

CE111: Engineering Drawing

Lecture 7:

Theory of Projections

DRAWINGS:

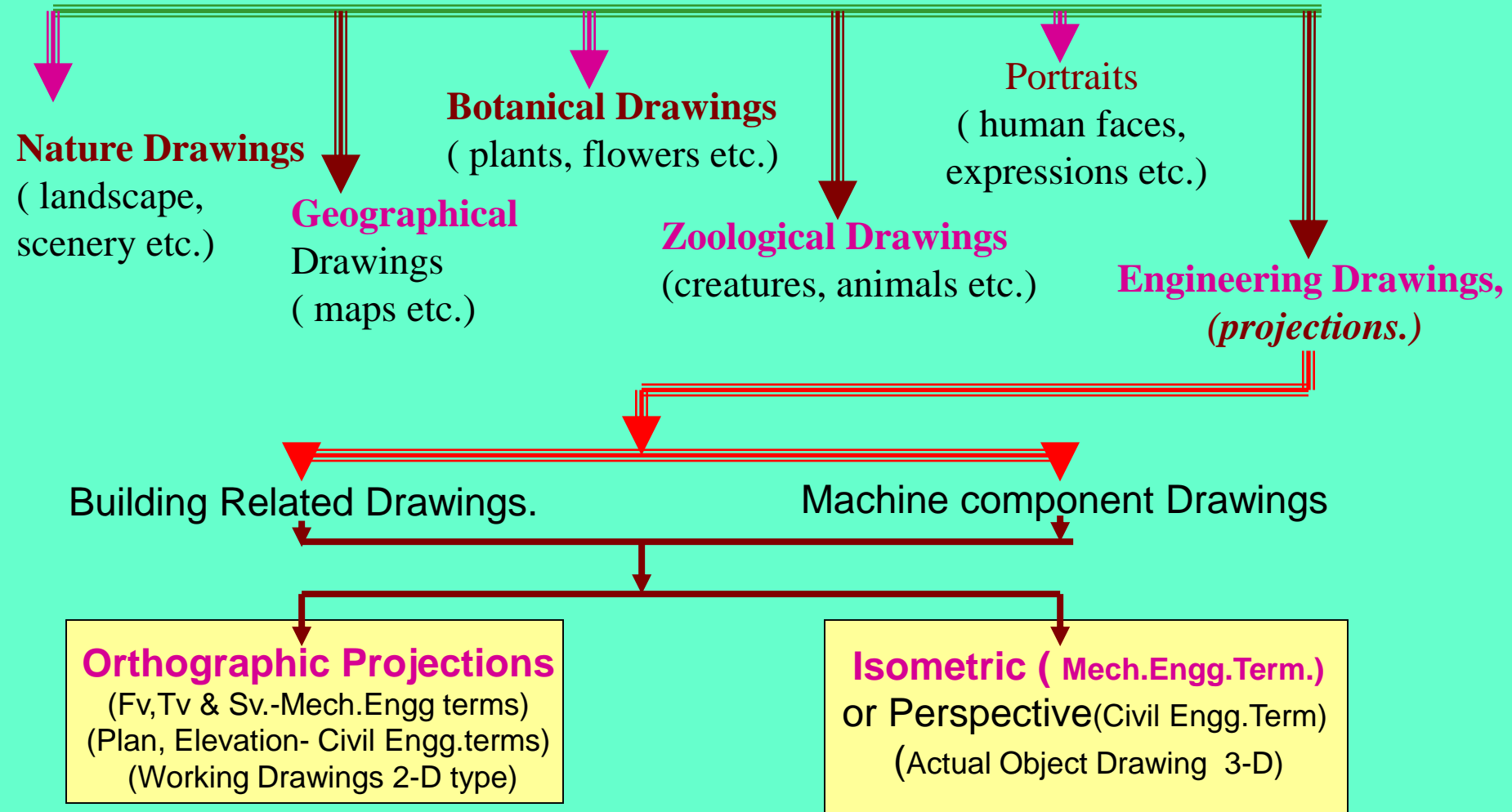
(A Graphical Representation)

The Fact about:

If compared with Verbal or Written Description,
Drawings offer far better idea about the Shape, Size & Appearance of
any object or situation or location, that too in quite a less time.

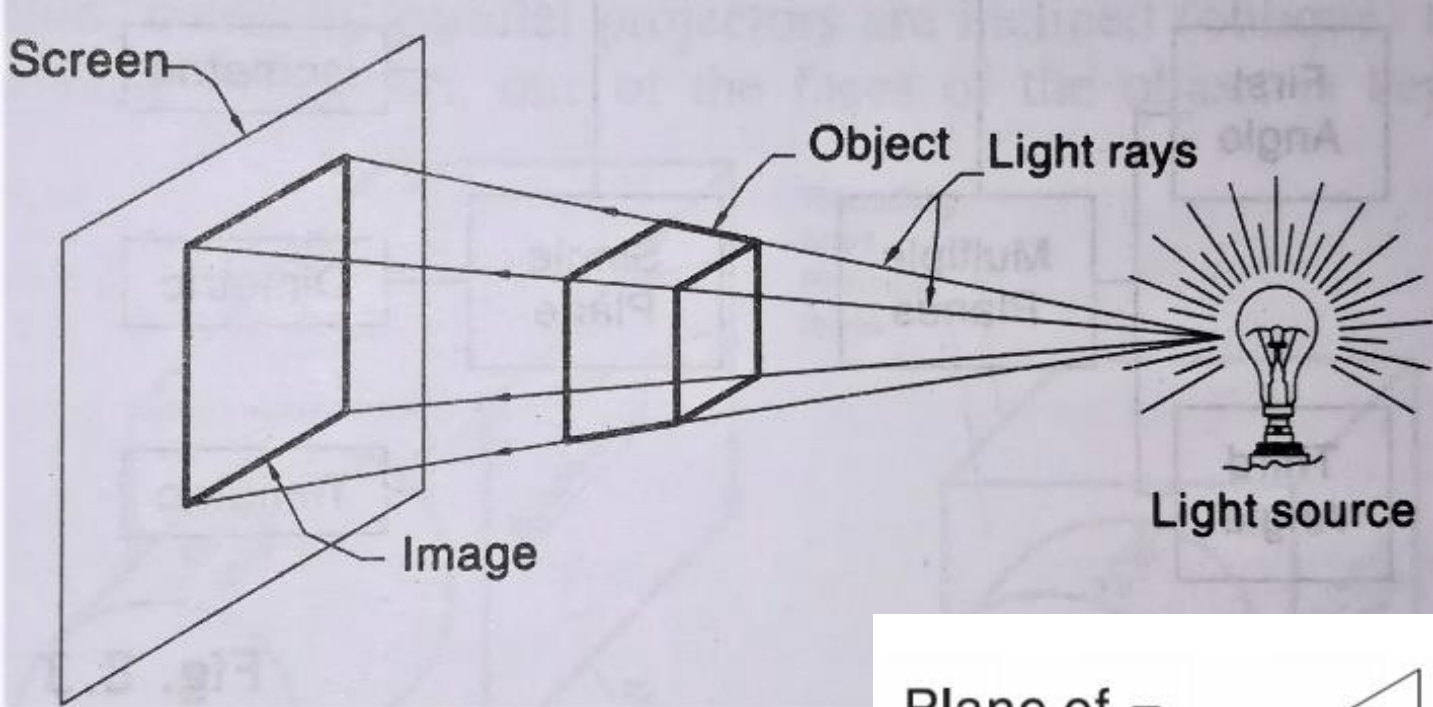
*Hence it has become the Best Media of Communication
not only in Engineering but in almost all Fields.*

Drawings **(Some Types)**

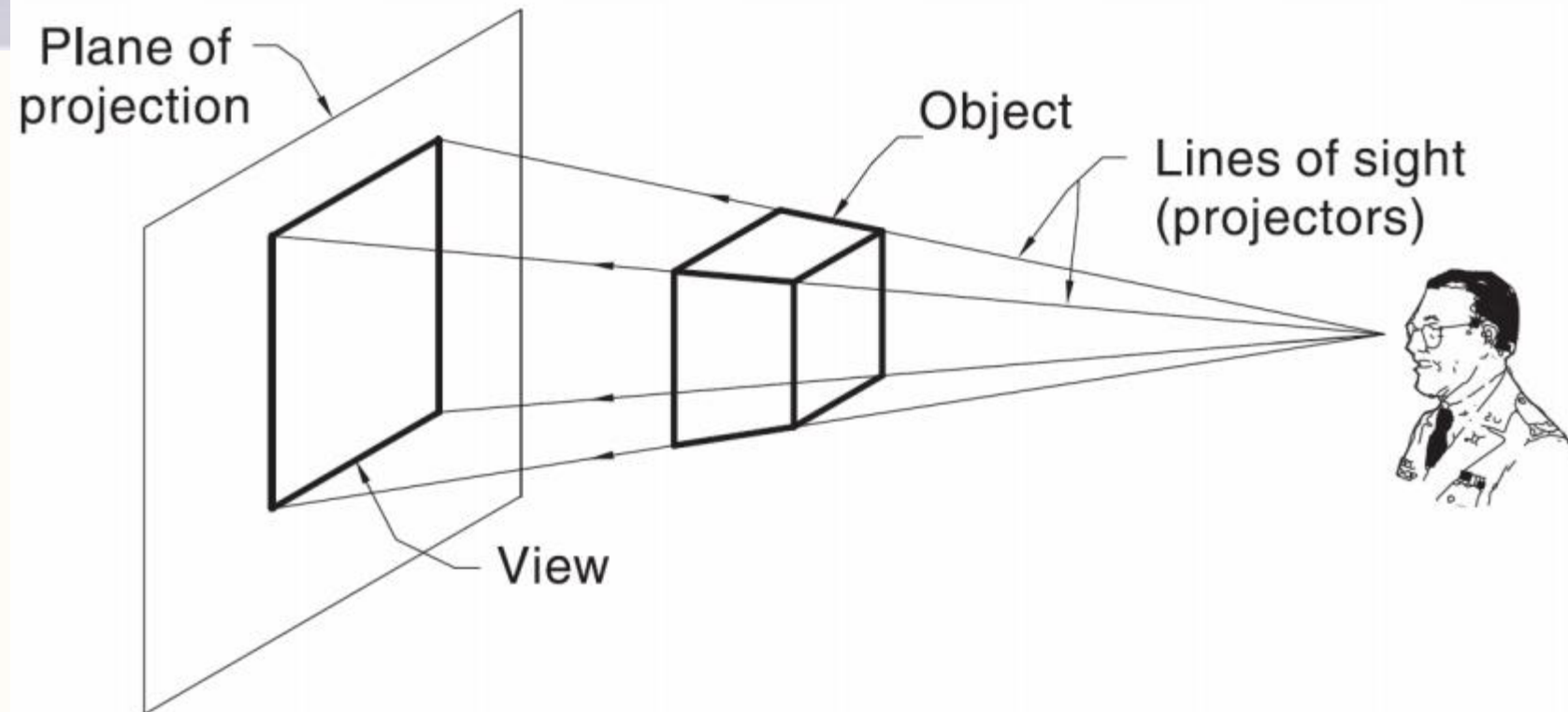




3D view of an
object from any
point in the
space



Projection system





Projection theory

3D objects and structures are represented graphically on a 2-D media.

All projection theory are based on two variables:

1. Line of sight
2. Plane of projection (POP).

A plane of projection (i.e, an image or picture plane) is an imaginary flat plane upon which the image created by the line of sight is projected.

The image is produced by connecting the points where the lines of sight pierce the projection plane. In effect, 3D object is transformed into a 2D representation, also called projections.

The paper or computer screen on which a drawing is created is a plane of projection



Projection Methods

Projection methods are very important techniques in engineering drawing.

