Tishk International University
Engineering Faculty
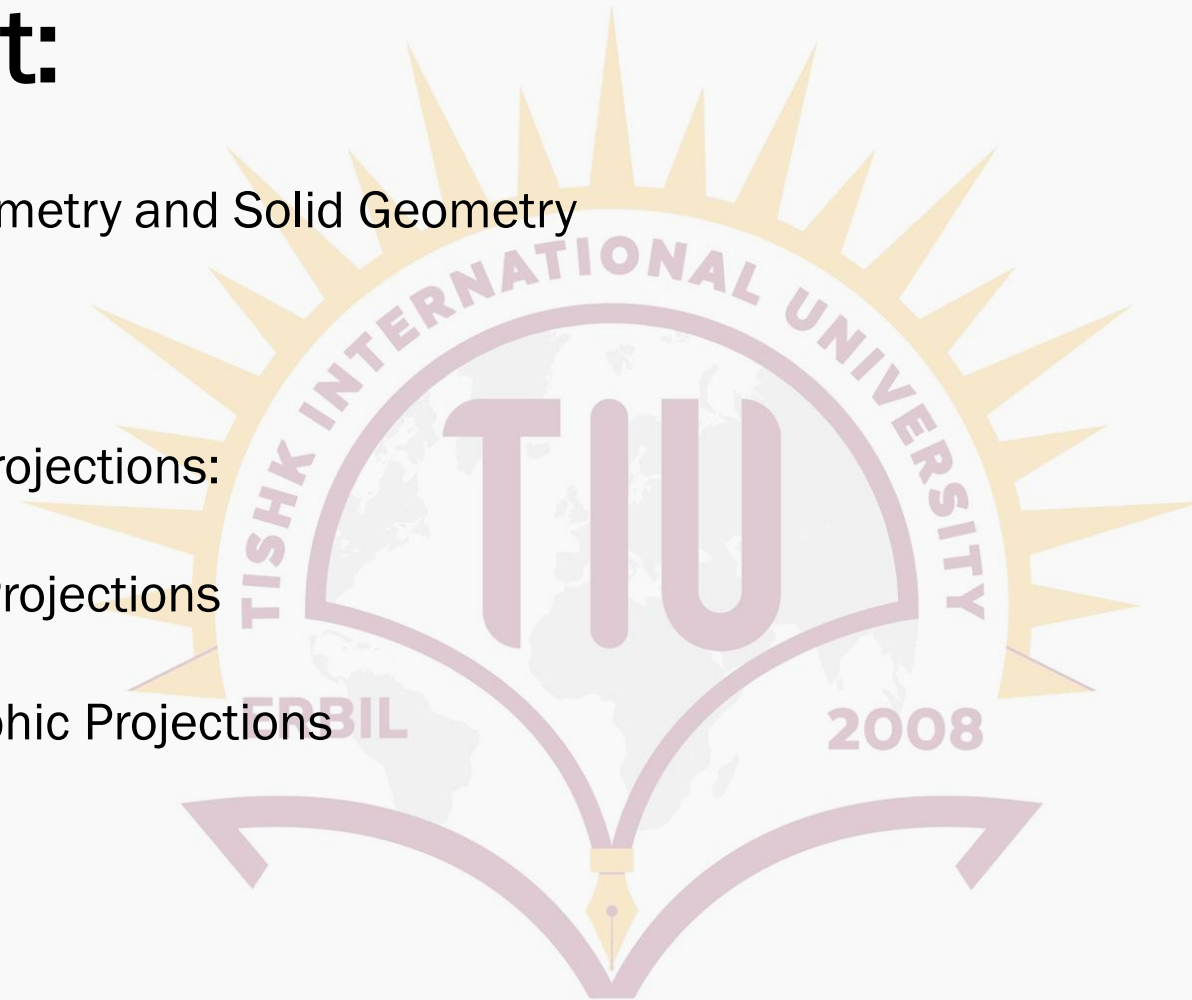**Petroleum and Mining Engineering Department**

Engineering Drawing

Lecture 6: Orthographic Projections

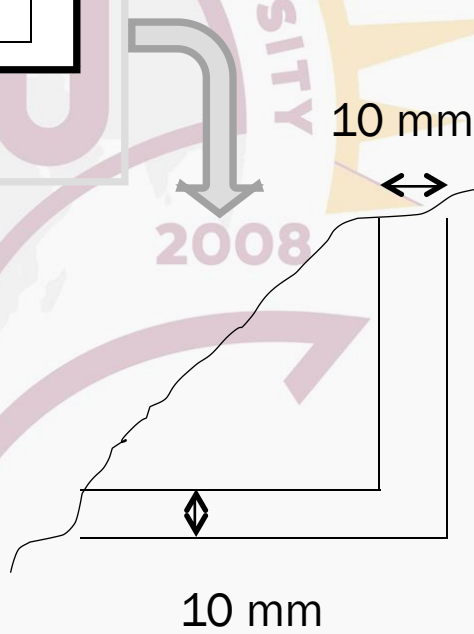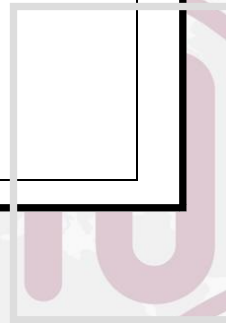**First Grade- Fall Semester 2020-2021**

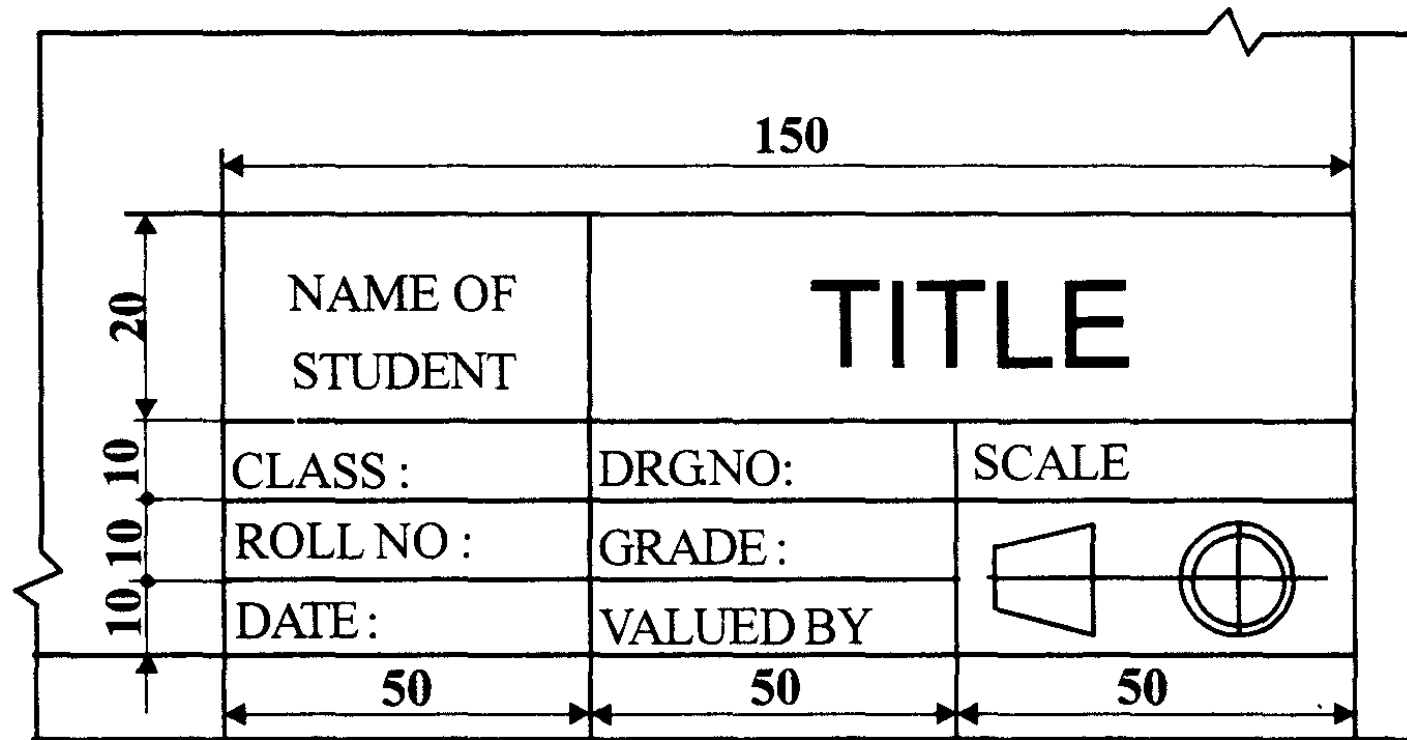**Instructor: Sheida Mostafa Sheikheh**

Content:

- Plane Geometry and Solid Geometry

- Projection

- Types of Projections:

1. Pictorial Projections

2. Orthographic Projections

Draw a border line 10 mm from the edge all round the sheet

10 mm

10 mm

Title Block:

Plane Geometry and Solid Geometry:

✓ The study of geometry can be broken into two broad types:

➢ Plane geometry, which deals with only two dimensions, and

➢ solid geometry which allows all three.

✓ The world around us is obviously three-dimensional, having width, depth and height.

✓ Solid geometry deals with objects in that space such as cubes and spheres.

✓ Plane geometry deals in objects that are flat, such as triangles and lines, that can be drawn on a flat piece of paper.

