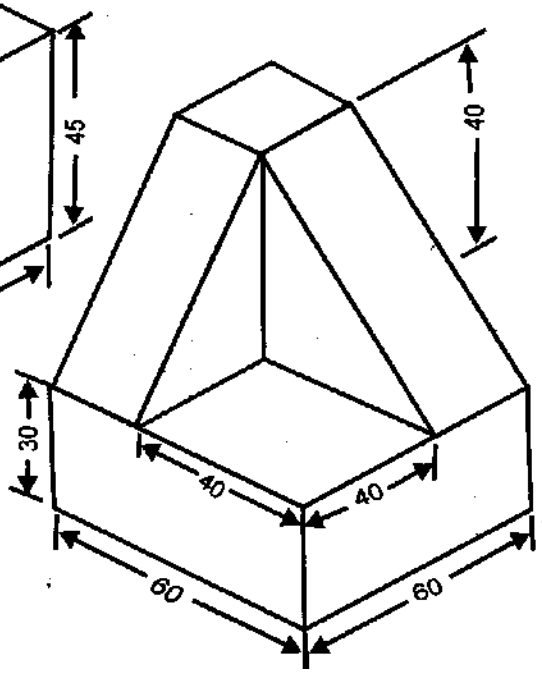


Fig 10.7





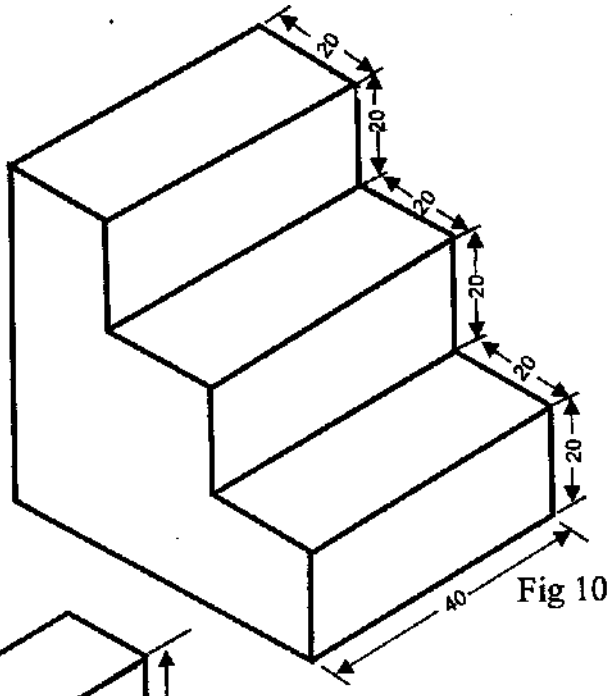
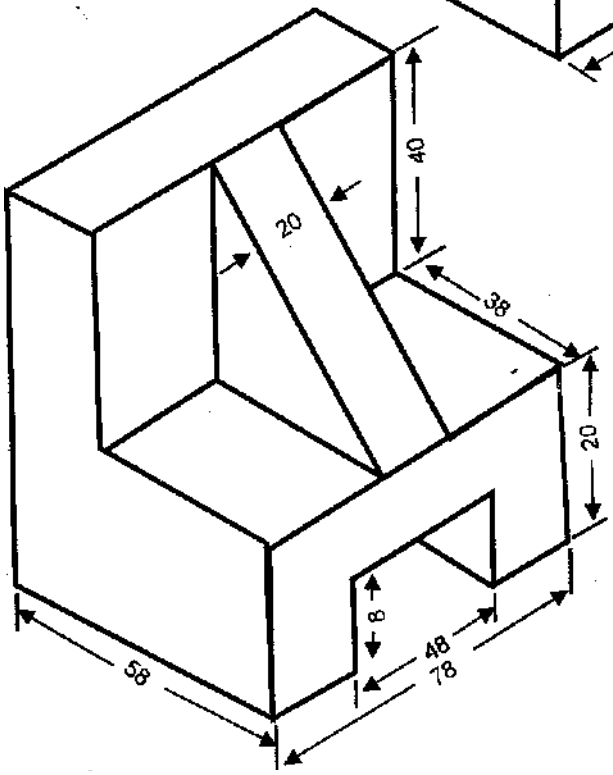
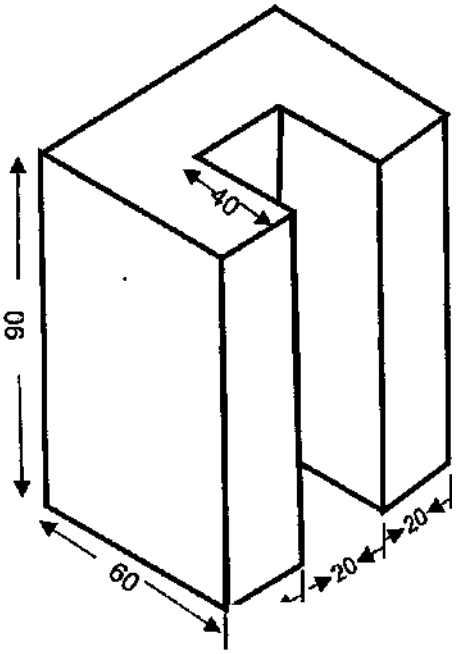
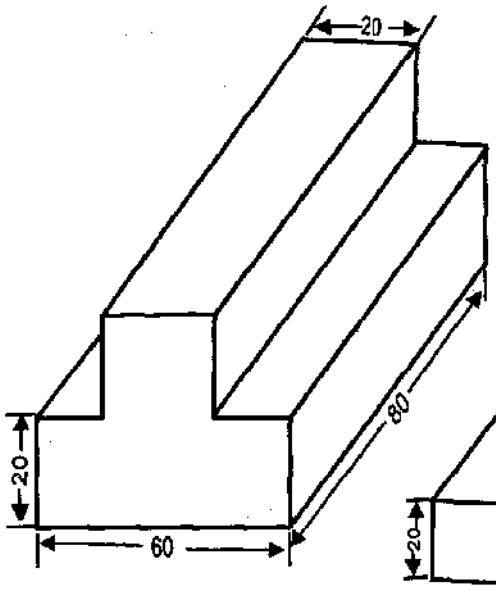
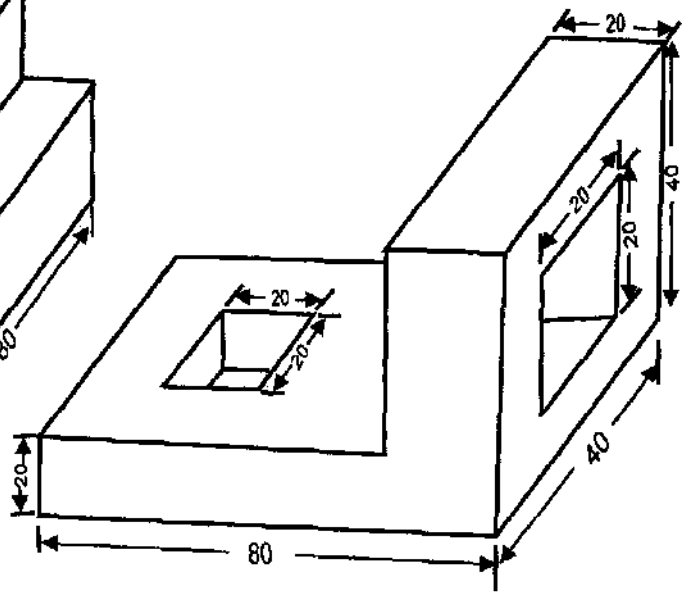


Fig 10.10









Fig, 10.12 Fig 10.13

10.3 ORTHOGRAPHIC PROJECTION

It is often required that the image of an object be represented on a plane surface. This plane is referred to as plane of projection.

The representation of the image of an object when viewed at right angles to the plane of projection is referred to as Orthographic projection. In this type of projection the line of sight are parallel and at right angle to the plane projection.