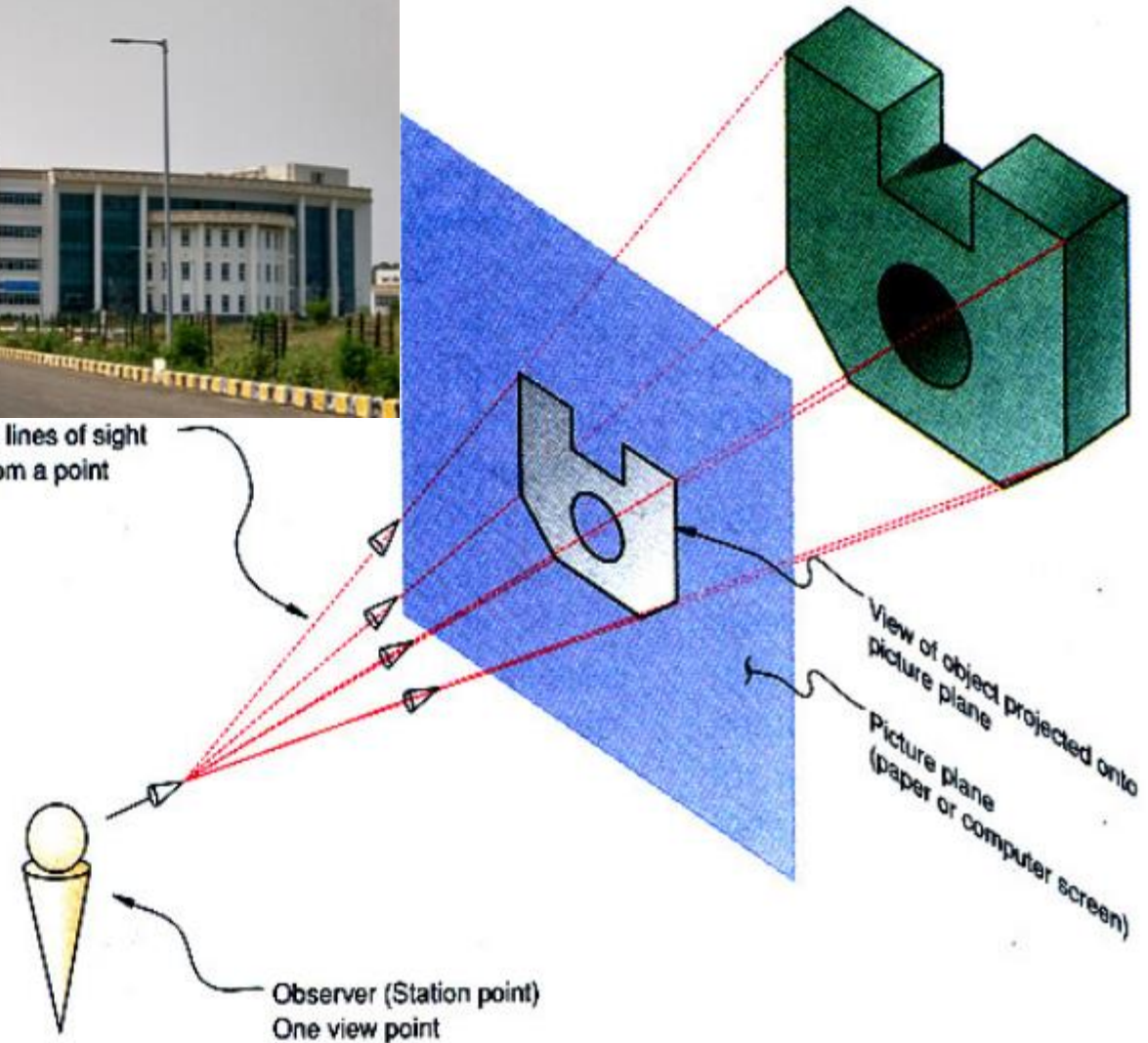
Two projection methods used are:

1. Convergent or Perspective
2. Parallel.

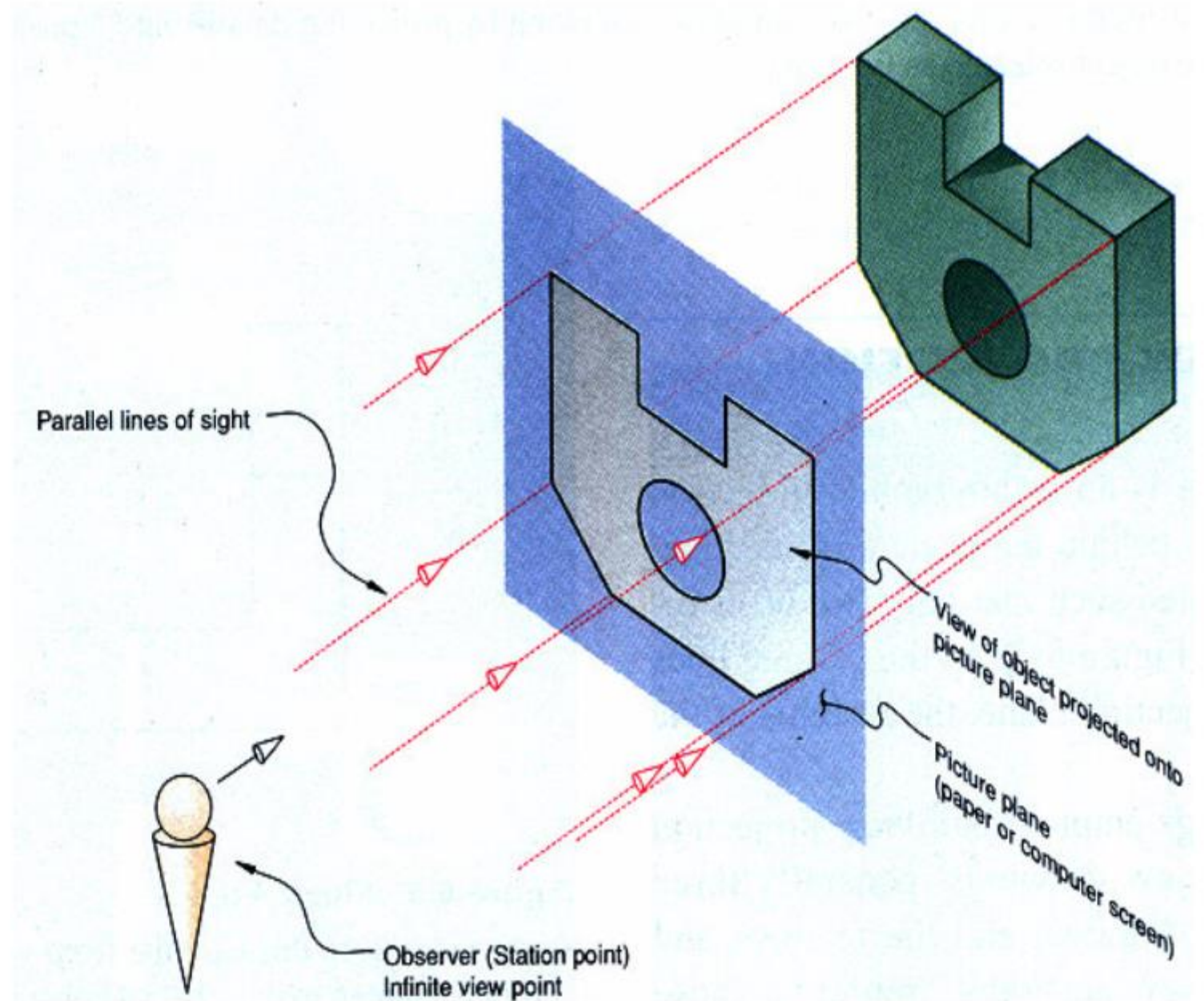


Nonparallel lines of sight
radiating from a point

**In perspective
projection, all
lines of sight
start at a
single point.**



In parallel projection, all lines of sight are parallel.





Parallel vs Perspective Projection

Parallel projection

Distance from the observer to the object is infinite, projection lines are parallel – object is positioned at infinity.

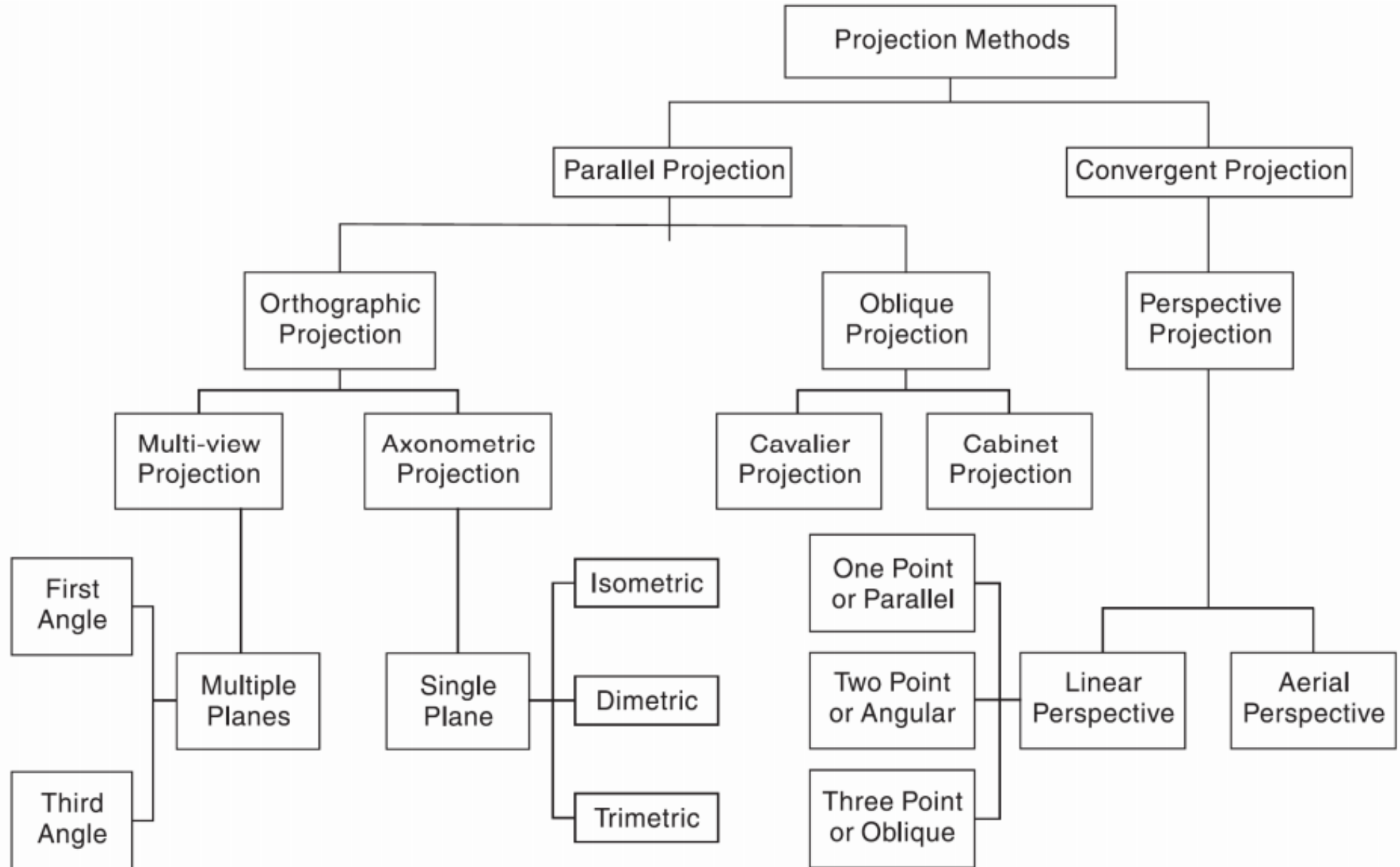
Less realistic but easier to draw.

Perspective projection

Distance from the observer to the object is finite and the object is viewed from a single point – projectors are not parallel.

Perspective projections mimic what the human eyes see, however, they are difficult to draw.

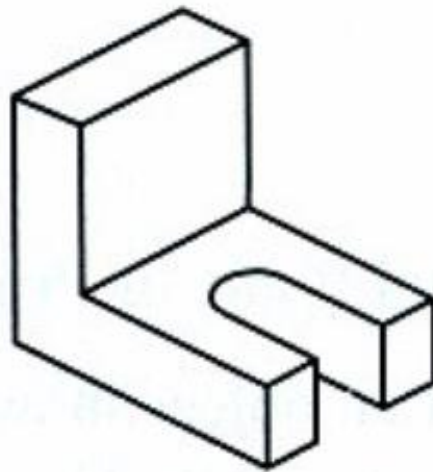
Projection Methods



Orthographic Projection

A parallel projection technique in which the plane of projection is perpendicular to the parallel line of sight.

Orthographic projection technique can produce either pictorial drawings that show all three dimensions of an object in one view, or multi-views that show only two dimensions of an object in a single view.