# Plane Geometry and Solid Geometry:
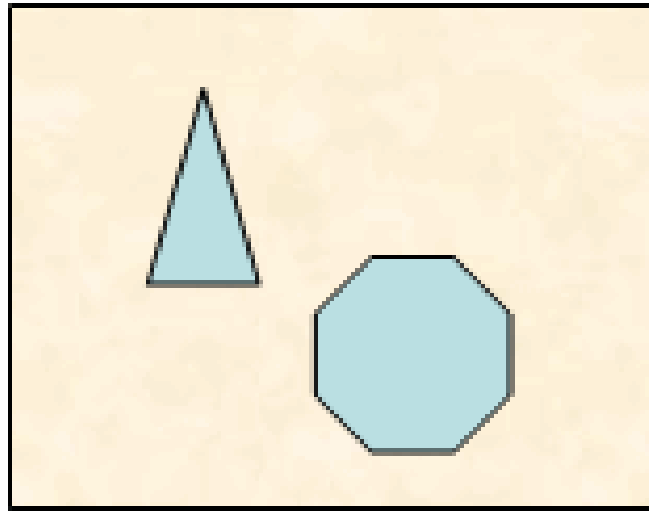
Plane geometry
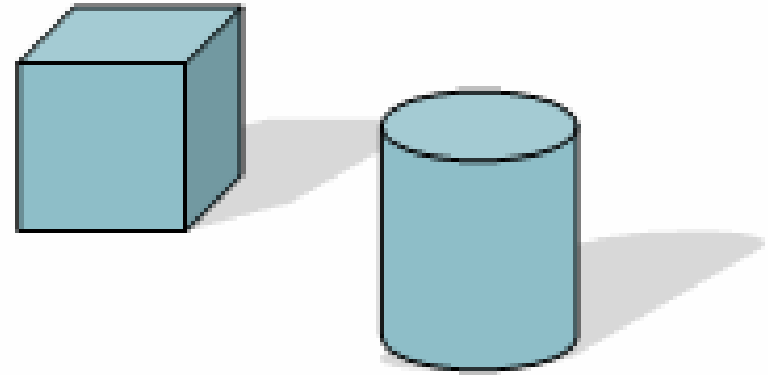
Solid geometry

Solid Geometry:

✓ Engineering drawing, particularly solid geometry is the graphic language used in the industry to:

➢ Record the ideas and information necessary in the form of blueprints to make machines, buildings, structures etc., by engineers and technicians who design, develop, manufacture and market the products.
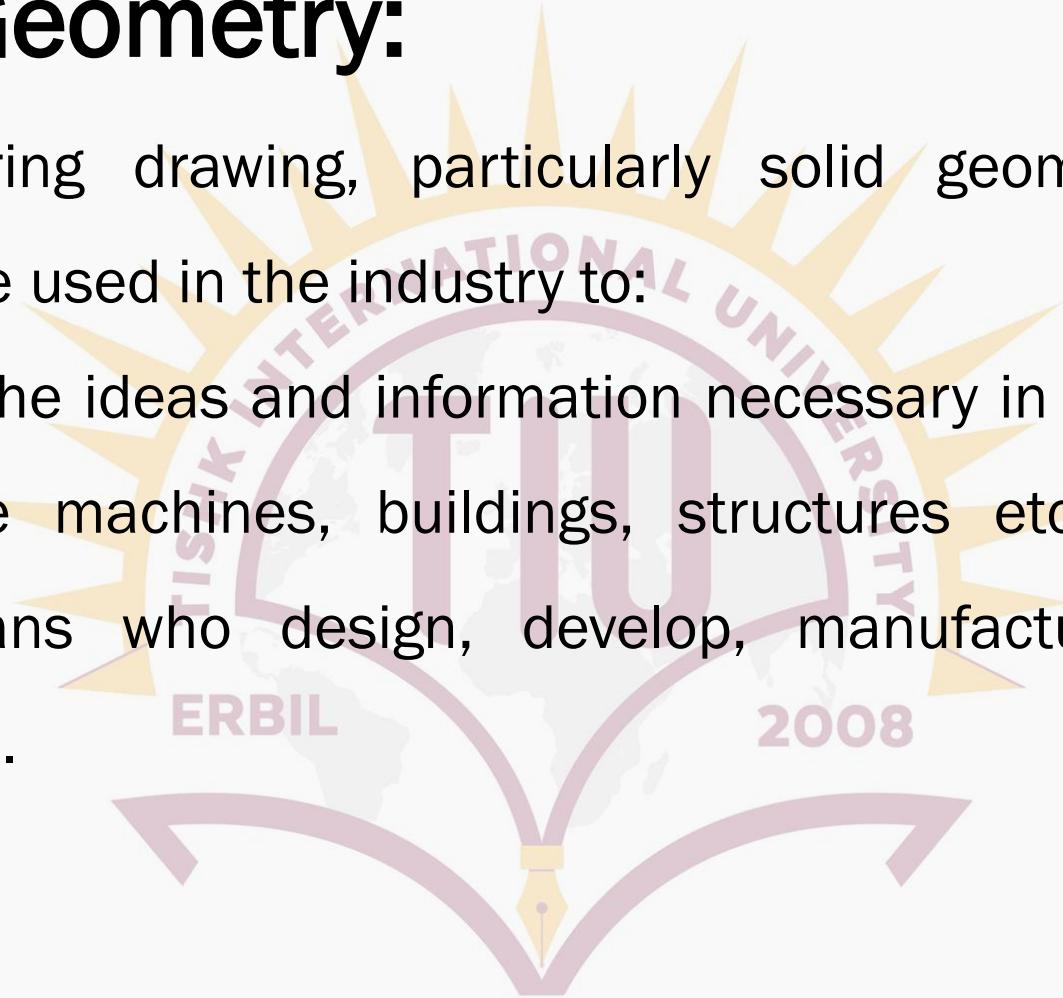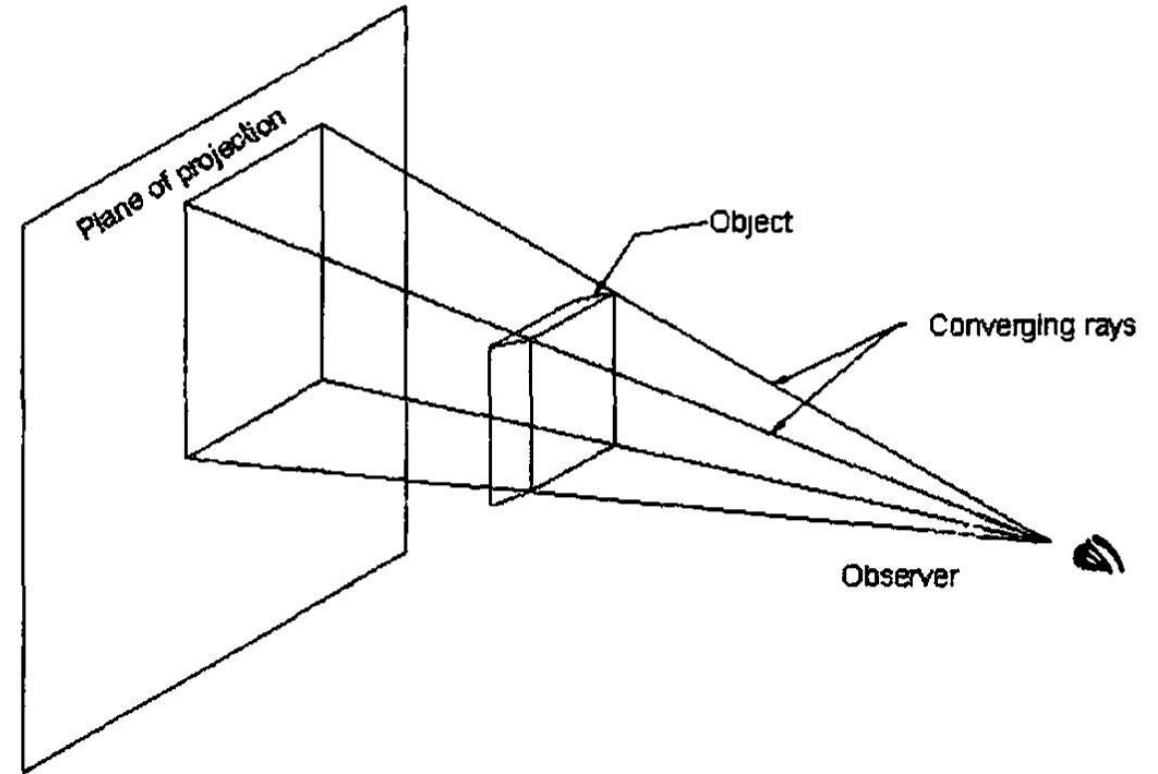
Projection:

✓ As per the optical physics, an object is seen when the light rays called visual rays coming from the object strike the observer's eye. The size of the image formed in the retina (the area at the back of the eye that receives light and sends pictures of what the eye sees to the brain) depends on the distance of the observer from the object.
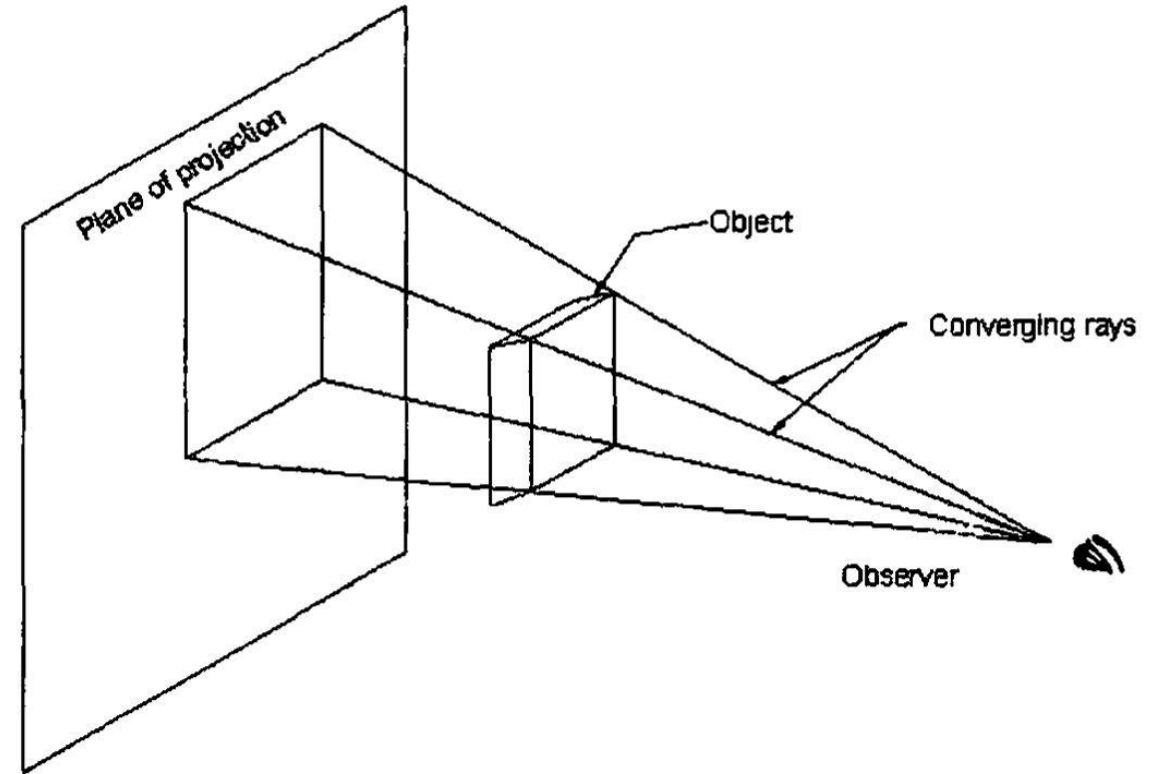
Projection:

- If an imaginary transparent plane is introduced such that the object is in between the observer and the plane, the image obtained on the screen is as shown in the figure.

- This is called **perspective view** of the object. Here, straight lines (rays) are drawn from various points on the contour of the object to meet the transparent plane, thus the object is said to be **projected** on that plane.

Perspective Projection

Projection:

- The figure or view formed by joining, in correct sequence, the points at which these lines meet the plane is called the **projection** of the object.

- The lines or rays drawn from the object to the plane are called **projectors**.