There are three planes of projection which are used to specify the shape of an object. Horizontal plane, vertical plane and Auxiliary vertical plane. These plane are mutually perpendicular and are depicted in Fig. 10.14

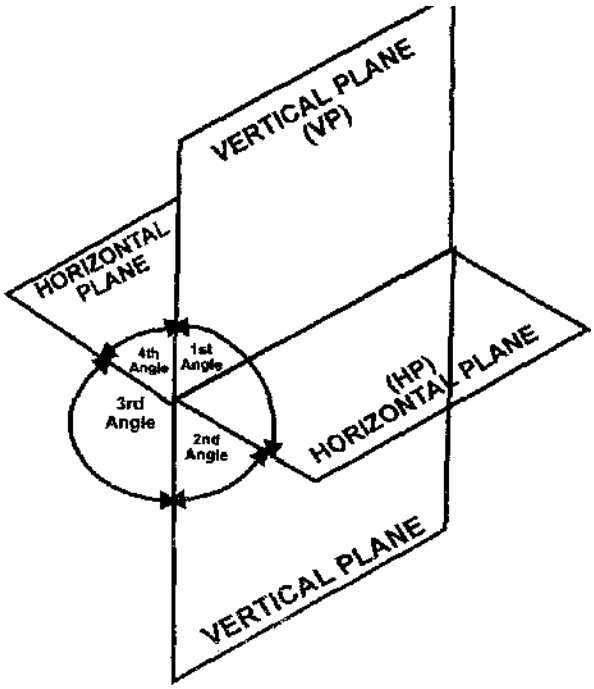


Fig. 10.14

The Horizontal plane (HP) and the vertical plane (VP) intersect forming quadrants (angles of 90 degrees) which are referred to as the first, second, third and fourth angles. Fig. 10.15 shows the quadrants.