Isometric



Oblique

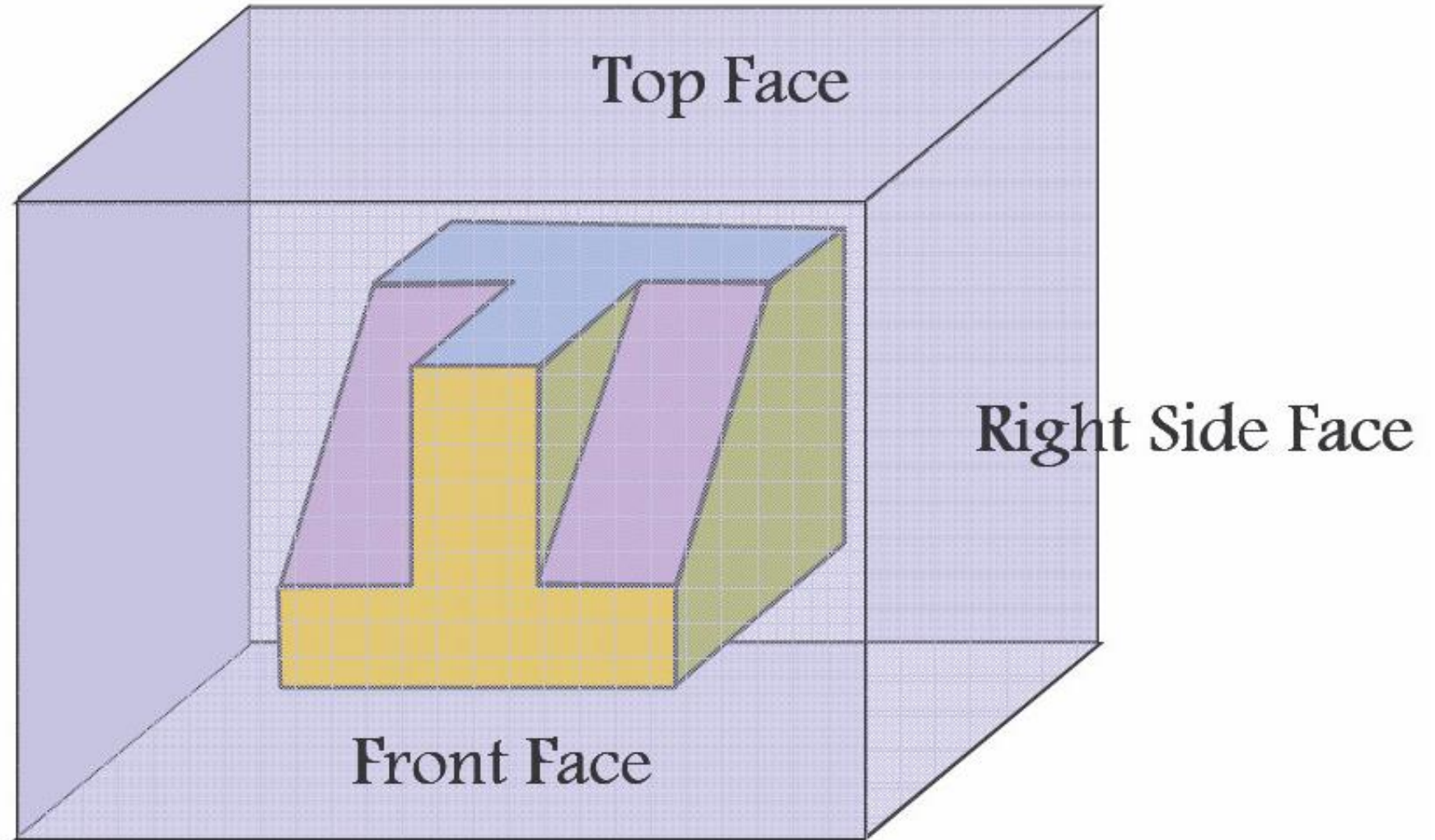


Multiview



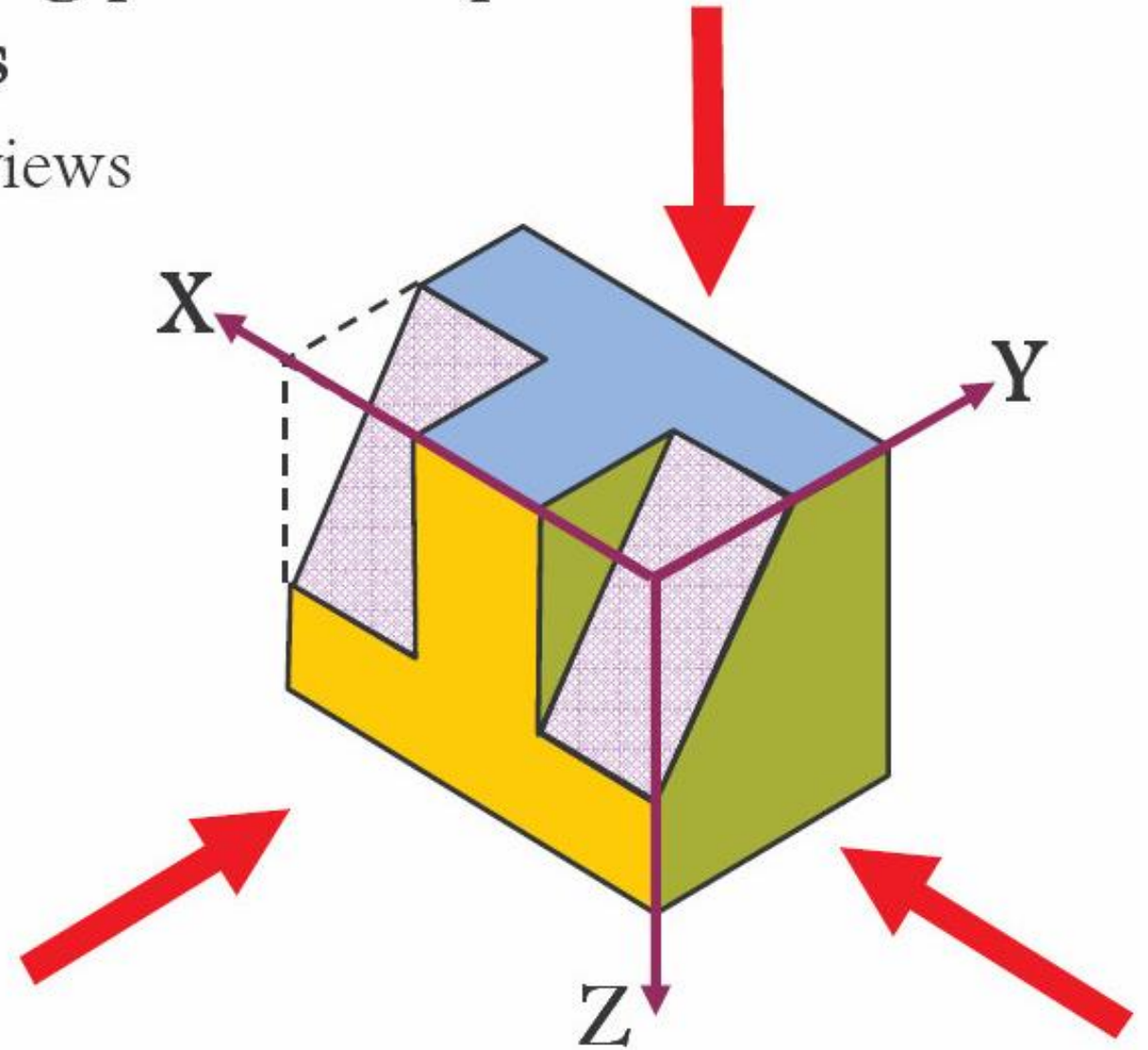
Transparent Viewing Box

- Viewing faces



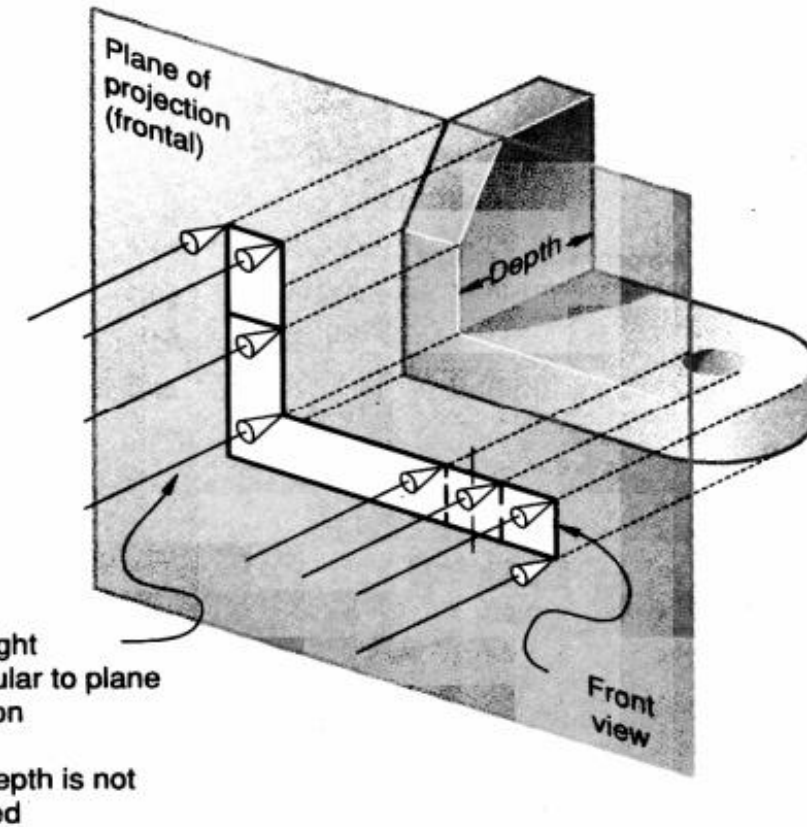
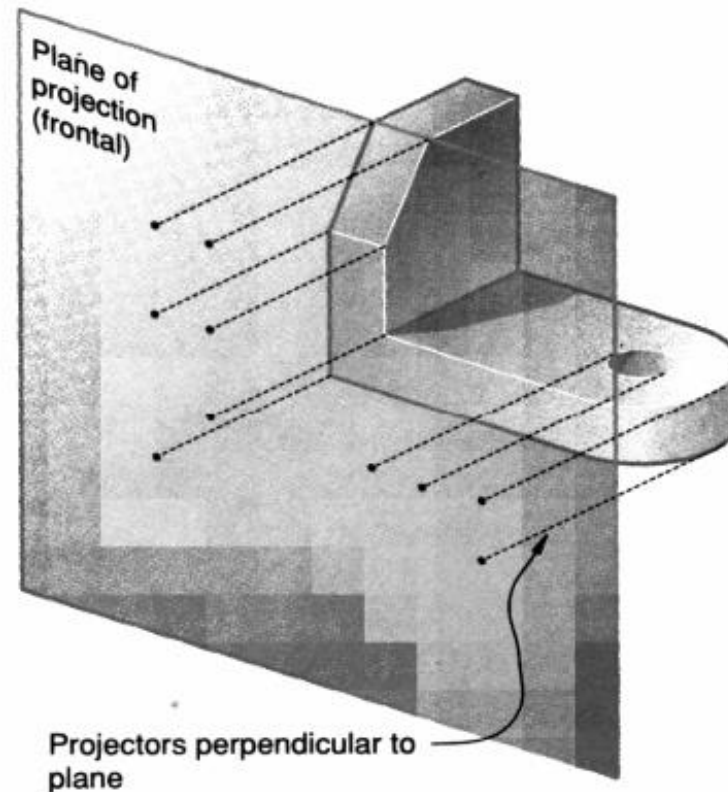
Orthographic projections

- When the viewing planes are parallel to these principal planes
 - Orthographic views

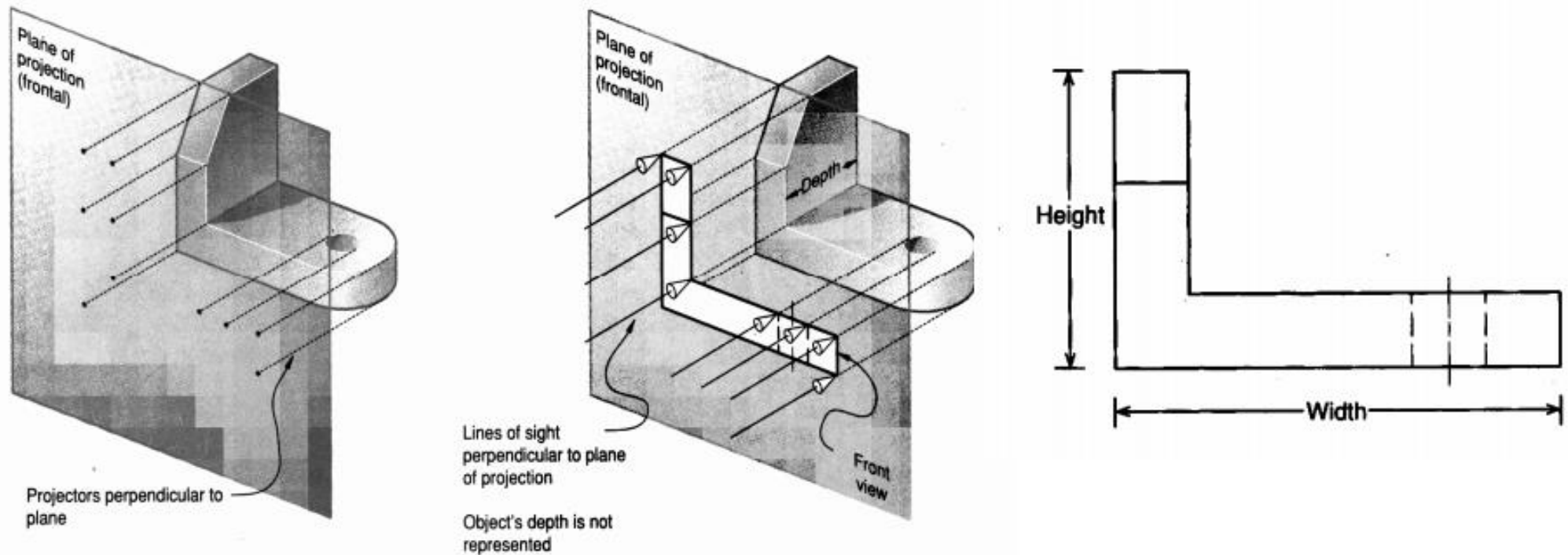


Multi-view Projection

An orthographic projection for which the object is oriented such that only two of its dimensions are shown. The dimensions obtained are the true dimensions of the object