- The transparent plane on which the projections are drawn is known **as plane of projection**.

Perspective Projection

Types of Projections:

1. Pictorial Projections:

(i) Perspective Projection

(ii) Isometric Projection

(iii) Oblique Projection
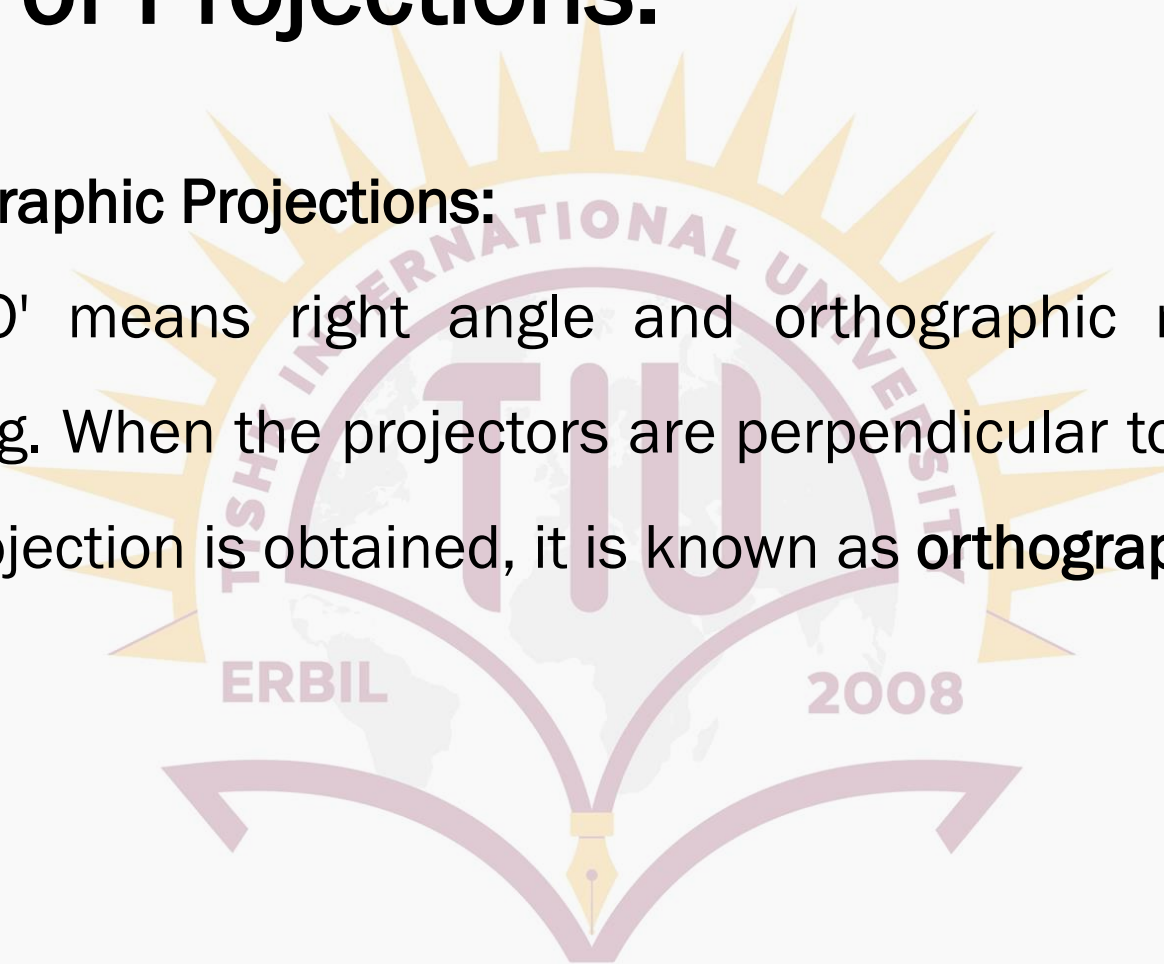
2. Orthographic Projections

Types of Projections:

1. Pictorial Projections:

✓ The Projections in which the description of the object is completely understood in one view is known as **pictorial projection**.

✓ They have the advantage of conveying an immediate impression of the general shape and details of the object, but not its true dimensions or sizes.
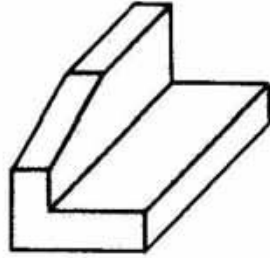
Types of Projections:

2. Orthographic Projections:

✓ 'ORTHO' means right angle and orthographic means right angled drawing. When the projectors are perpendicular to the plane on which the projection is obtained, it is known as **orthographic projection**.
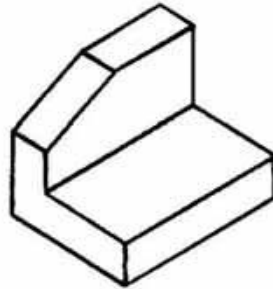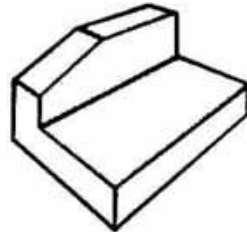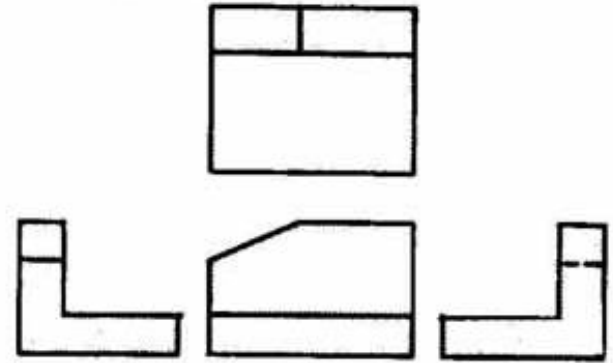
TYPES OF PROJECTIONS