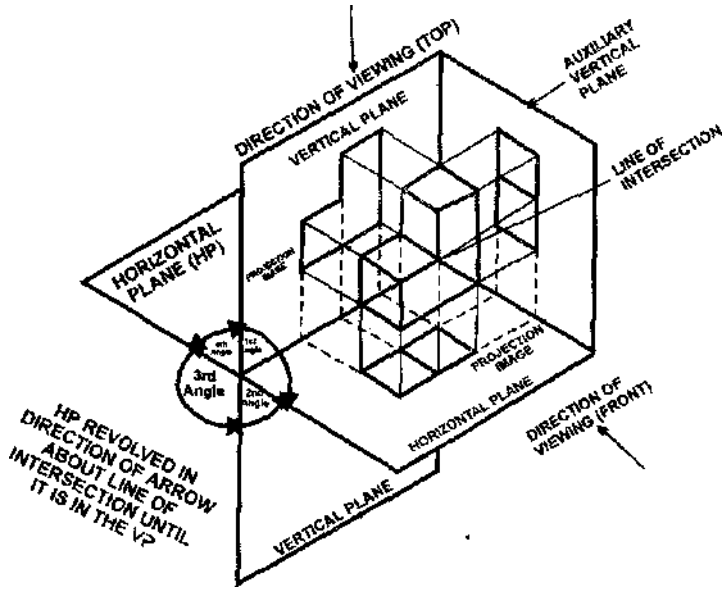


Figure 10.15

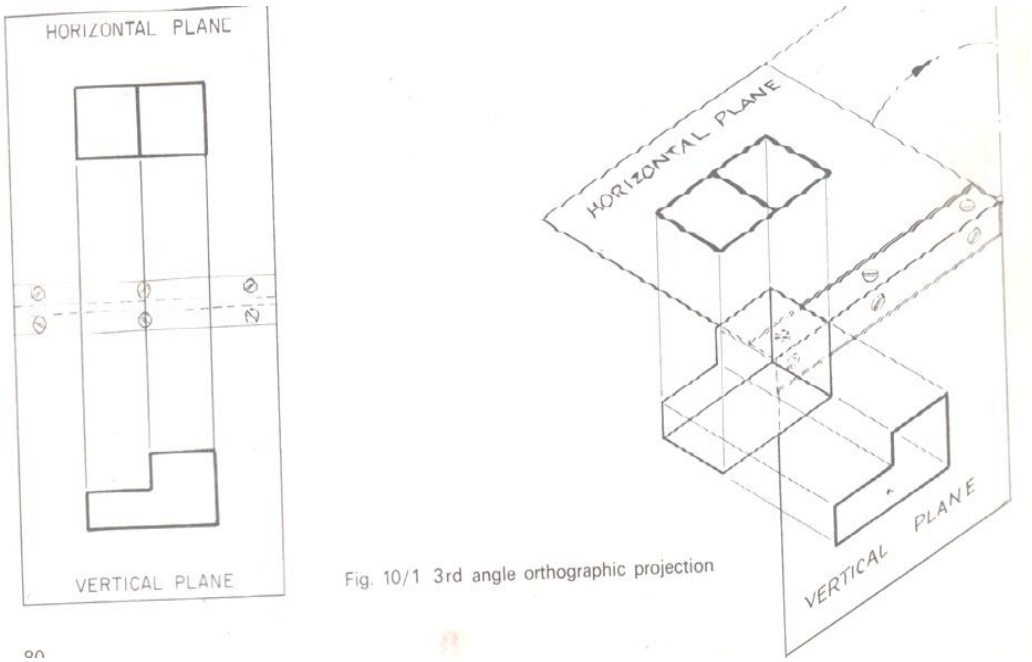


Fig. 10/1 3rd angle orthographic projection

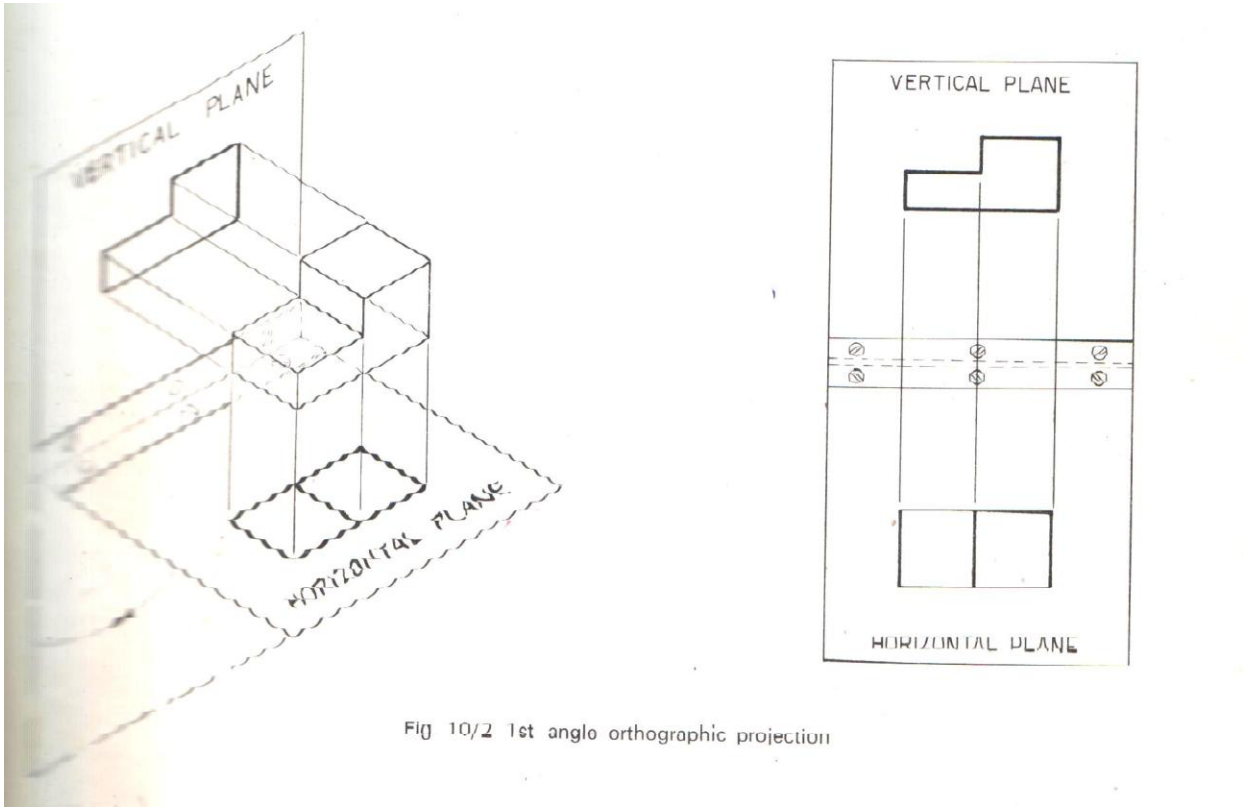
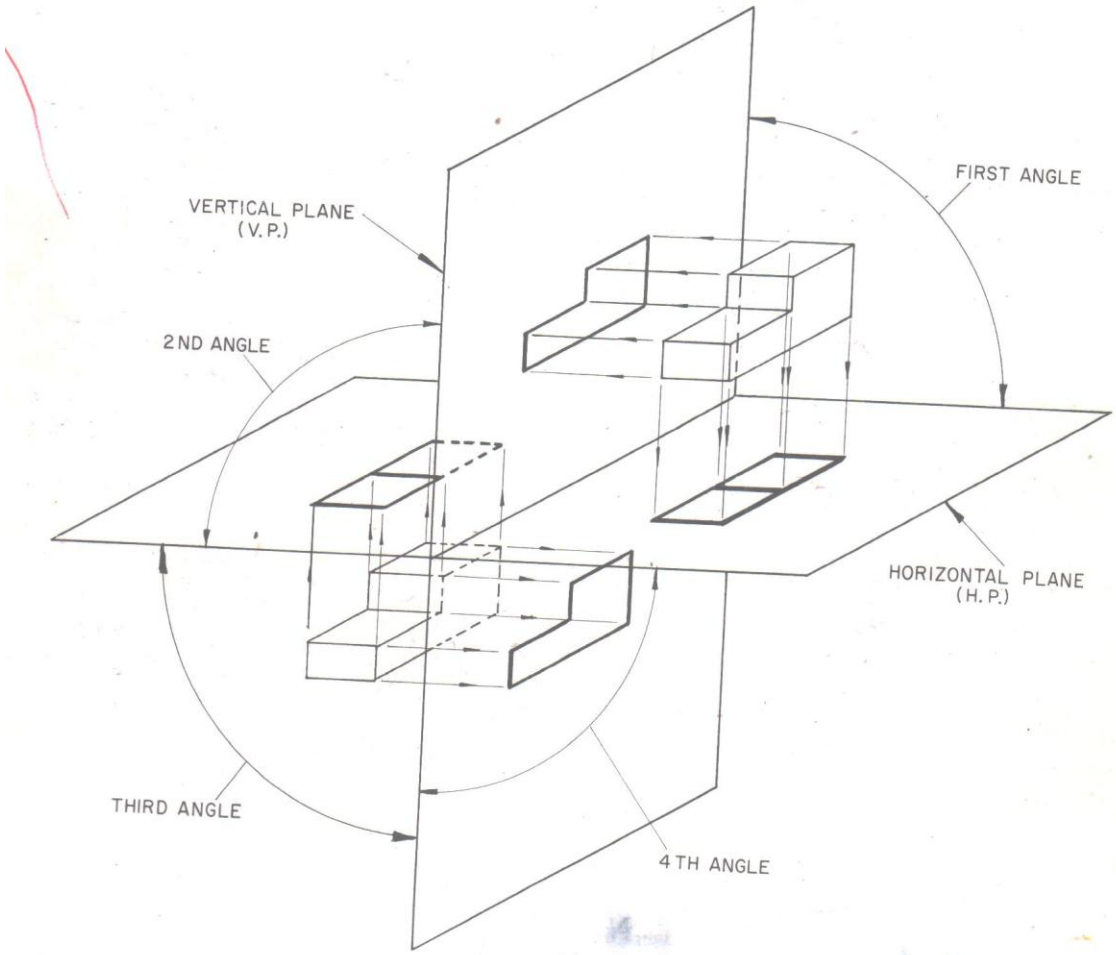


Fig 10/2 1st angle orthographic projection

The projection in vertical plane is termed the elevation (side and front). Whilst the projection on the horizontal plane is termed the plan.