Frontal plane of projection

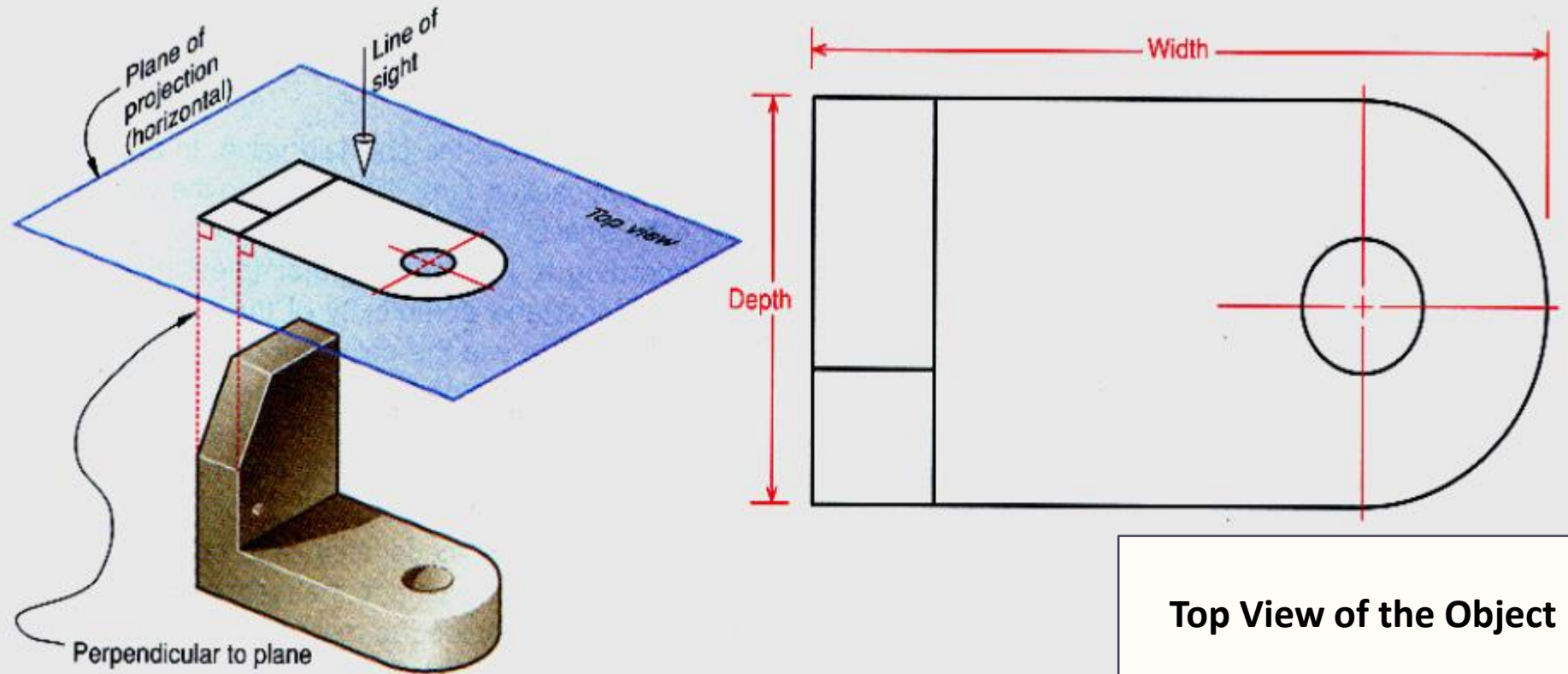


Frontal plane of projection is the plane onto which the **front view** of the multi-view drawing is projected. Front view of an object shows the **width** and **height** dimensions.

Horizontal plane of projection

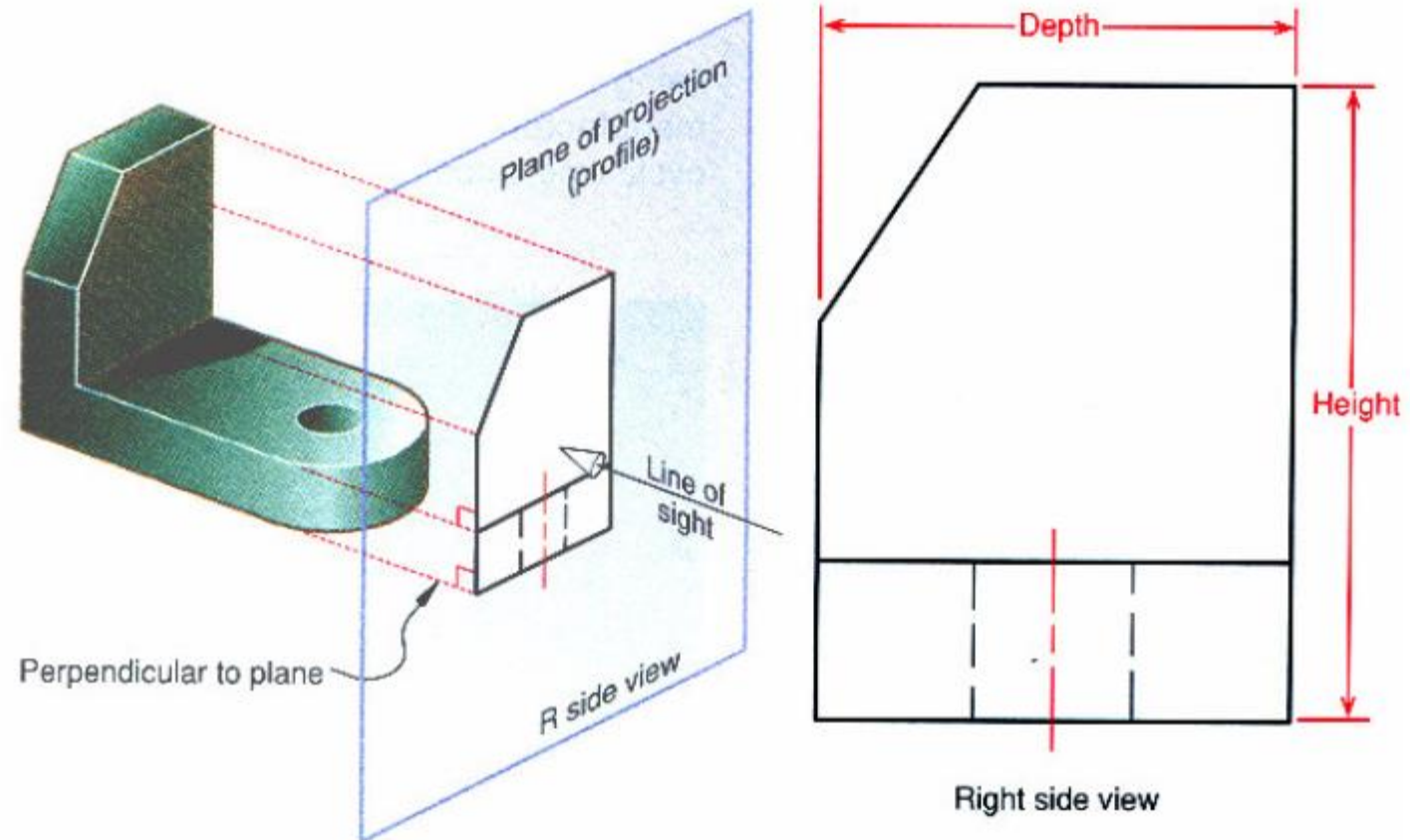
Horizontal plane of projection is the plane onto which the **top view** of the multi-view drawing is projected.

Top view of an object shows the **width** and **depth** dimensions.



Profile plane of projection

In multi-view drawings, the right side view is the standard side view used. The right side view of an object shows the depth and the height dimensions. The right side view is projected onto the profile plane of projection, which is a plane that is parallel to the right side of the object.



ORTHOGRAPHIC PROJECTIONS:

It Is A Technical Drawing In Which Different Views Of An Object
Are Projected On Different Reference Planes
Observing Perpendicular To Respective Reference Plane

Different Reference planes are

**Horizontal Plane (HP),
Vertical Frontal Plane (VP)
Side Or Profile Plane (PP)**

And

Different Views are Front View (FV), Top View (TV) and Side View (SV)

FV is a view projected on VP.

TV is a view projected on HP.

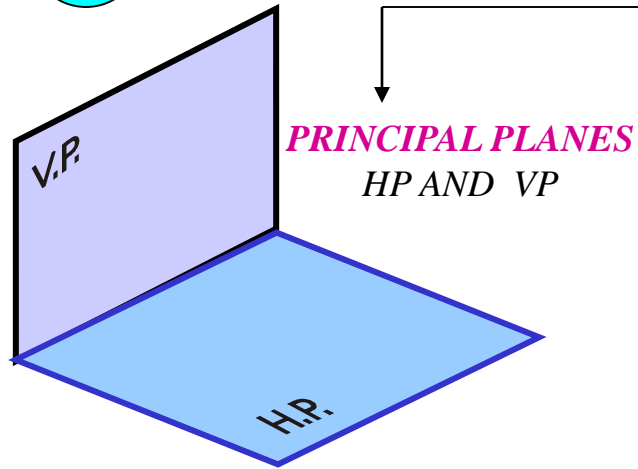
SV is a view projected on PP.

IMPORTANT TERMS OF ORTHOGRAPHIC PROJECTIONS:

- 1 Planes.**
- 2 Pattern of planes & Pattern of views**
- 3 Methods of drawing Orthographic Projections**

1

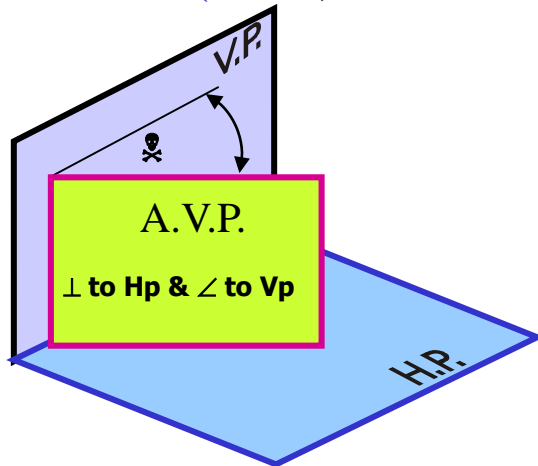
PLANES



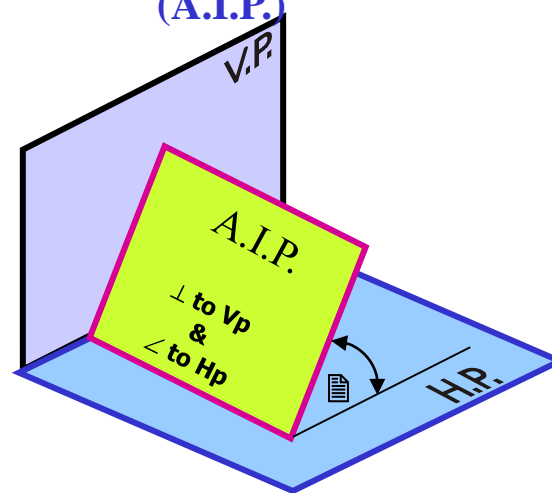
PRINCIPAL PLANES
HP AND VP

AUXILIARY PLANES

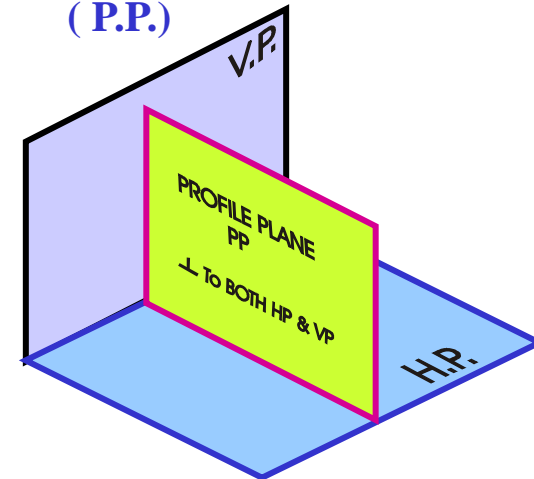
Auxiliary Vertical Plane
(A.V.P.)