PICTORIAL

OBLIQUE PROJECTION

ISOMETRIC PROJECTION

PERSPECTIVE PROJECTION
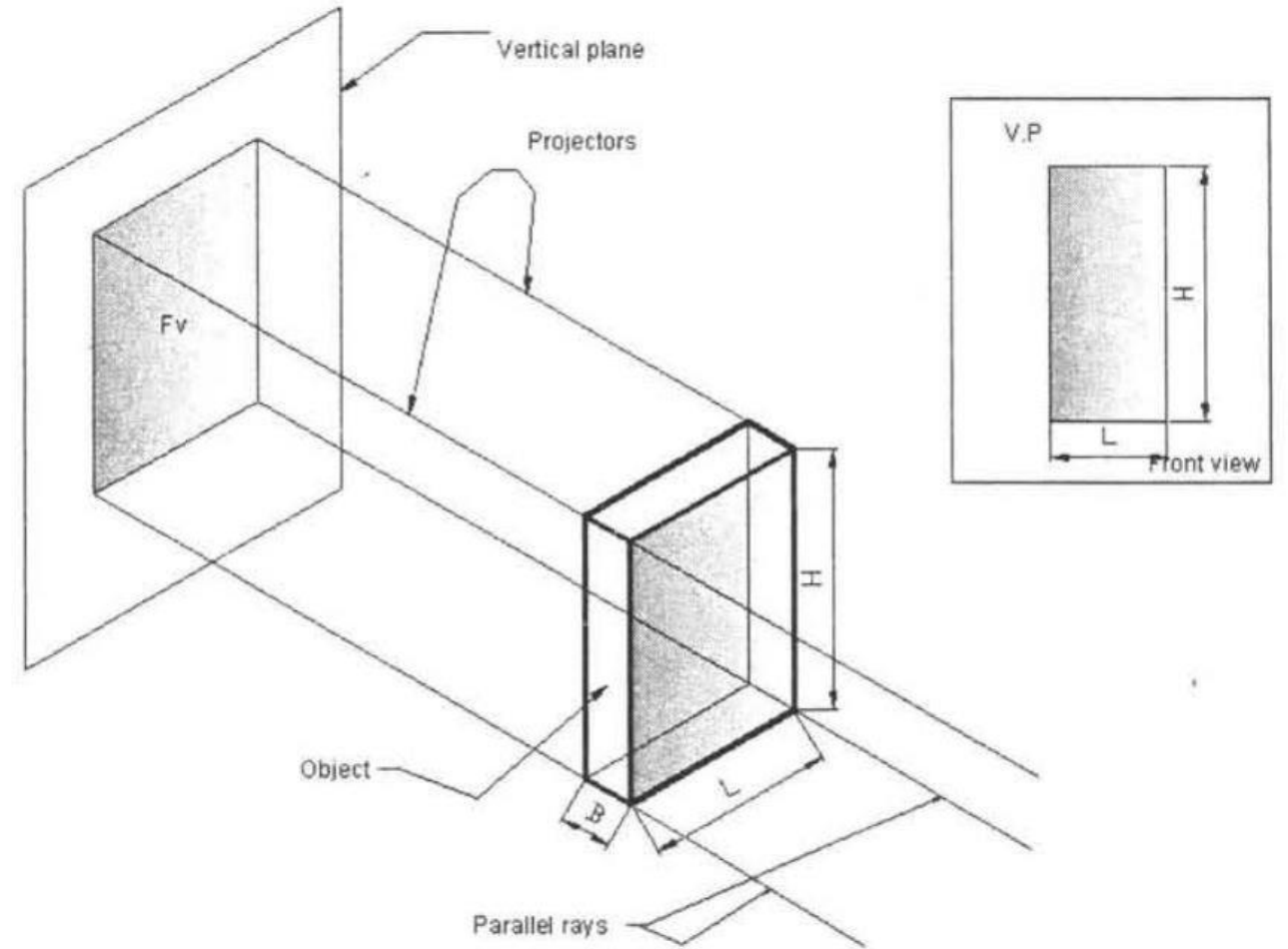
MULTIVIEW

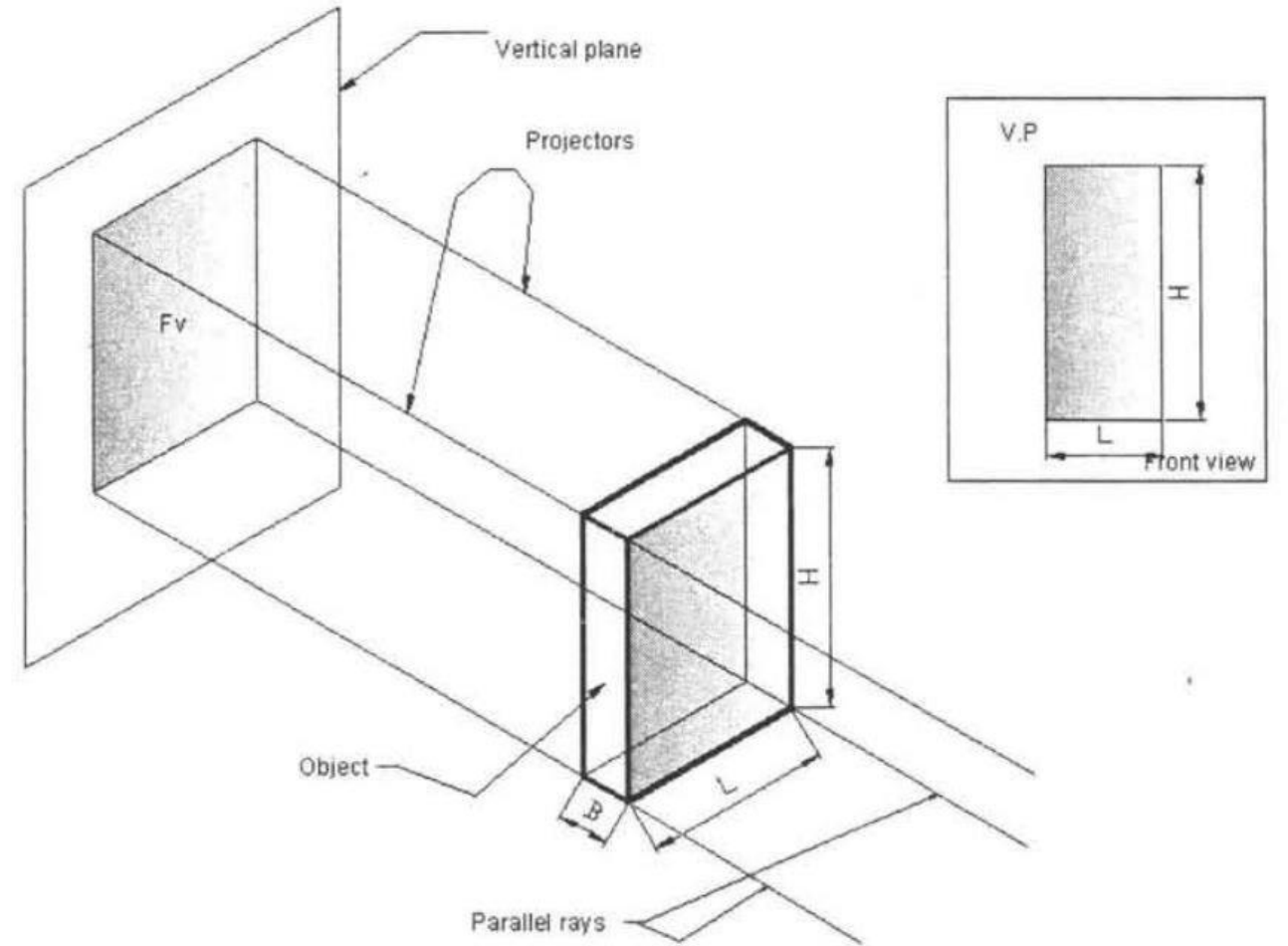ORTHOGRAPHIC PROJECTION

Method of Obtaining Front View

✓ Imagine an observer looking at the object from an infinite distance (See the figure).

Method of Obtaining Orthographic Front View

Method of Obtaining Front View

✓ The rays are parallel to each other and perpendicular to both the front surface of the object and the plane. When the observer is at a finite distance from the object, the rays converge to the eye as in the case of perspective projection. When the observer looks from the front surface F or the block, its true shape and size is seen.
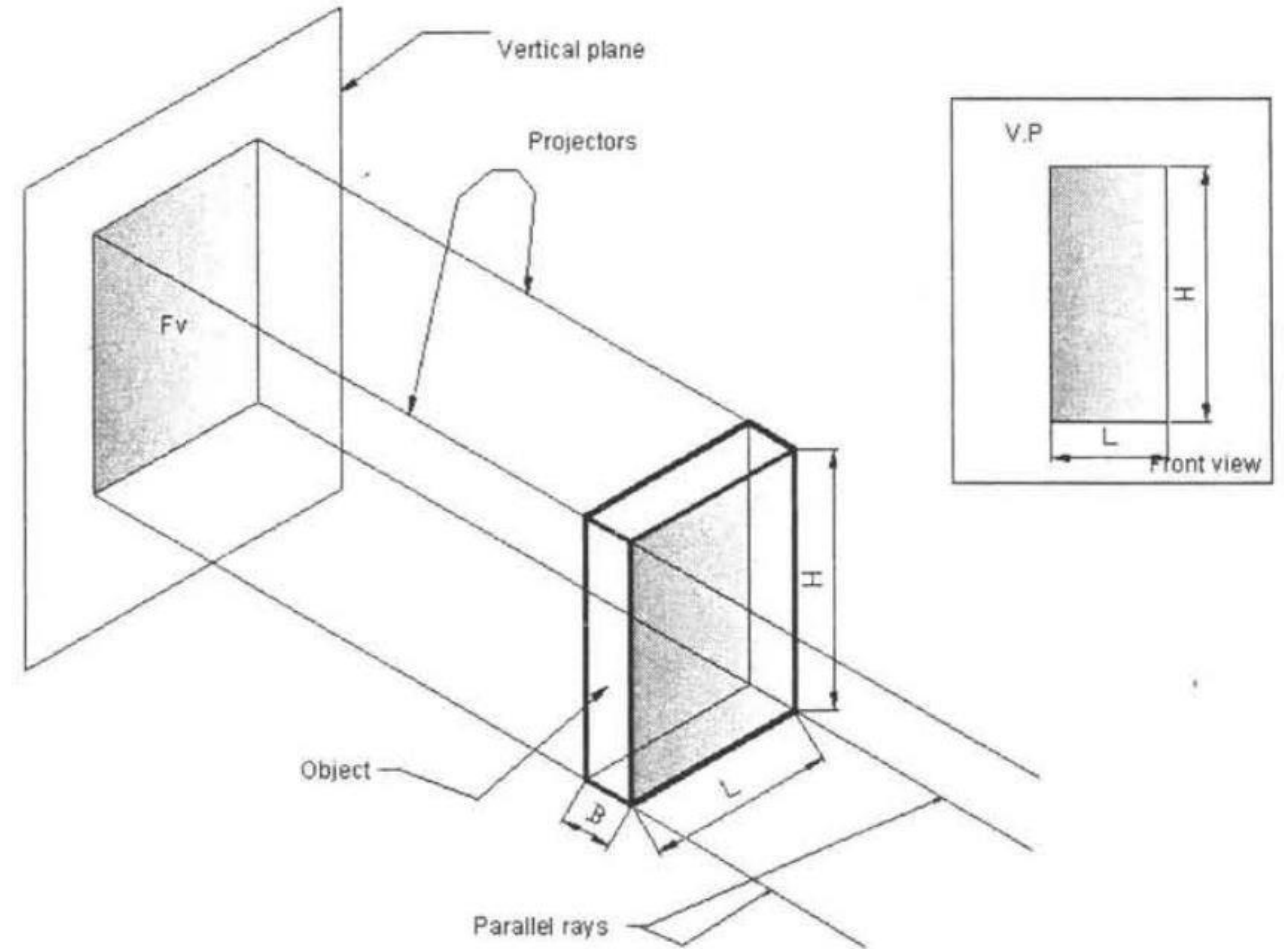

Method of Obtaining Orthographic Front View
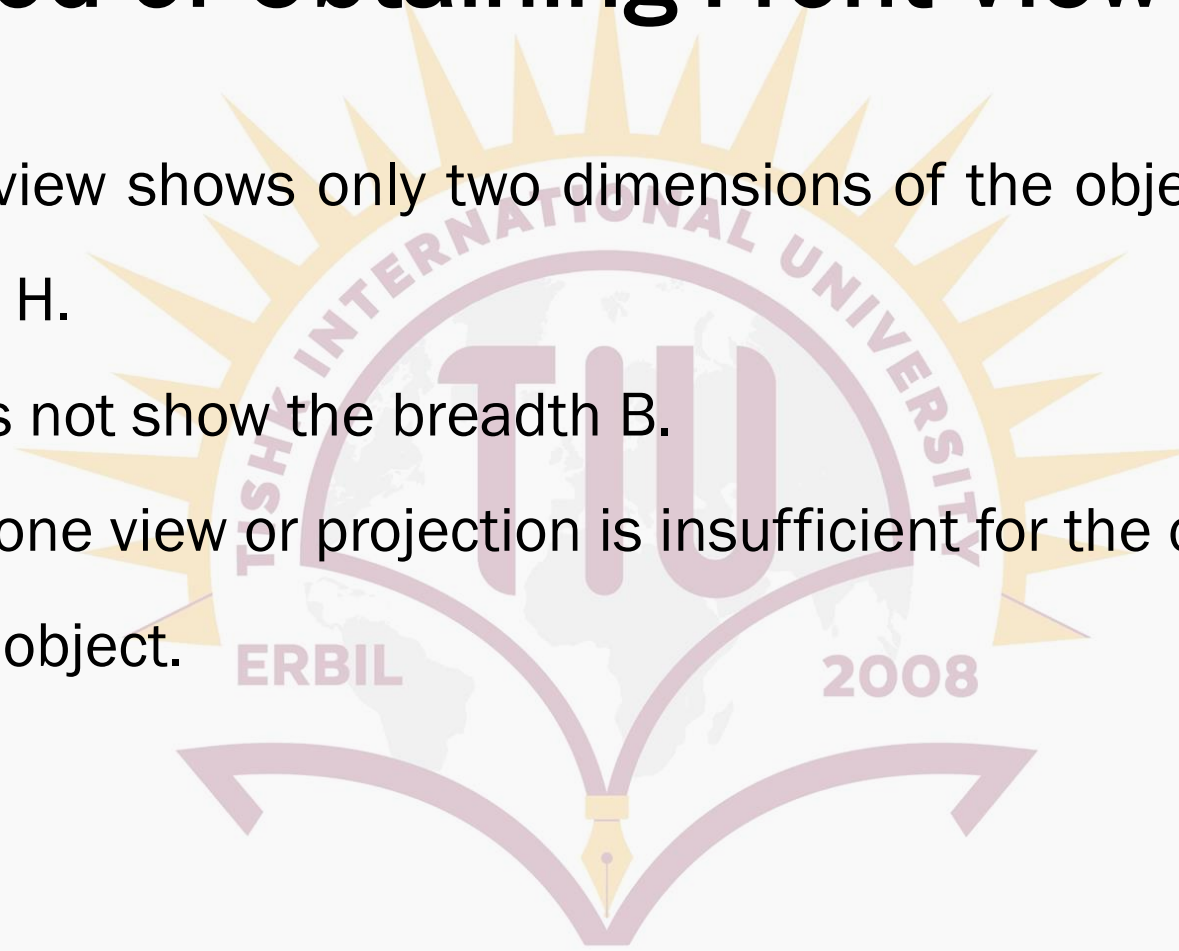
Method of Obtaining Front View

✓ When the rays or projectors are extended further, they meet the **vertical plane** (V.P) located behind the object. By joining the projectors meeting the plane in correct sequence the **Front view** (shown in the figure) is obtained.