FIRST AND THIRD ANGLE PROJECTIONS

In first angle projection the object is placed in the first quadrant. The view obtained reveal that the elevation is above the plan upon resolving the horizontal plane about the line XY, which intersects the vertical and Horizontal planes, until both planes coincide (fig. 10.14). In the third angle projection, where the object it placed in the third quadrant, the plan is above the elevation.

We thus, see that when the same object is placed in the first and third quadrants the views obtained on projection are exactly the same, however, the relative position of the plan and elevation are different.

The views obtained and their relative positions when the same object is placed in both the first and fourth angles are the same, that is, they overlap. In the same vein, views obtained in the third and second angle overlap. It can therefore be seen why we speak of only first and third angle projections.

END VIEWS

In most cases the elevation and plan view do not fully describe the shape of an object. It therefore becomes, in such cases, mandatory that another view of the object be drawn for a good grasp of the complete shape of the object. This view, often referred to as end view or end elevation can be obtained by the introduction of another plane of projection called an auxiliary Vertical plane (AVP), oriented perpendicularly to both the Vertical plane and horizontal plane.

The end view is either to the left or right of the elevation depending on the position of the Auxiliary vertical plane.

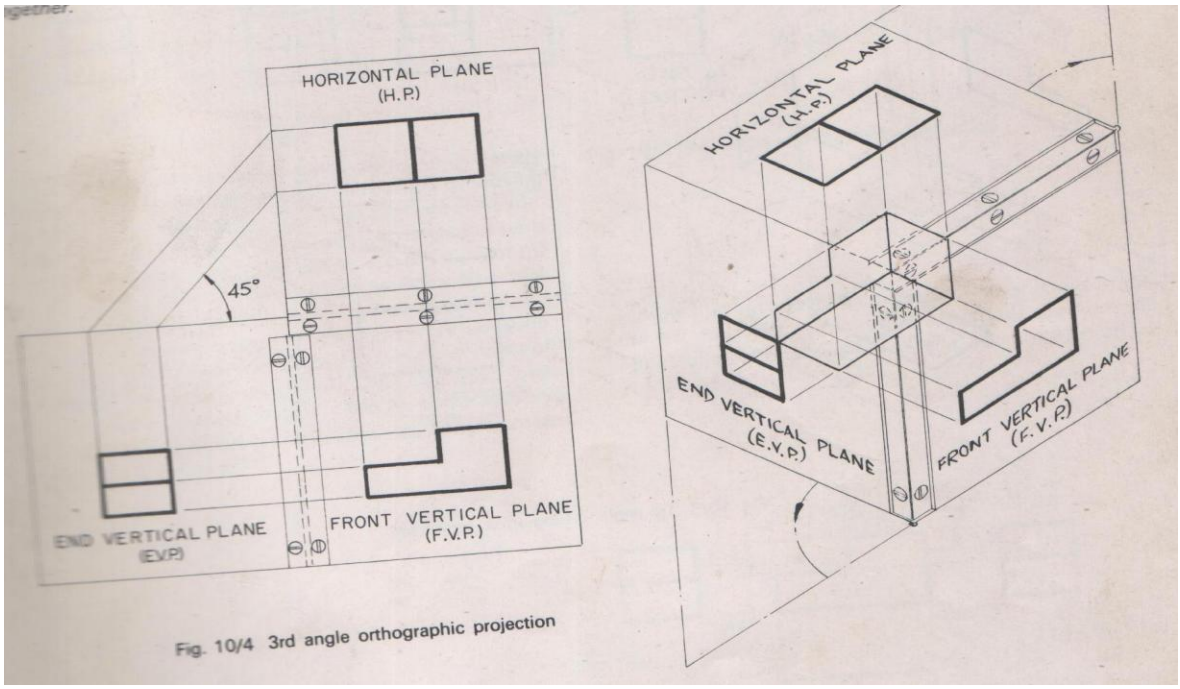


Fig. 10/4 3rd angle orthographic projection

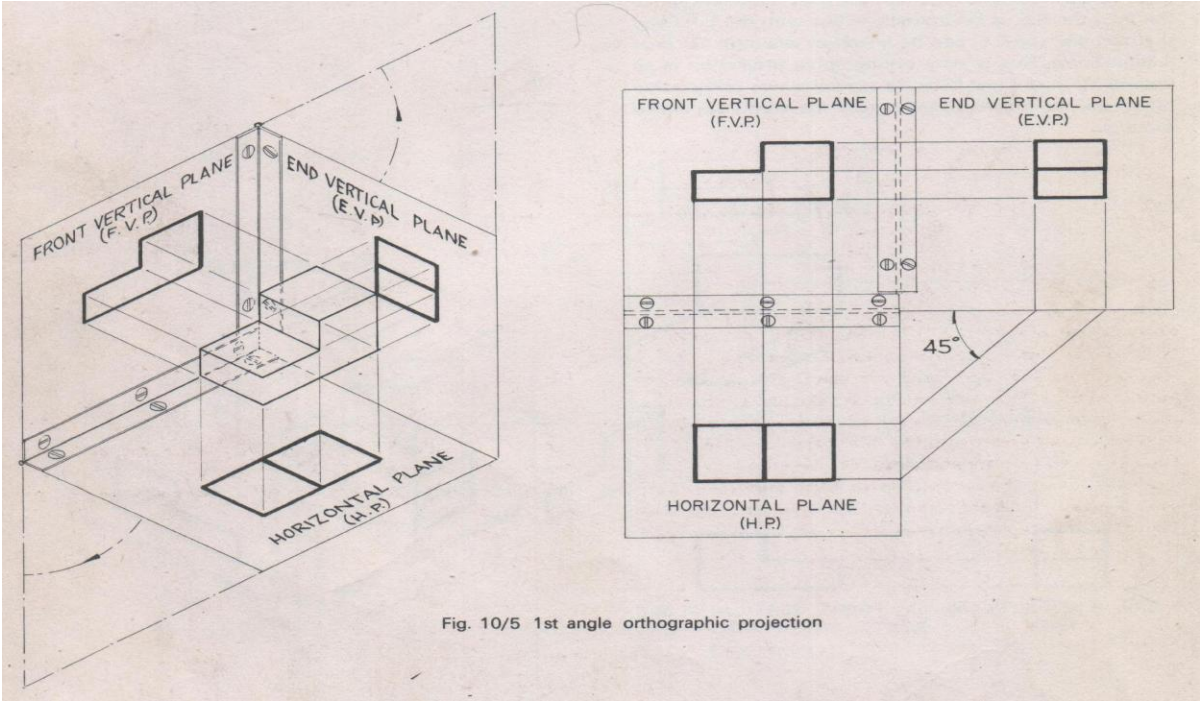


Fig. 10/5 1st angle orthographic projection

PROJECTION SYMBOLS

It is necessary to indicate on the drawing which system of projection has been used. This is done by a symbol consisting of an elevation and an end view of a frustrum of a cone.

The first and third angle symbols are shown in Fig 10.16

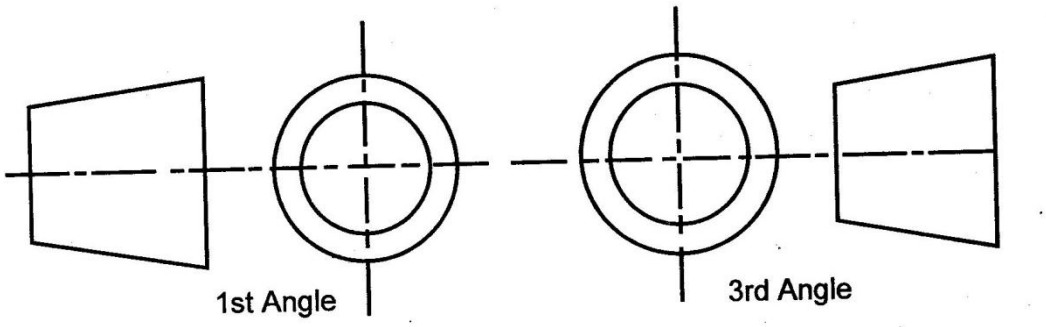


Fig. 10.16

POINTS TO NOTE IN ORTHOGRAPHIC PROJECTION

i. Enough space should be left between the views on a drawing to accommodate dimension and notes without crowding,

ii. The spacing should be planned before beginning.

iii. Hidden detail should only be used where it is essential for a complete description of the object but it should not be used for dimensioning.

iv. Avoid completing the view separately since it wastes time. Measurements can often be made on two or more views simultaneously or projected from one to another as soon as they are made therefore build all the views together.