Auxiliary Inclined Plane
(A.I.P.)



Profile Plane
(P.P.)



Six Principal views

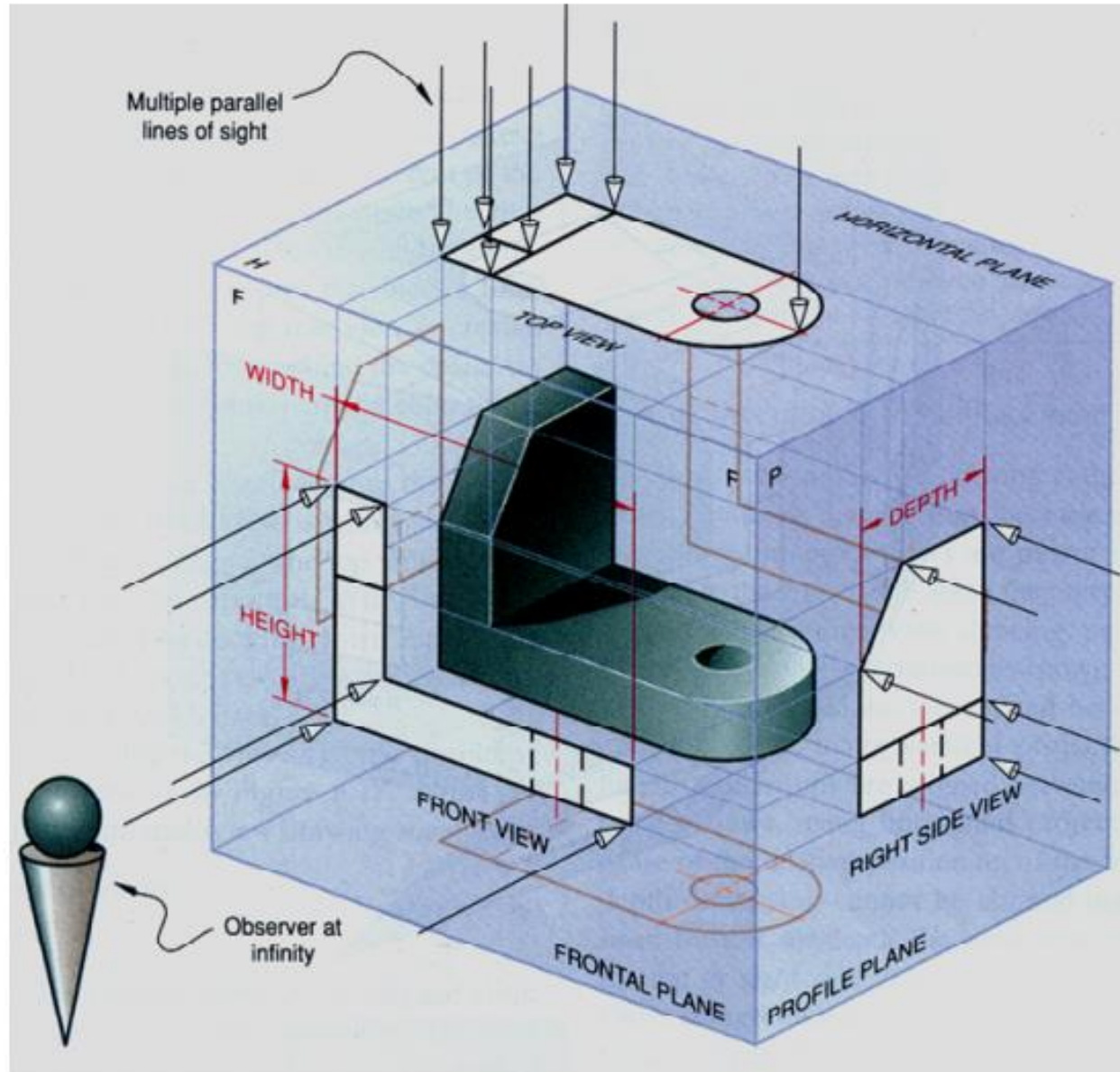
The plane of projection can be oriented to produce an infinite number of views of an object. However, some views are more important than others.

These principal views are six mutually perpendicular views that are produced by six mutually perpendicular planes of projection.

Imagine suspending an object in a glass box with major surfaces of the object positioned so that they are parallel to the sides of the box, six sides of the box become projection planes, showing the six views – front, top, left, right, bottom and rear.



Six Principal Views

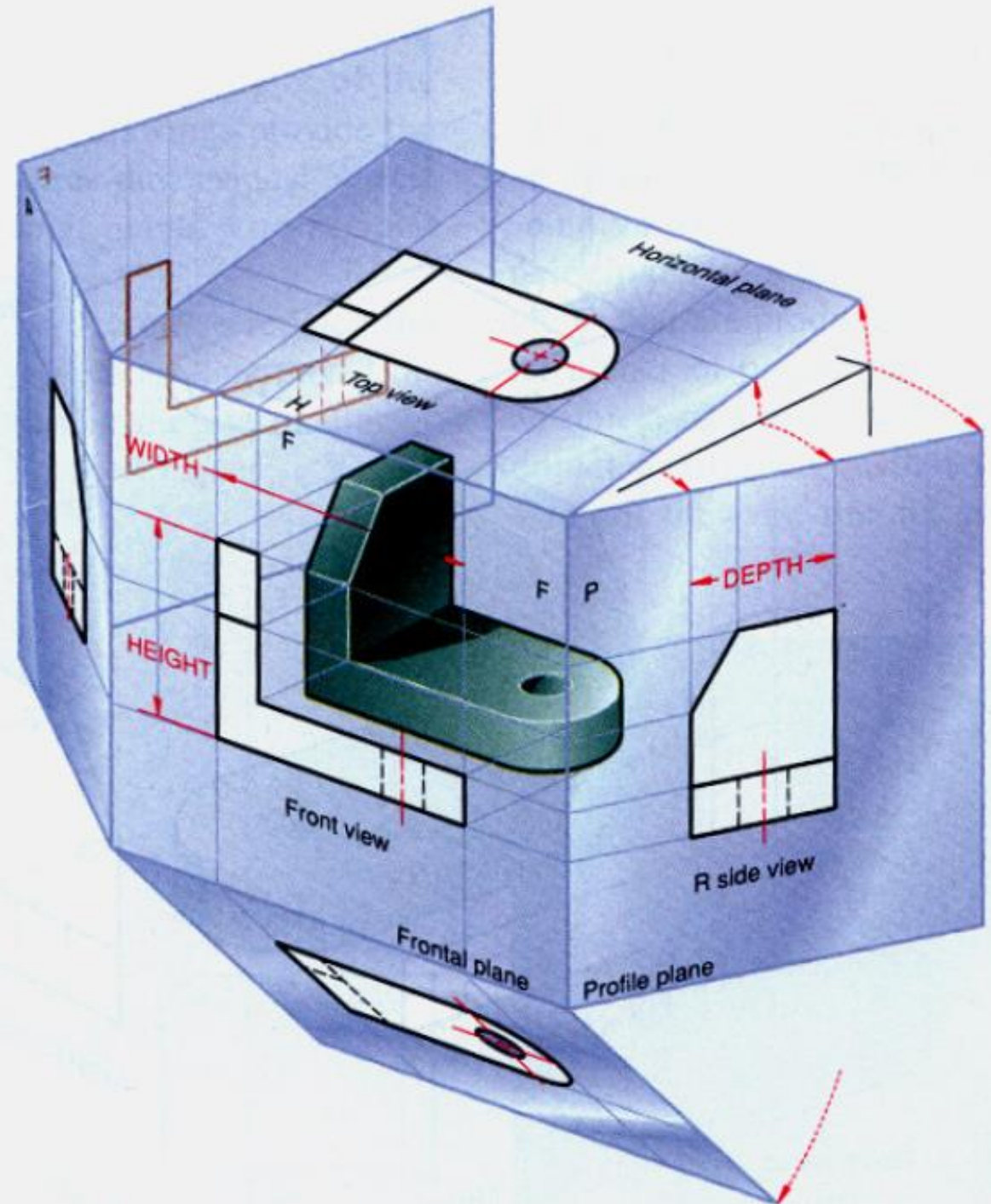


Object is suspended in a glass box producing six principal views: each view is perpendicular to and aligned with the adjacent views.