Method of Obtaining Orthographic Front View

Method of Obtaining Front View

✓ Front view shows only two dimensions of the object, Viz. length L and height H.

✓ It does not show the breadth B.

✓ Thus, one view or projection is insufficient for the complete description of the object.

Method of Obtaining Top View:

✓ As Front view alone is insufficient for the complete description of the object, another plane called Horizontal plane (H.P) is assumed such that it is hinged and perpendicular to V.P and the object is in front of the V.P and above the H.P as shown in the figure.

Method of Obtaining Orthographic Top View.
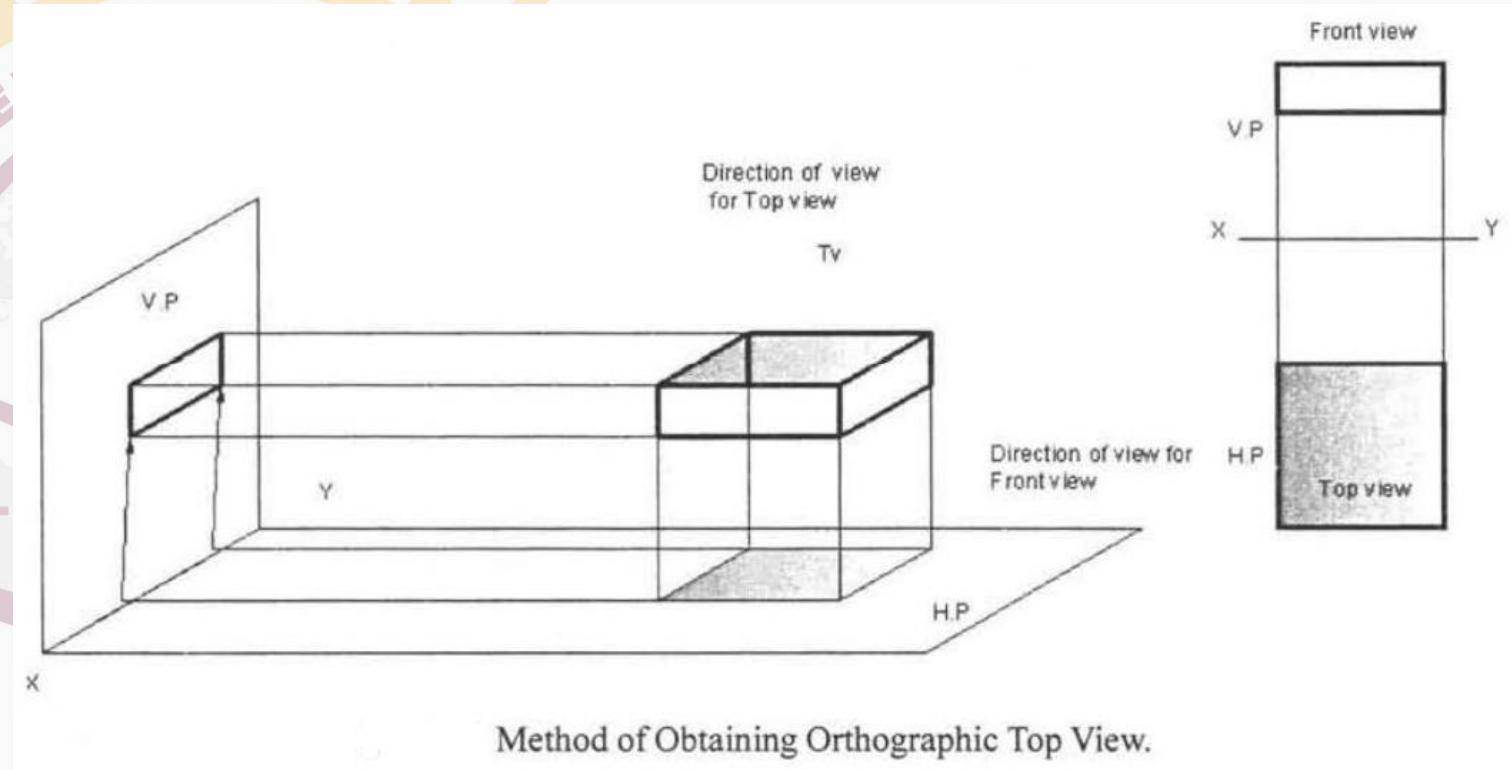
Method of Obtaining Top View:

✓ Looking from the top, the projection of the top surface is the **Top view** (T_v). Both top surface and Top view are of exactly the same shape and size. Thus, Top view gives the **True length L** and breadth **B** of the block but not the height H.


Method of Obtaining Orthographic Top View.
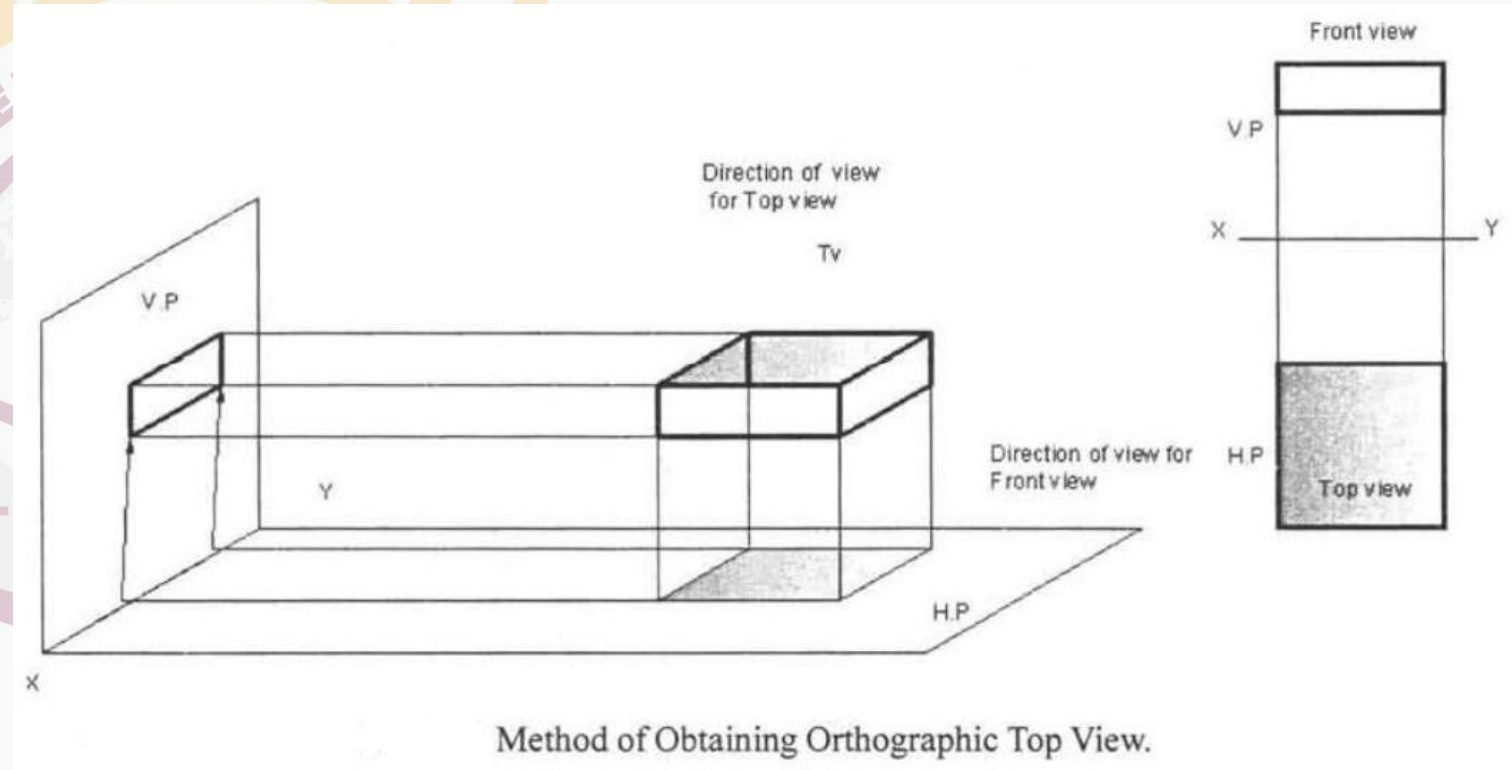
Notes

(1) Each projection shows that surface of the object which is nearer to the observer. and far away from the plane.

(2) Orthographic projection is the standard drawing form of the industrial world.

(3) XY Line: The line of intersection of VP and H.P is called the reference line and is denoted as xy.

Obtaining the Projection on the Drawing Sheet

✓ It is convention to rotate the H.P through 90° in the clockwise direction about xy line so that it lies in the extension of VP as shown in Figure.


Method of Obtaining Orthographic Top View.
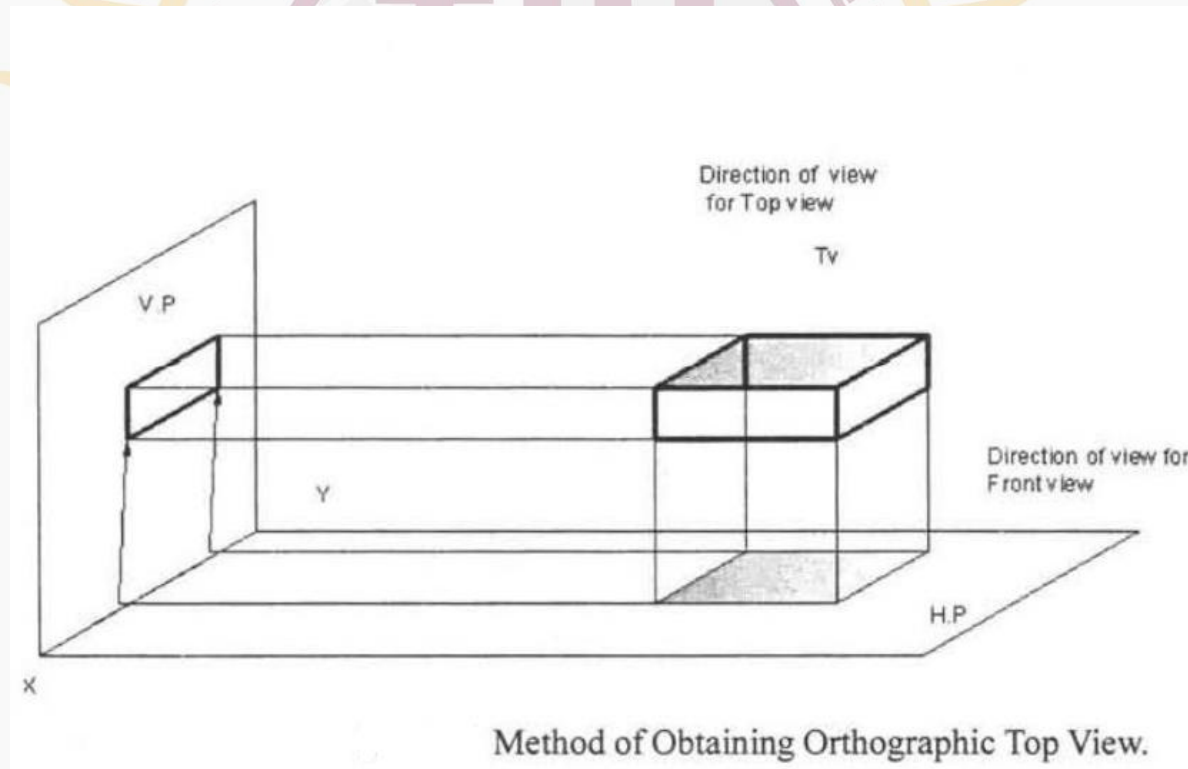
Obtaining the Projection on the Drawing Sheet