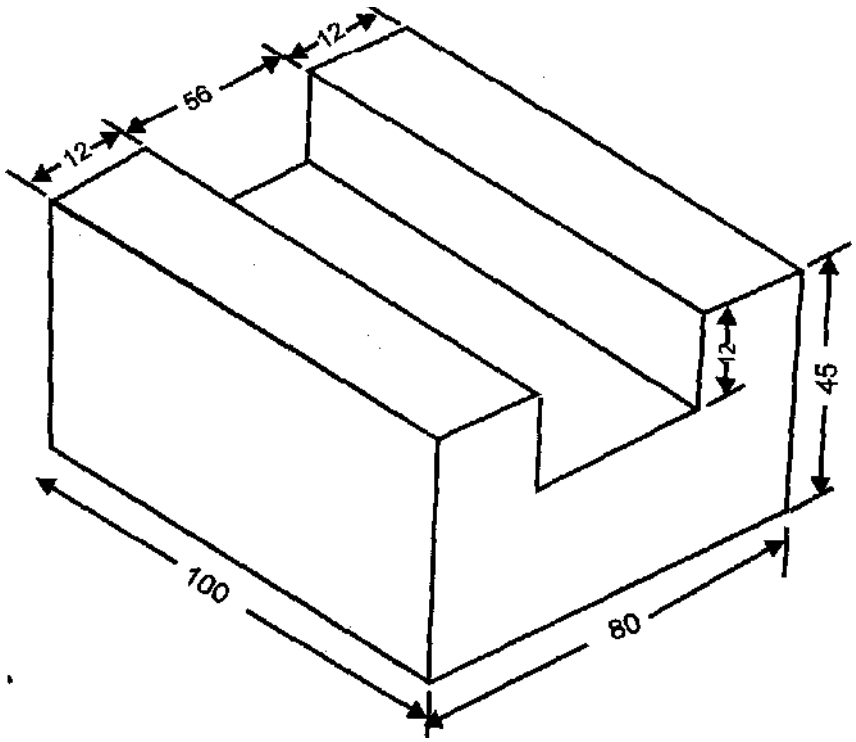


Fig 10.17

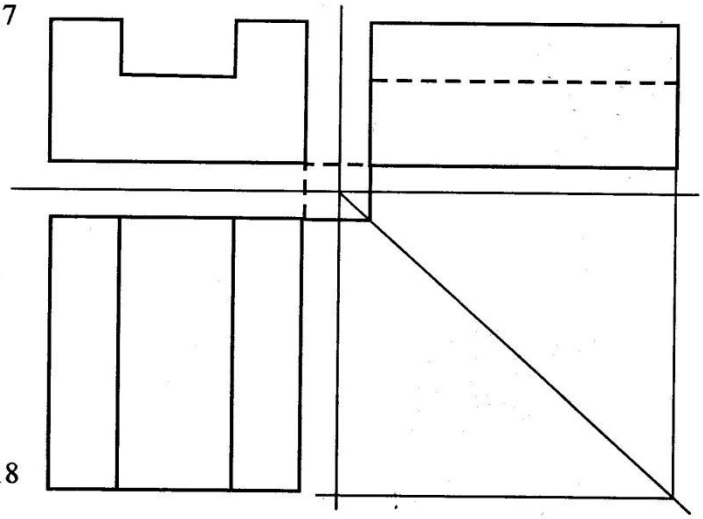


Fig. 10.18

PROBLEMS ON ORTHOGRAPHIC PROJECTION

Sketch the following views of the given objects:

a. Elevation in direction of arrow T.
b. End view in direction of arrow S.
c. Plan view projected from view (a).

(Use first an d third angle projection for objects, shown on Fig. 1 -5