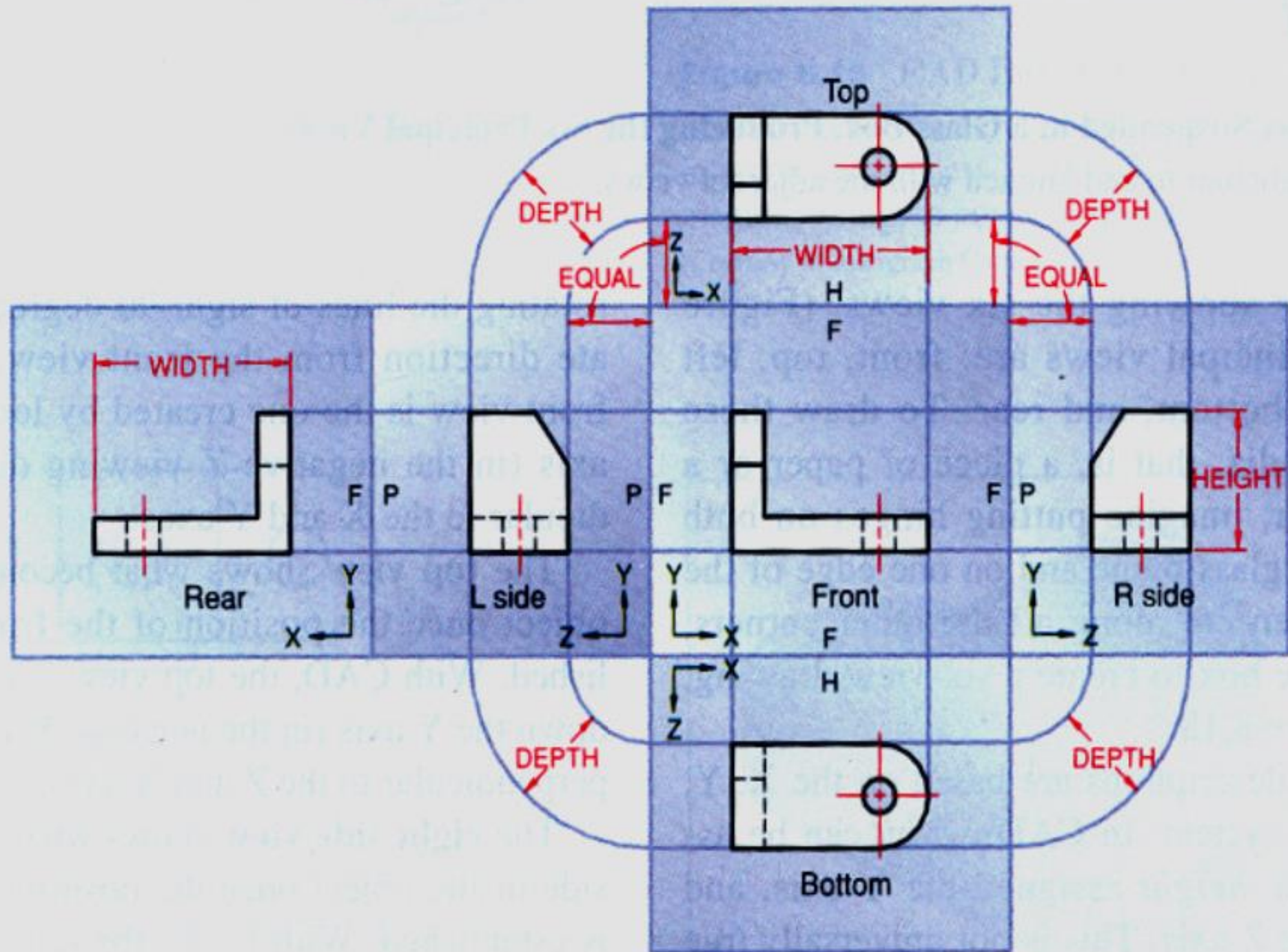


**Unfolding the glass
box to produce six
view drawing**

**Top, front and bottom
views are all aligned
vertically and share the
same width dimension.**

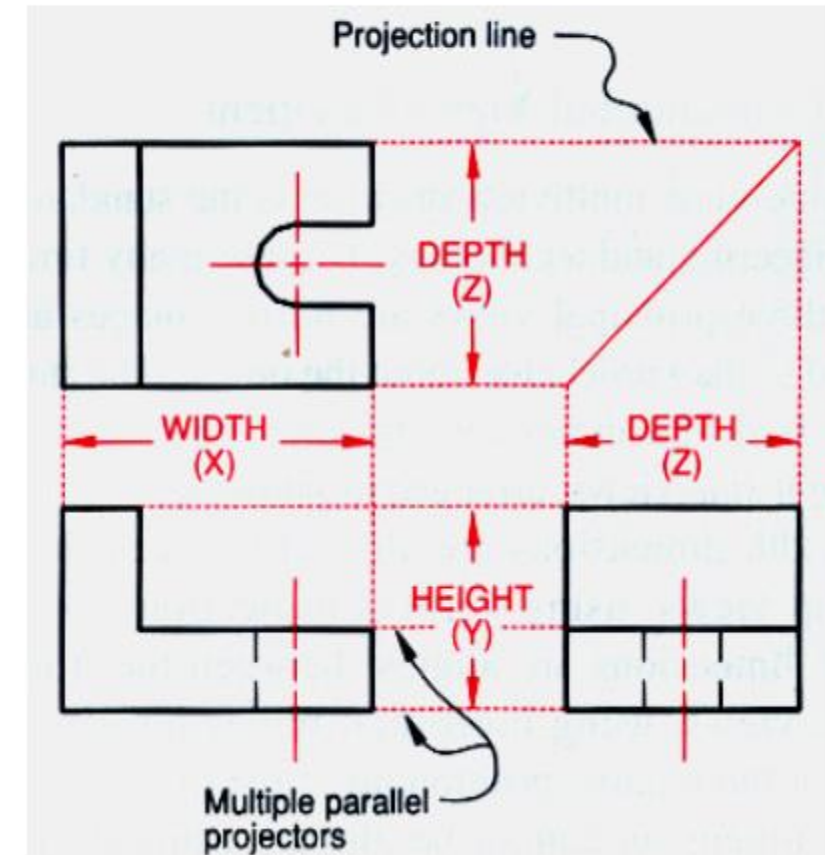


Rear, left side, front and right side views are all aligned horizontally and share the same height dimension.



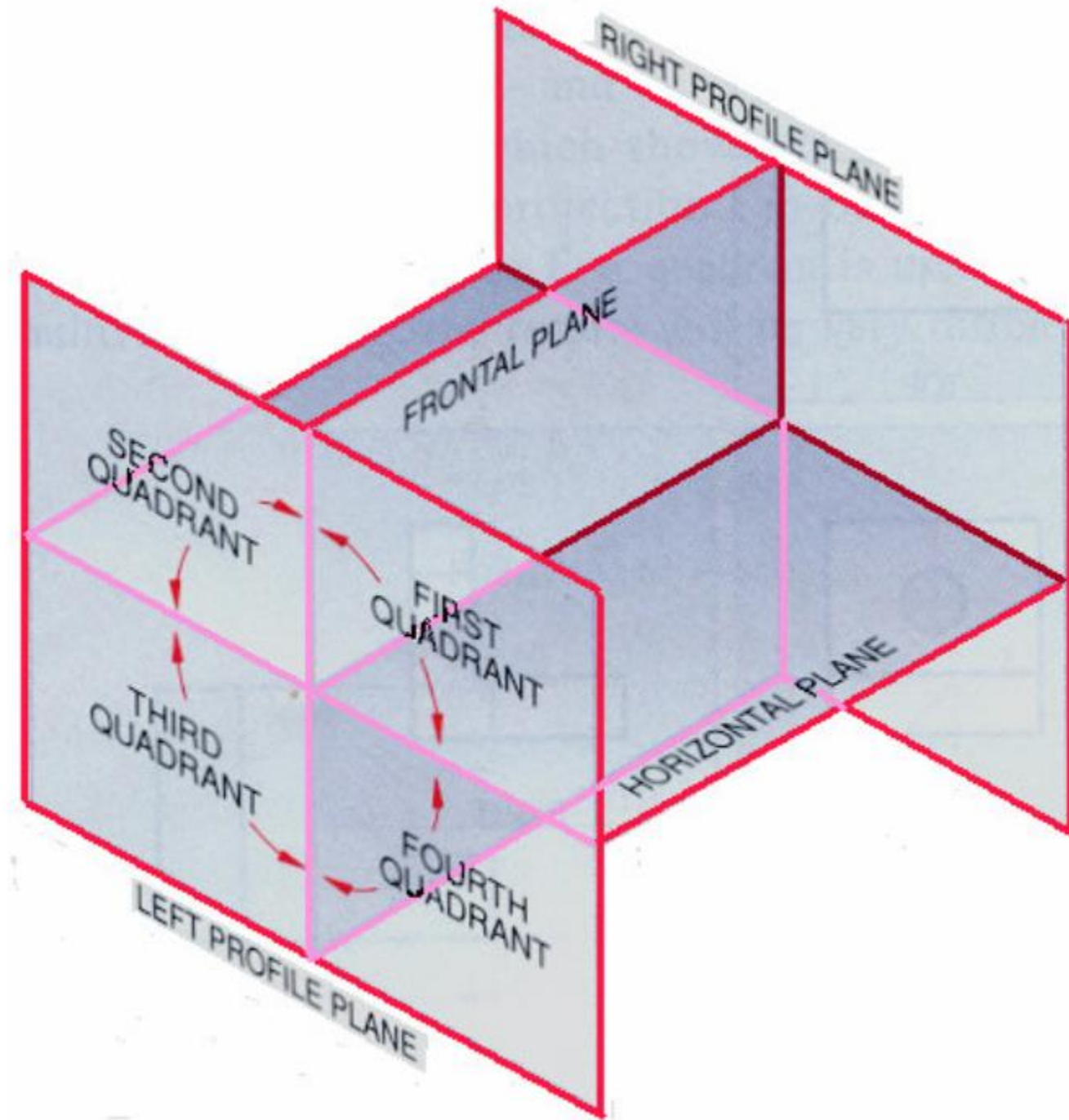
Conventional view placement

The three-view multiview drawing is the standard used in engineering and technology, because many times the other three principal views are mirror images and do not add to the knowledge about the object.



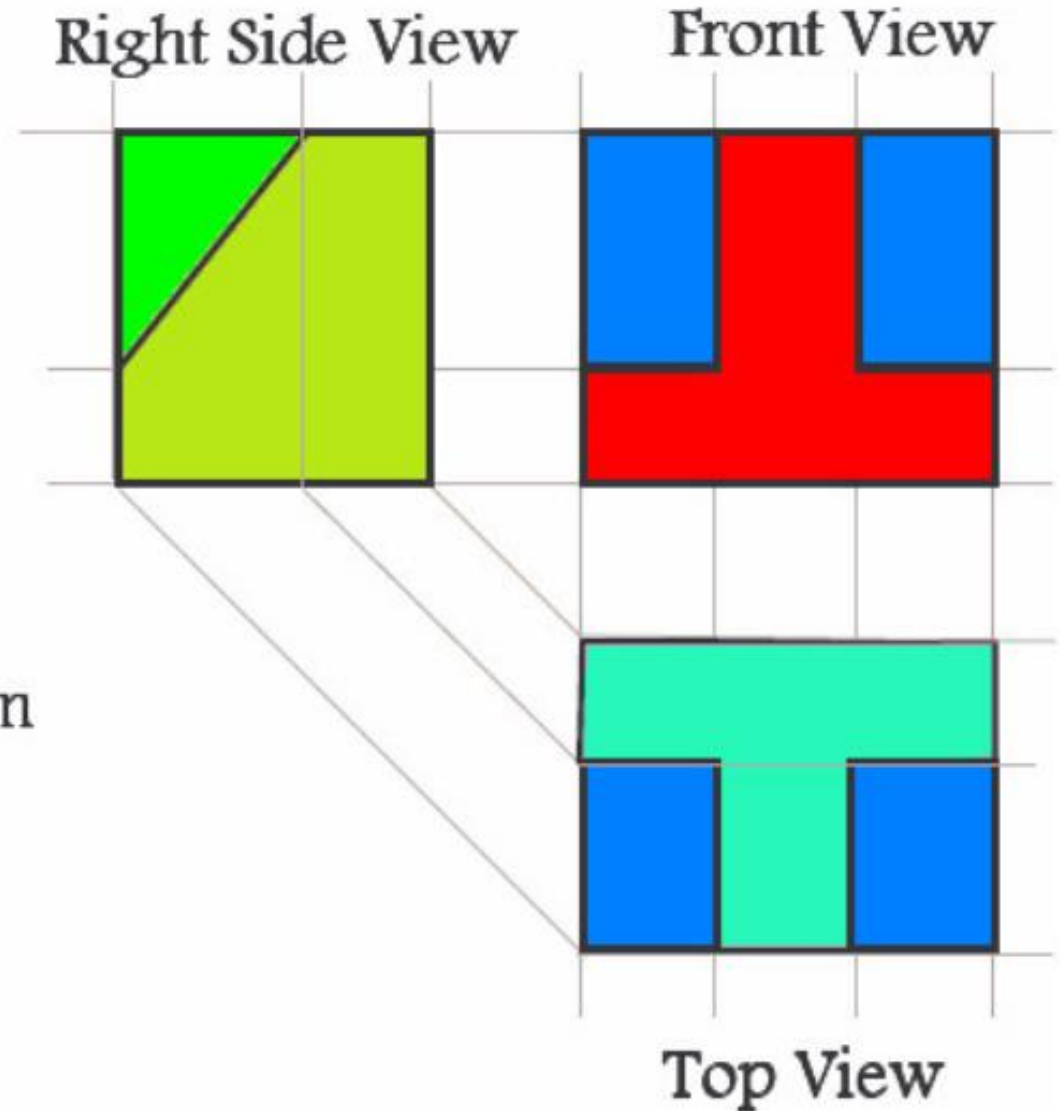
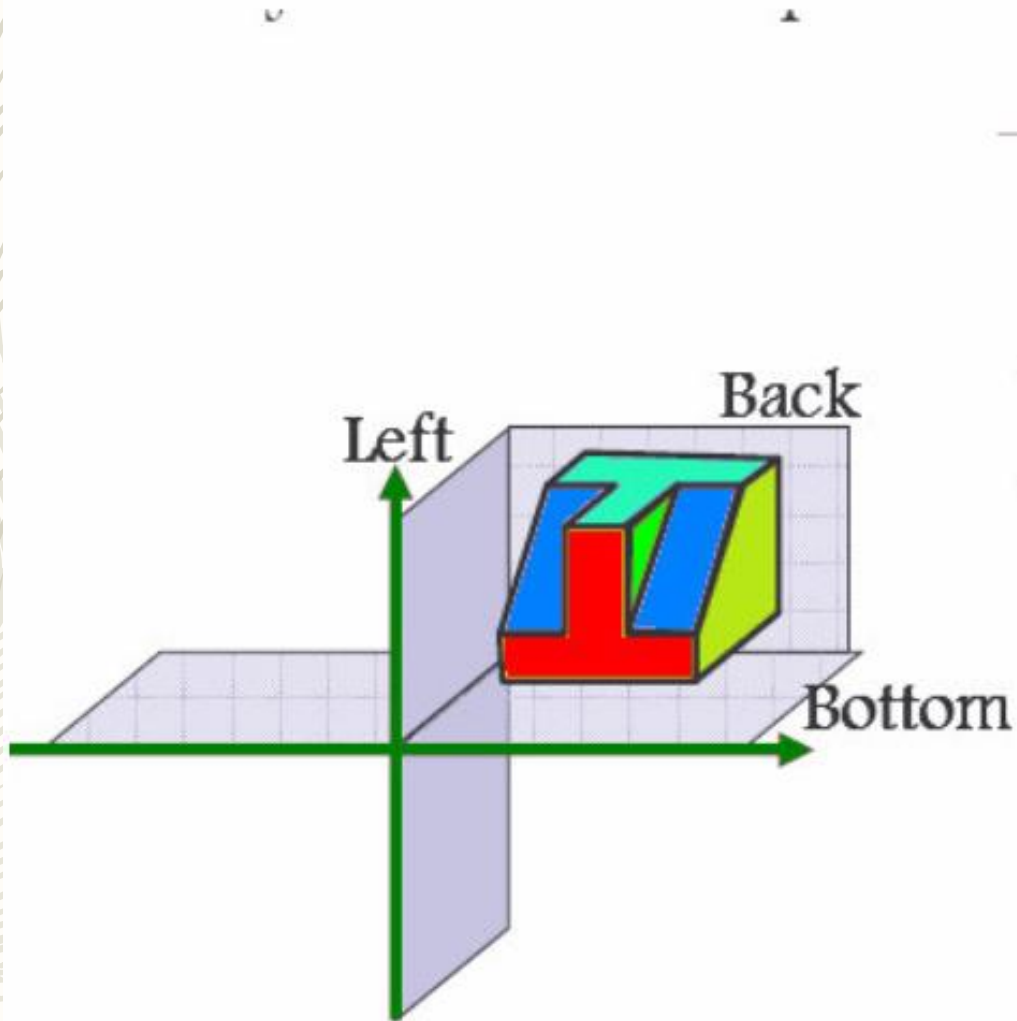
The standard views used in a three-view drawing are the top, front and the right side views.