✓ The two projections **Front view** and **Top view** may be drawn on the two-dimensional drawing sheet as shown in Figure.
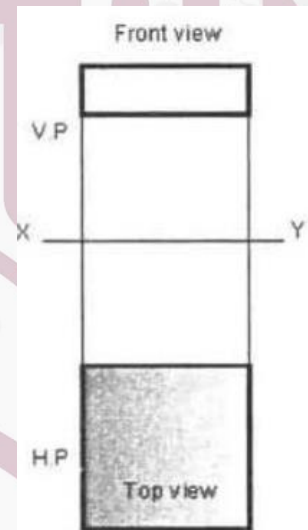
Obtaining the Projection on the Drawing Sheet

✓ Thus, all details regarding the shape and size, Viz. Length (L), Height(H) and Breadth(B) of any object may be represented by means of orthographic projections i.e., Front view and Top view.


Method of Obtaining Orthographic Top View.
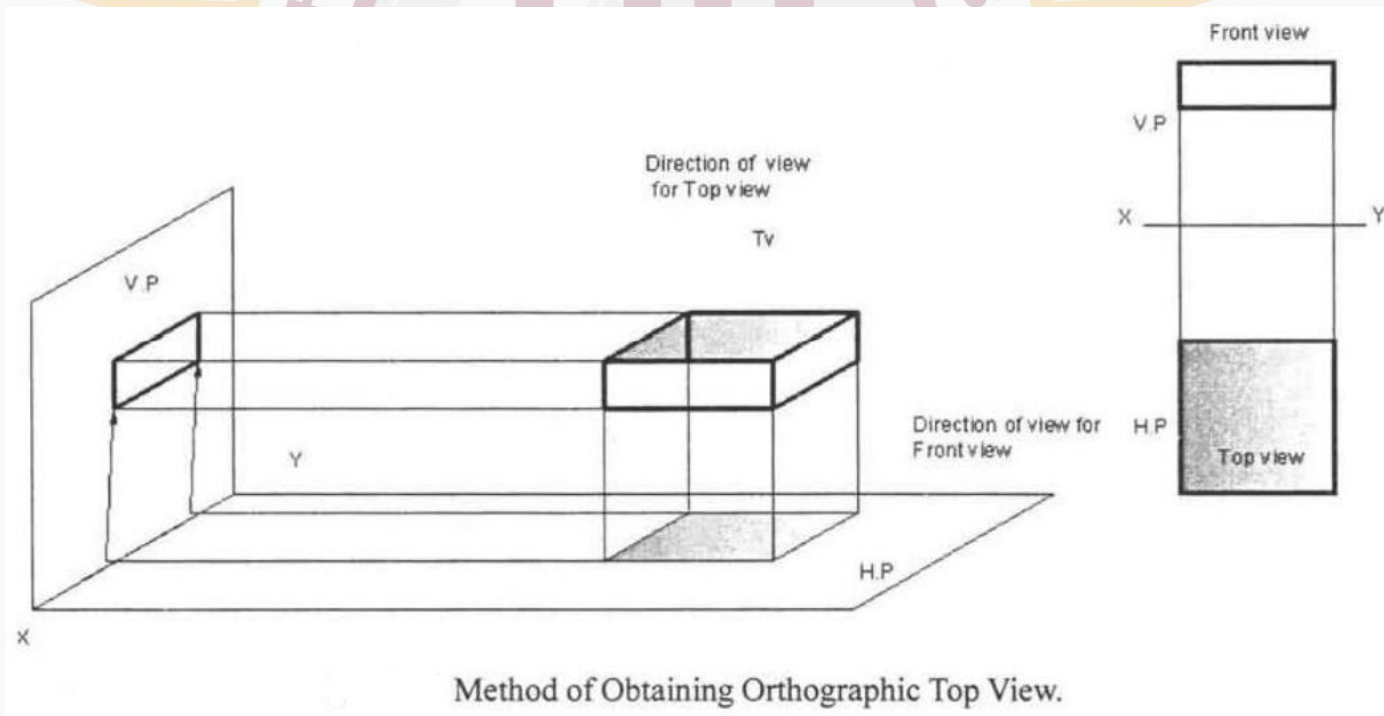
Terms Used

✓ V.P and H.P are called as **Principal planes of projection or reference planes.**

✓ They are always transparent and at right angles to each other.

✓ The projection on V.P is designated as **Front view** and the projection on H.P as **Top view.**
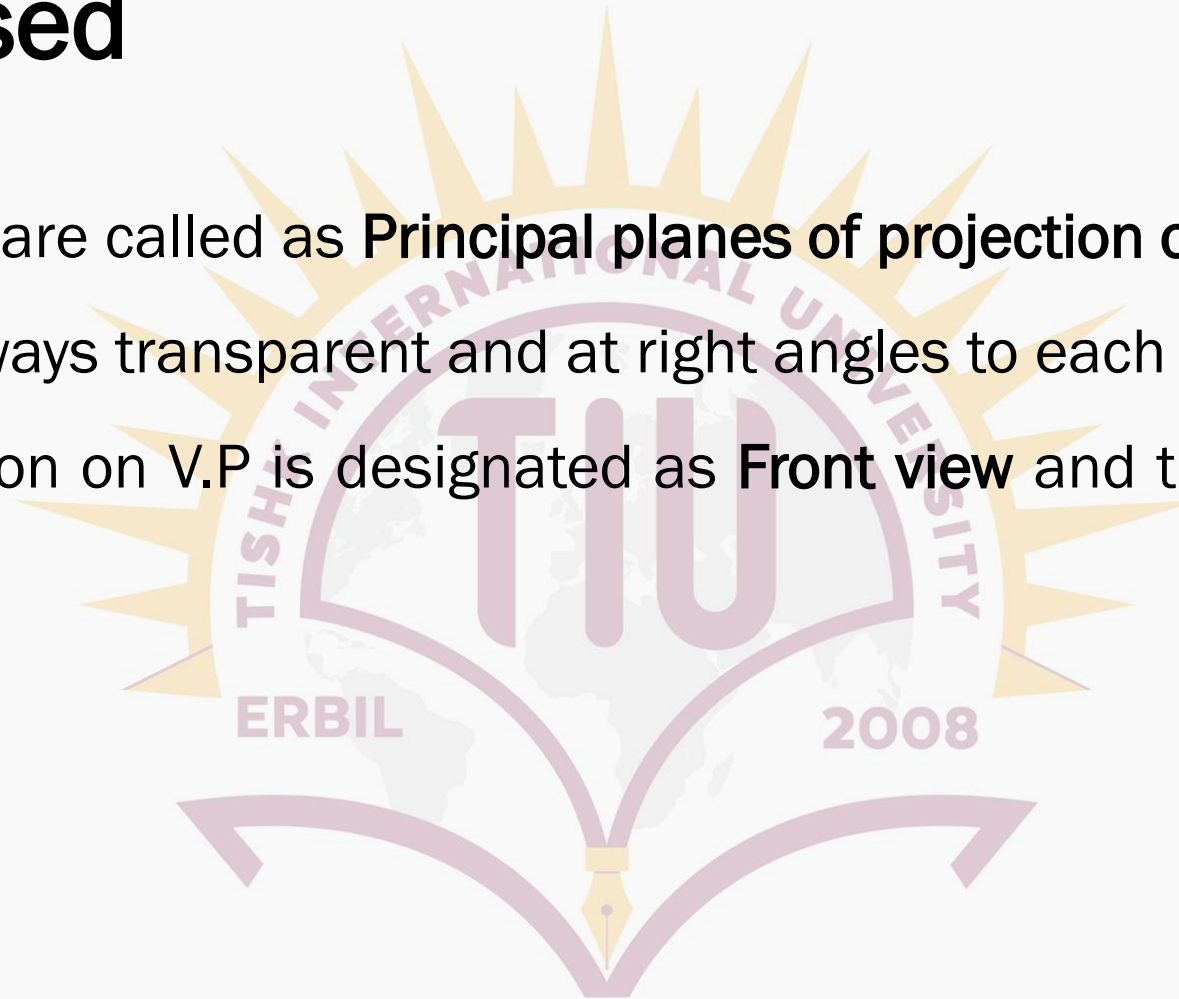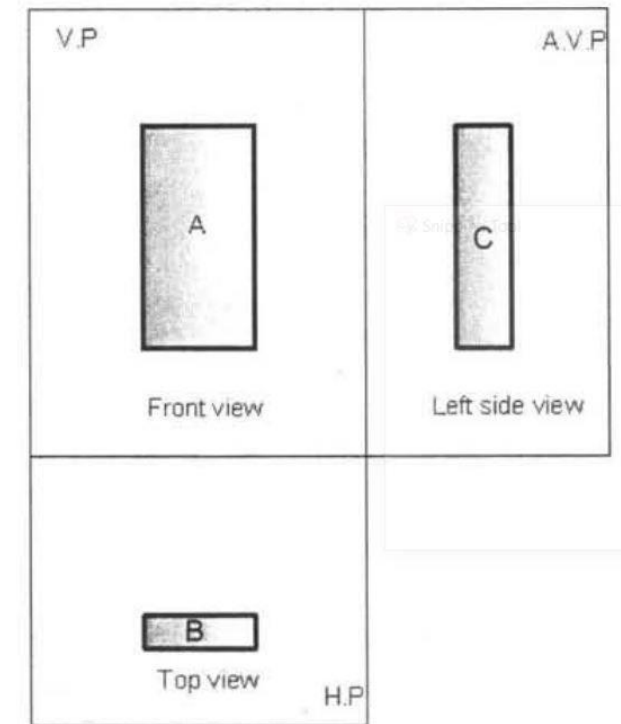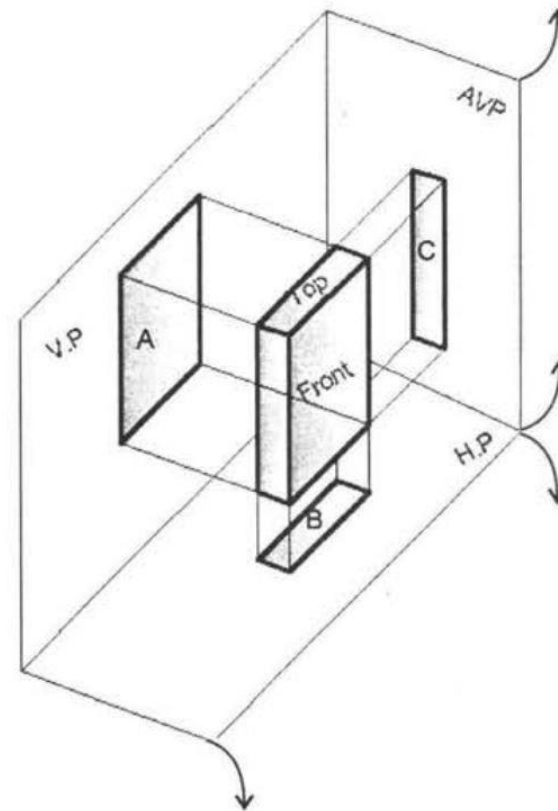
Four Quadrants