**The principal
projection planes and
Quadrants are used
to create first and
third angle projection
drawings.**



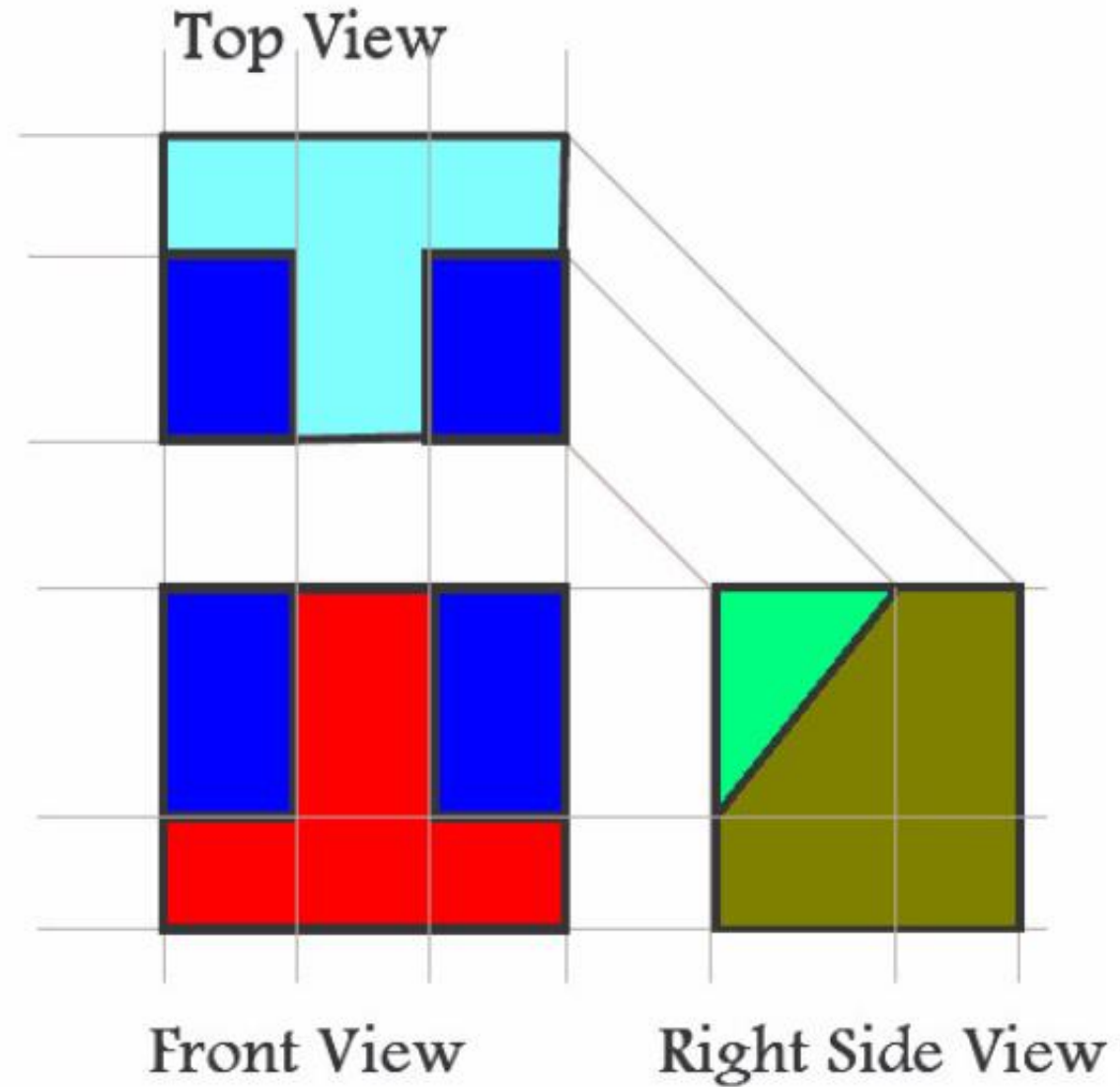
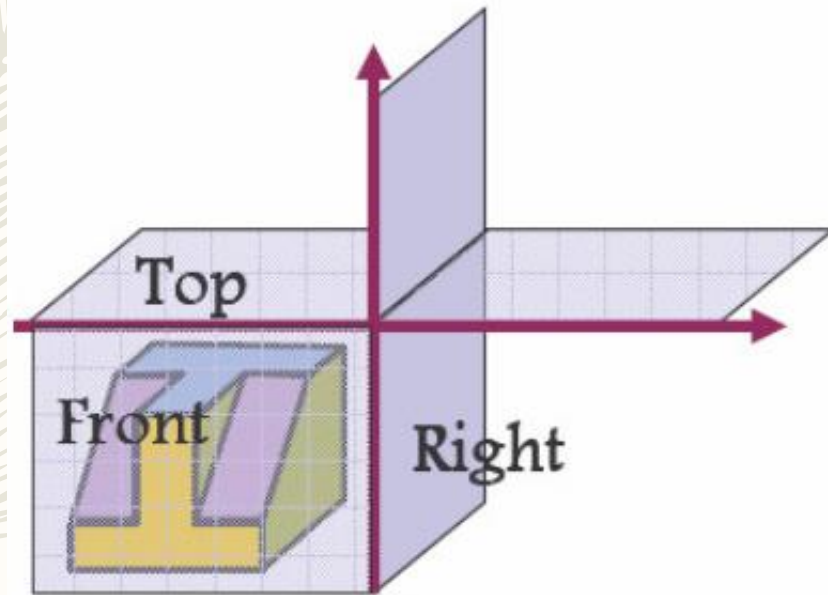
First Angle Projection

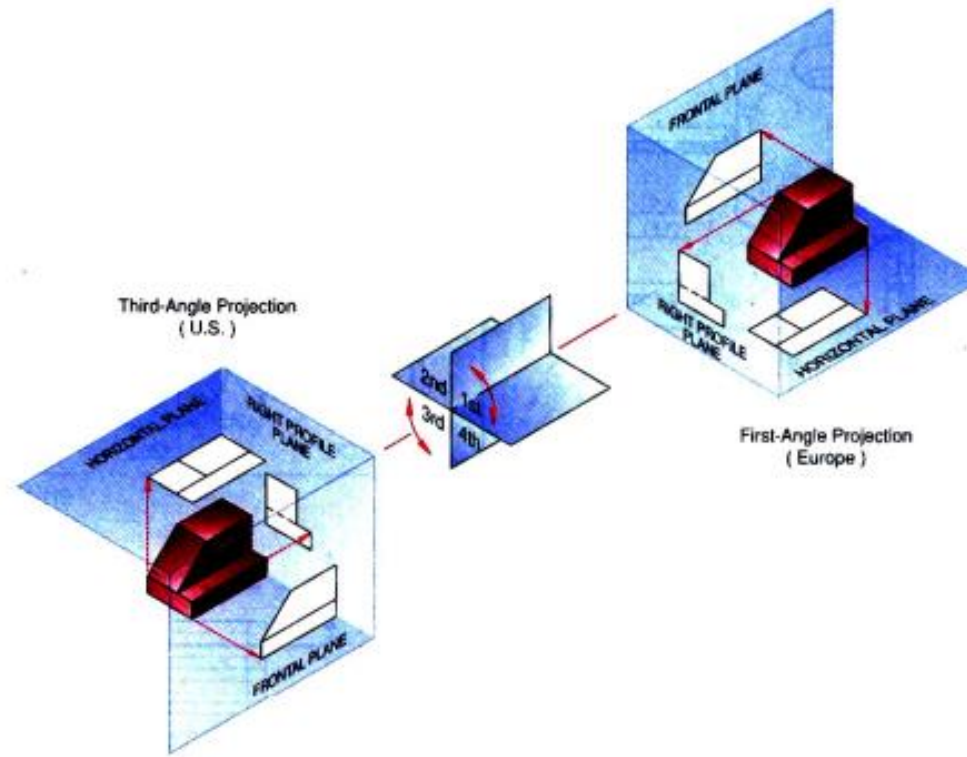
Object in the first quadrant



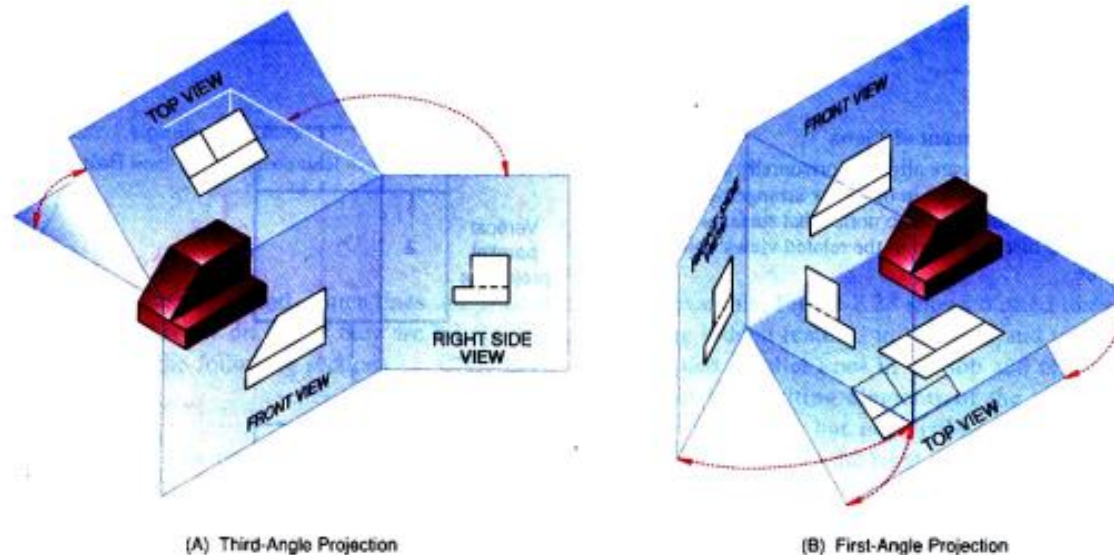
- **THIRD Angle Projection**

- Object behind plane





Placing the object in the third quadrant puts the projection planes between the viewer and the object.



When placed in the first quadrant, the object is between the viewer and the projection planes.



Difference between first- and third-angle projections

First angle projection

Object is kept in the first quadrant.

Object lies between observer and the plane of projection.

The plane of projection is assumed to be non-transparent.

Front (elevation) view is drawn above the XY line

Top (plan) view is drawn below the XY line

Left view is projected on the right plane and vice versa

Followed in India, European countries

Third-angle projection

Object is assumed to be kept in the third quadrant.

Plane of projection lies between the observer and the object.

The plane of projection is assumed to be transparent.

Front (elevation) view is drawn below the XY line

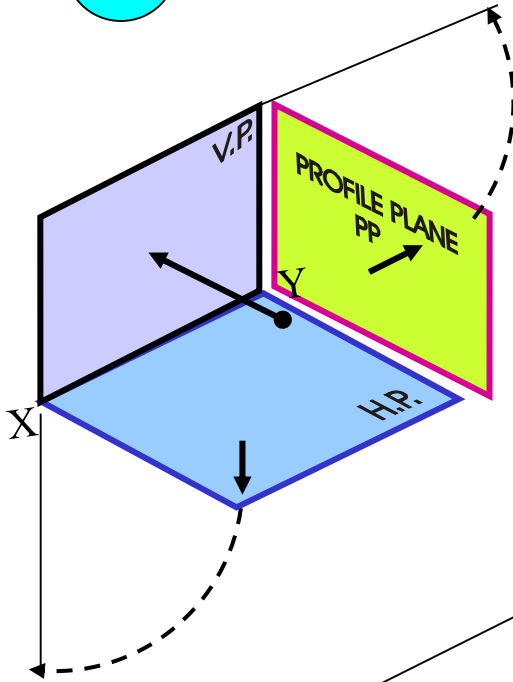
Top (plan) view is drawn above the XY line

Left view is projected on the left plane itself.