- When the planes of projections are extended beyond their line of intersection, they form **Four Quadrants.**

- These quadrants are numbered as I, II, III and IV in clockwise direction when rotated about reference line xy as shown in the figure.
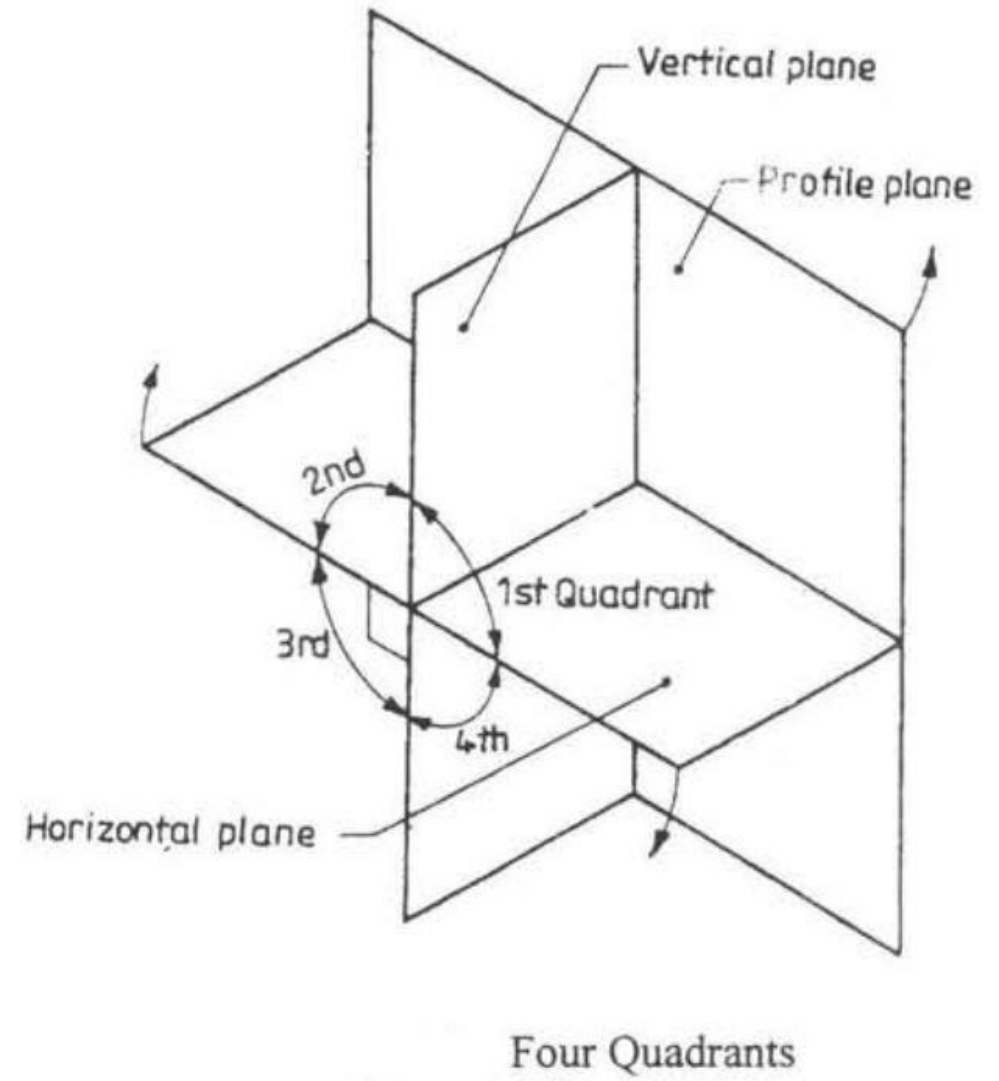
Four Quadrants

Four Quadrants

- In the Figure, the object is in the first quadrant and the projections obtained are "First angle projections".

i.e., the object lies in between the observer and the planes of projection. Front view shows the length(L) and height(H) of the object, and Top view shows the length(L) and the breadth(B) of it.

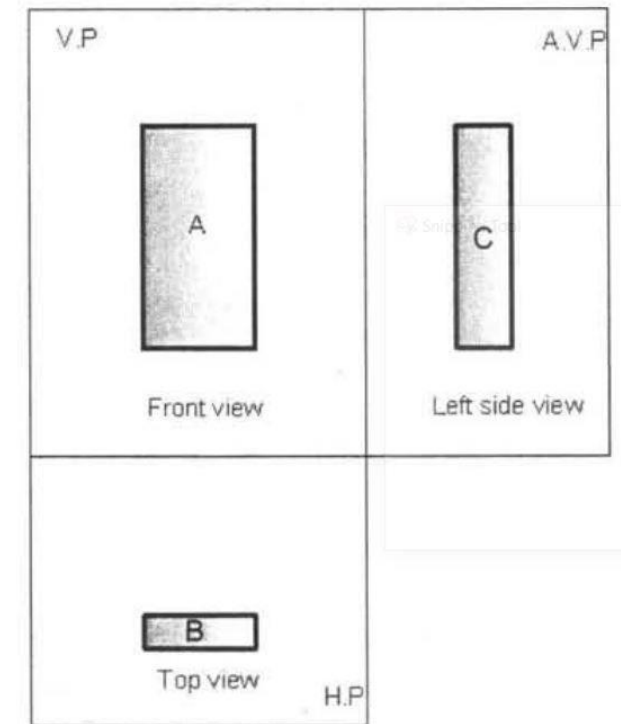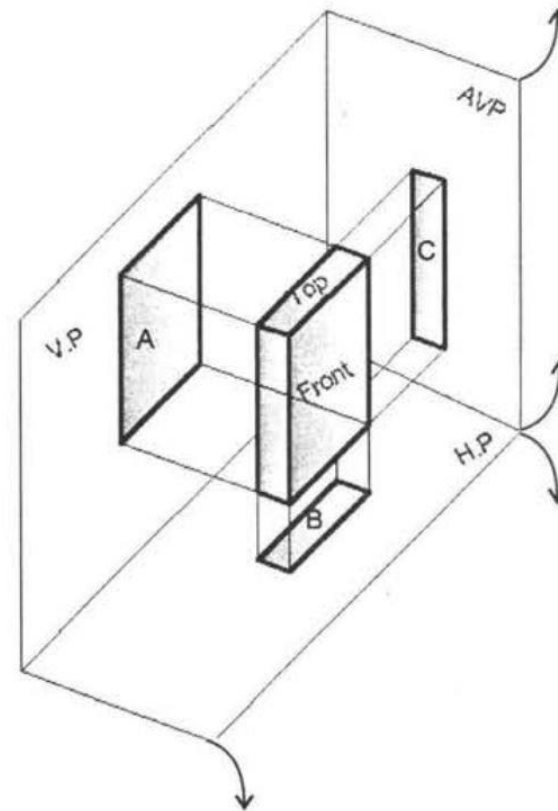Orthographic Projection of Front, Top and Side views