Followed in USA

2

PATTERN OF PLANES & VIEWS (First Angle Method)



THIS IS A PICTORIAL SET-UP OF ALL THREE PLANES. ARROW DIRECTION IS A NORMAL WAY OF OBSERVING THE OBJECT. BUT IN THIS DIRECTION ONLY VP AND A VIEW ON IT (FV) CAN BE SEEN. THE OTHER PLANES AND VIEWS ON THOSE CAN NOT BE SEEN.

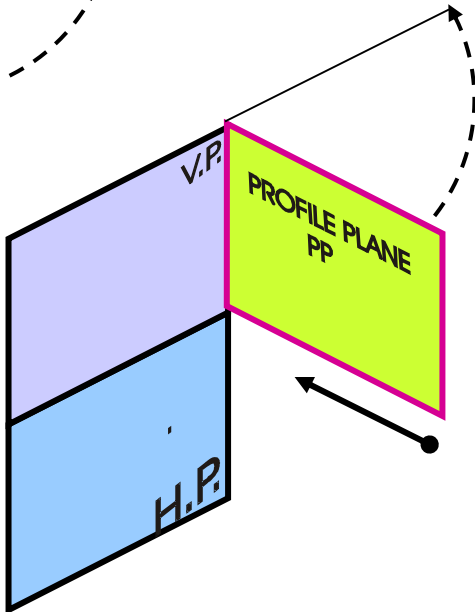
PROCEDURE TO SOLVE ABOVE PROBLEM:-

TO MAKE THOSE PLANES ALSO VISIBLE FROM THE ARROW DIRECTION,

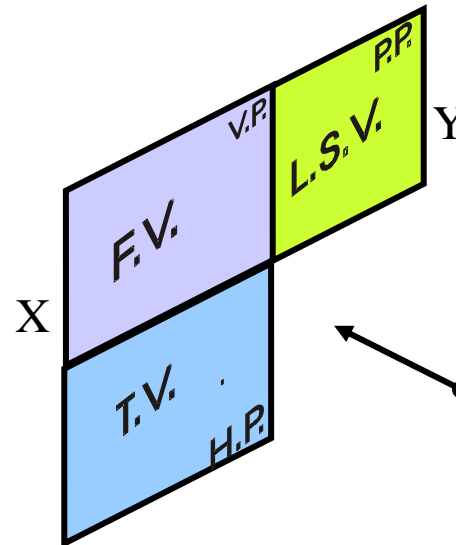
A) HP IS ROTATED 90° DOWNWARD

B) PP, 90° IN RIGHT SIDE DIRECTION.

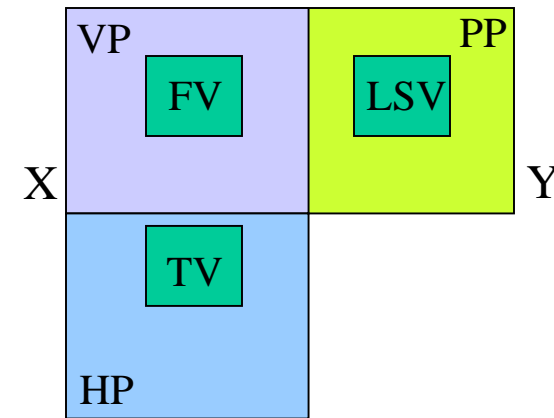
THIS WAY BOTH PLANES ARE BROUGHT IN THE SAME PLANE CONTAINING VP.



HP IS ROTATED DOWNWARD 90°
AND
BROUGHT IN THE PLANE OF VP.



PP IS ROTATED IN RIGHT SIDE 90°
AND
BROUGHT IN THE PLANE OF VP.



ACTUAL PATTERN OF PLANES & VIEWS
OF ORTHOGRAPHIC PROJECTIONS
DRAWN IN
FIRST ANGLE METHOD OF PROJECTIONS

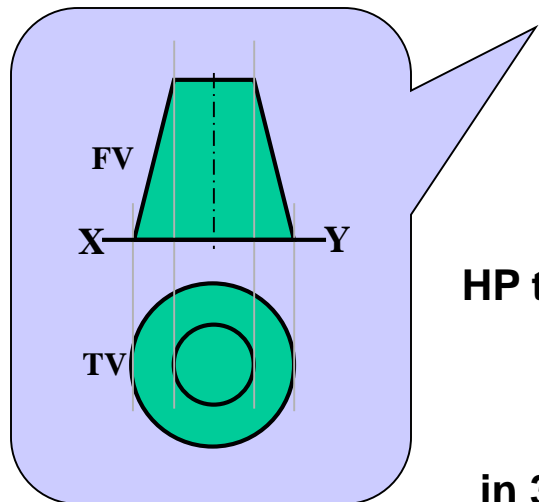
3

Methods of Drawing Orthographic Projections

First Angle Projections Method

Here views are drawn
by placing object
in 1st Quadrant

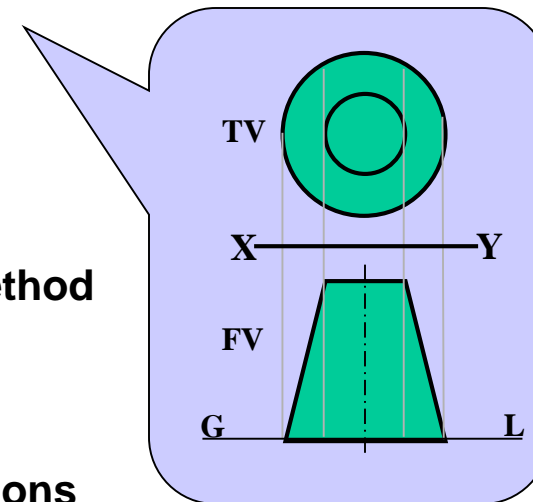
(Fv above X-y, Tv below X-y)



Third Angle Projections Method

Here views are drawn
by placing object
in 3rd Quadrant.

(Tv above X-y, Fv below X-y)



SYMBOLIC
PRESENTATION
OF BOTH METHODS
WITH AN OBJECT
STANDING ON HP (GROUND)
ON IT'S BASE.

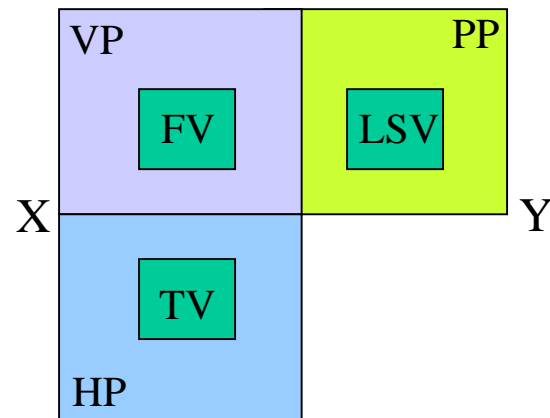
NOTE:-

HP term is used in 1st Angle method
&
For the same
Ground term is used
in 3rd Angle method of projections

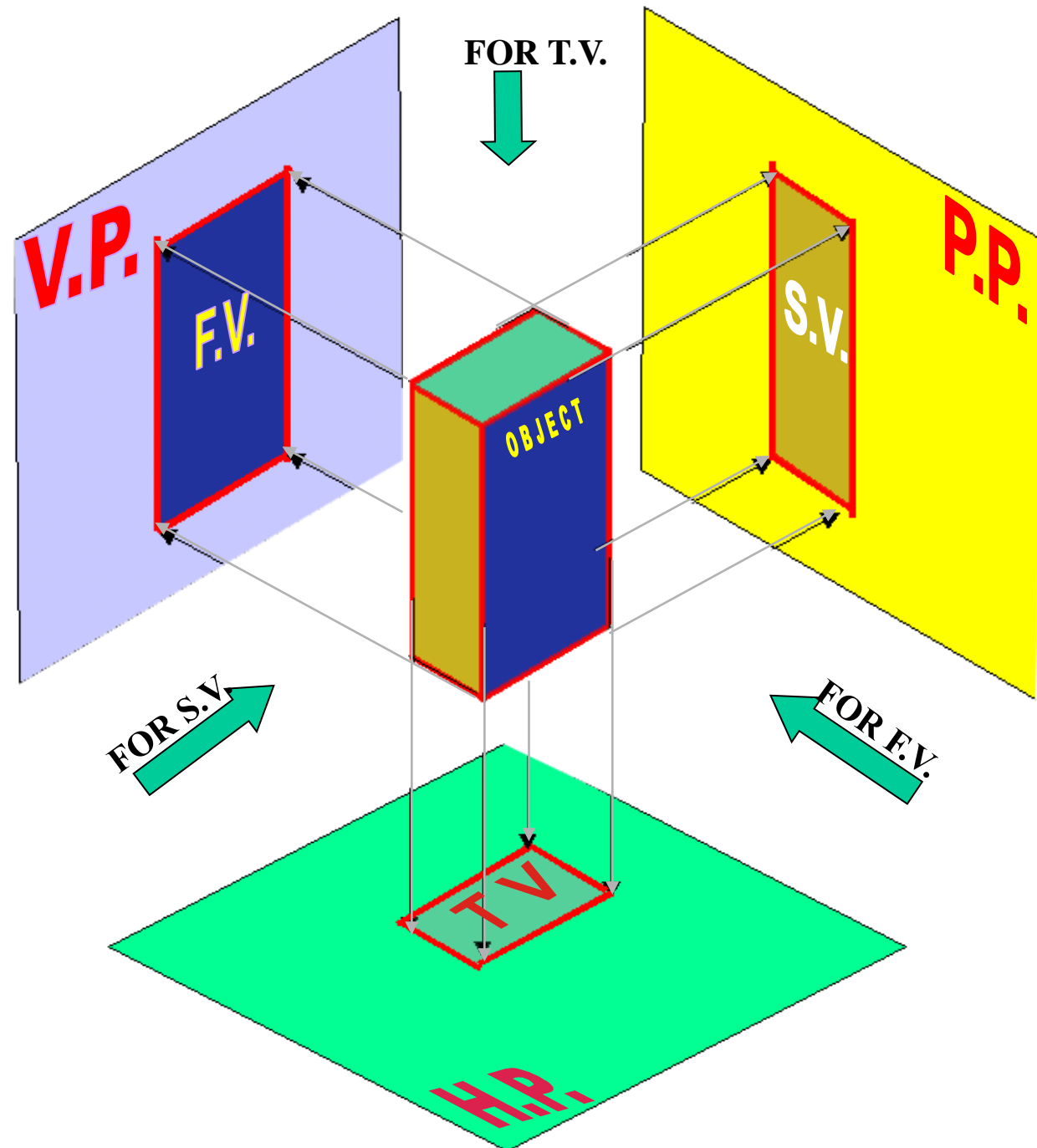
FIRST ANGLE PROJECTION

IN THIS METHOD,
THE OBJECT IS ASSUMED TO BE
SITUATED IN FIRST QUADRANT
MEANS
ABOVE HP & INFRONT OF VP.

OBJECT IS IN BETWEEN
OBSERVER & PLANE.



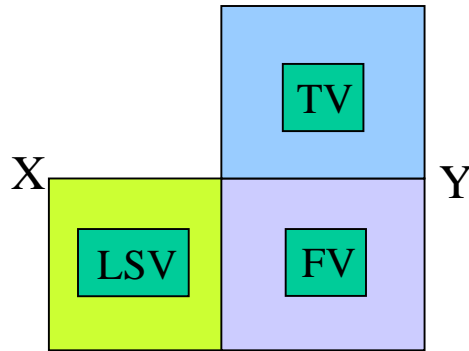
ACTUAL PATTERN OF
PLANES & VIEWS
IN
FIRST ANGLE METHOD
OF PROJECTIONS



THIRD ANGLE PROJECTION

IN THIS METHOD,
THE OBJECT IS ASSUMED TO BE
SITUATED IN THIRD QUADRANT
(BELOW HP & BEHIND OF VP.)

PLANES BEING TRANSPERENT
AND INBETWEEN
OBSERVER & OBJECT.



ACTUAL PATTERN OF
PLANES & VIEWS
OF
THIRD ANGLE PROJECTIONS