Four Quadrants

- The object may be situated in anyone of four quadrants, its position relative to the planes being described as in front of V.P and above H.P in the first quadrant and so on.
- Figure shows the two principle planes H.P and V.P and another Auxiliary Vertical Plane (AVP).
- AVP is perpendicular to both VP and H.P.
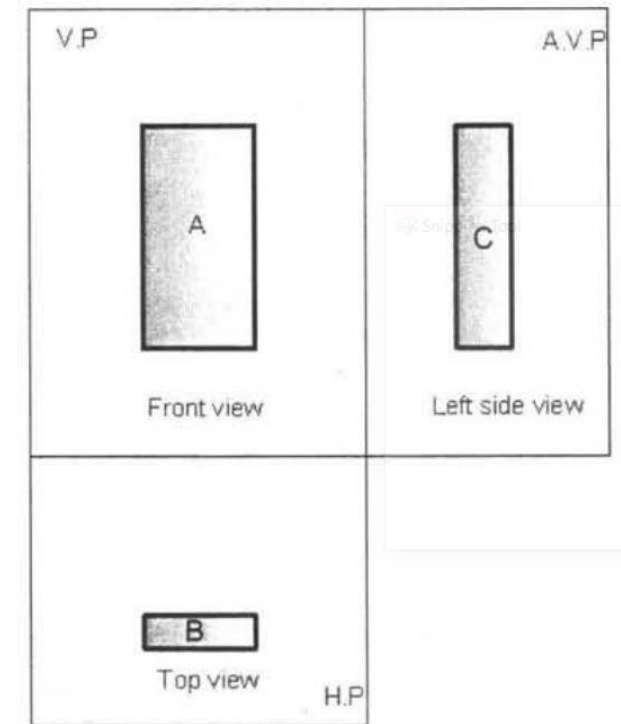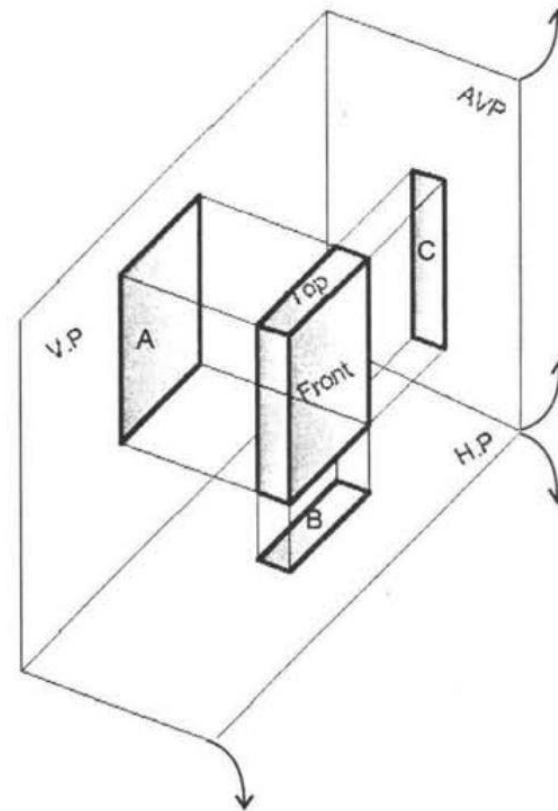
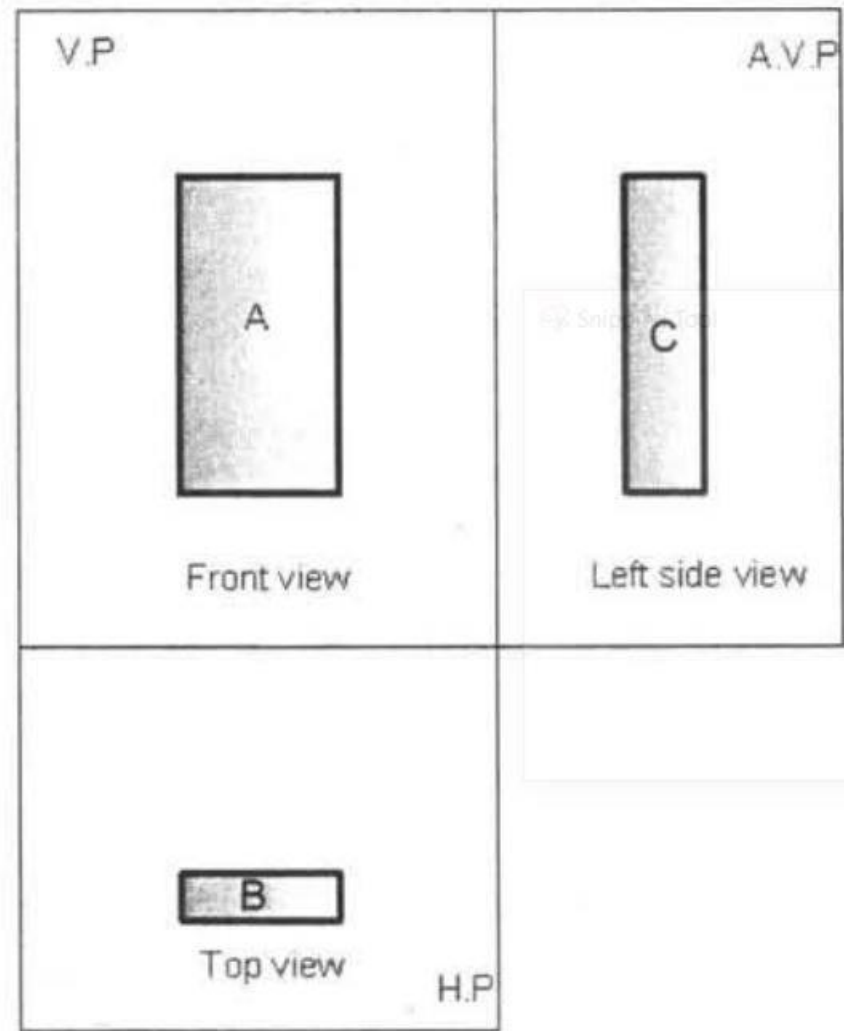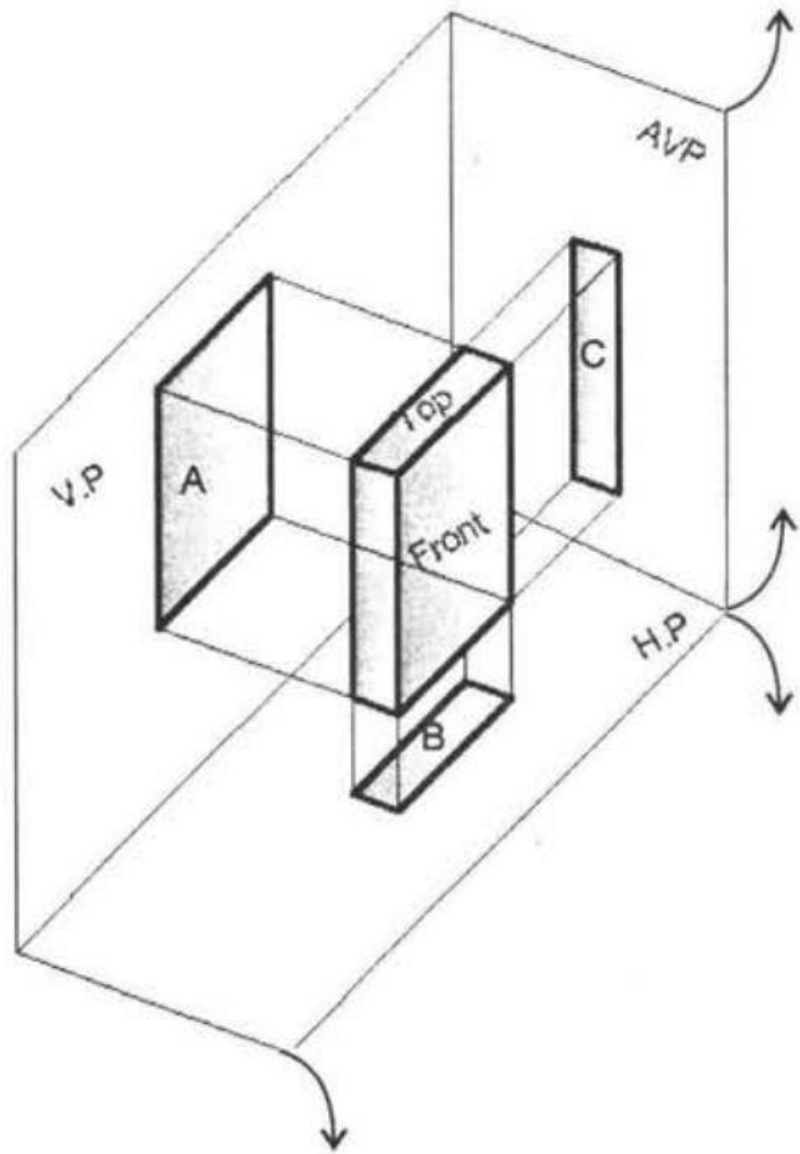Orthographic Projection of Front, Top and Side views

Four Quadrants

- Front view is drawn by projecting the object on the V.P.

- Top view is drawn by projecting the object on the H.P.

- The projection on the AVP as seen from the left of the object and drawn on the right of the front view, is called left side view.

Orthographic Projection of Front, Top and Side views
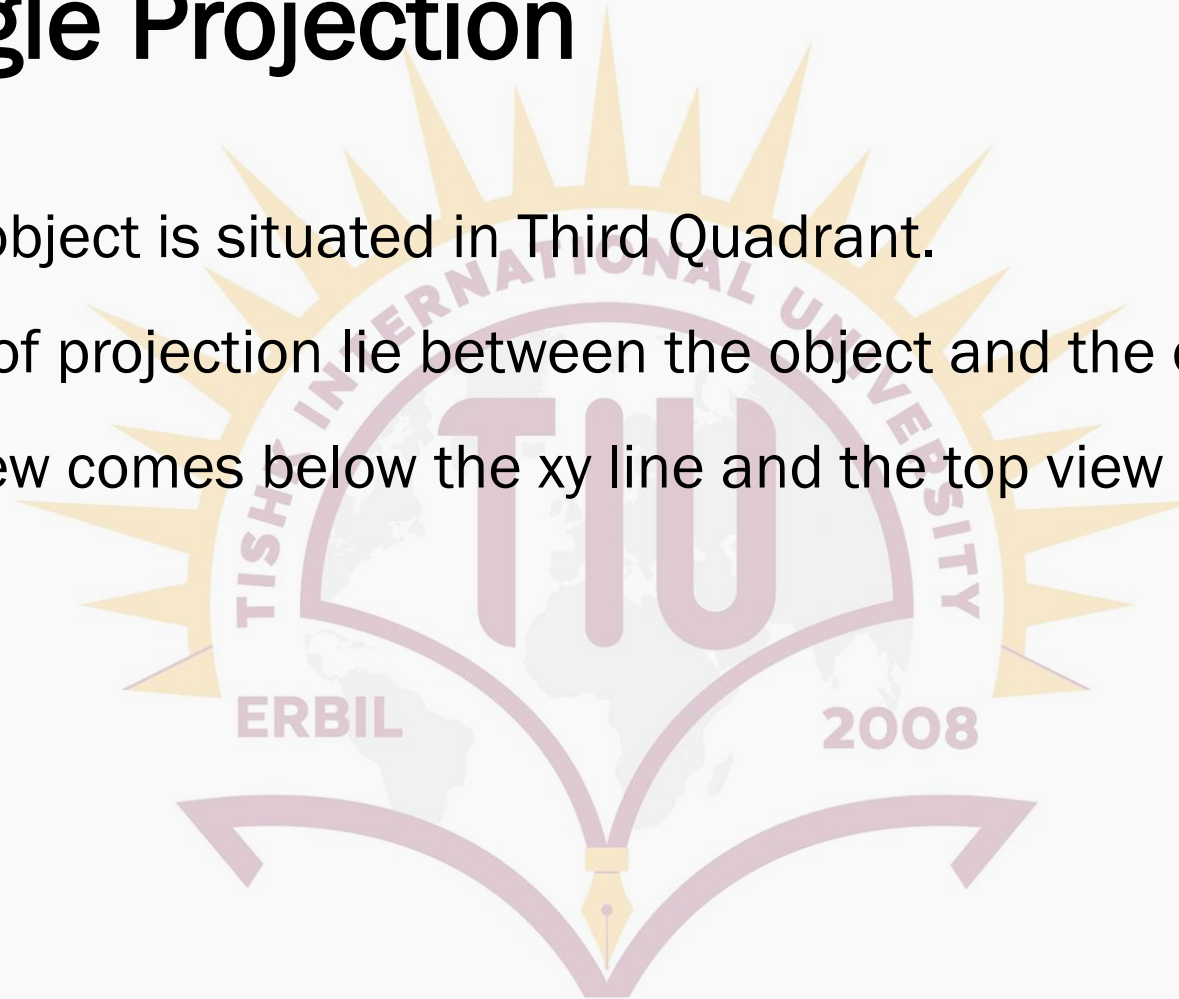
First Angle Projection

✓ When the object is situated in First Quadrant, that is, in front of V.P and above H.P, the projections obtained on these planes is called **First angle projection**.

(i)   The object lies in between the observer and the plane of projection.

(ii) The front view is drawn above the xy line and the top view below xy. (above xy line is V.P and below xy line is H.P).

(iii) In the front view, H.P coincides with xy line and in top view V.P coincides with xy line.

(iv) Front view shows the length(L) and height(H) of the object and Top view shows the length(L) and breadth(B) or width(W) or thickness(T) of it.

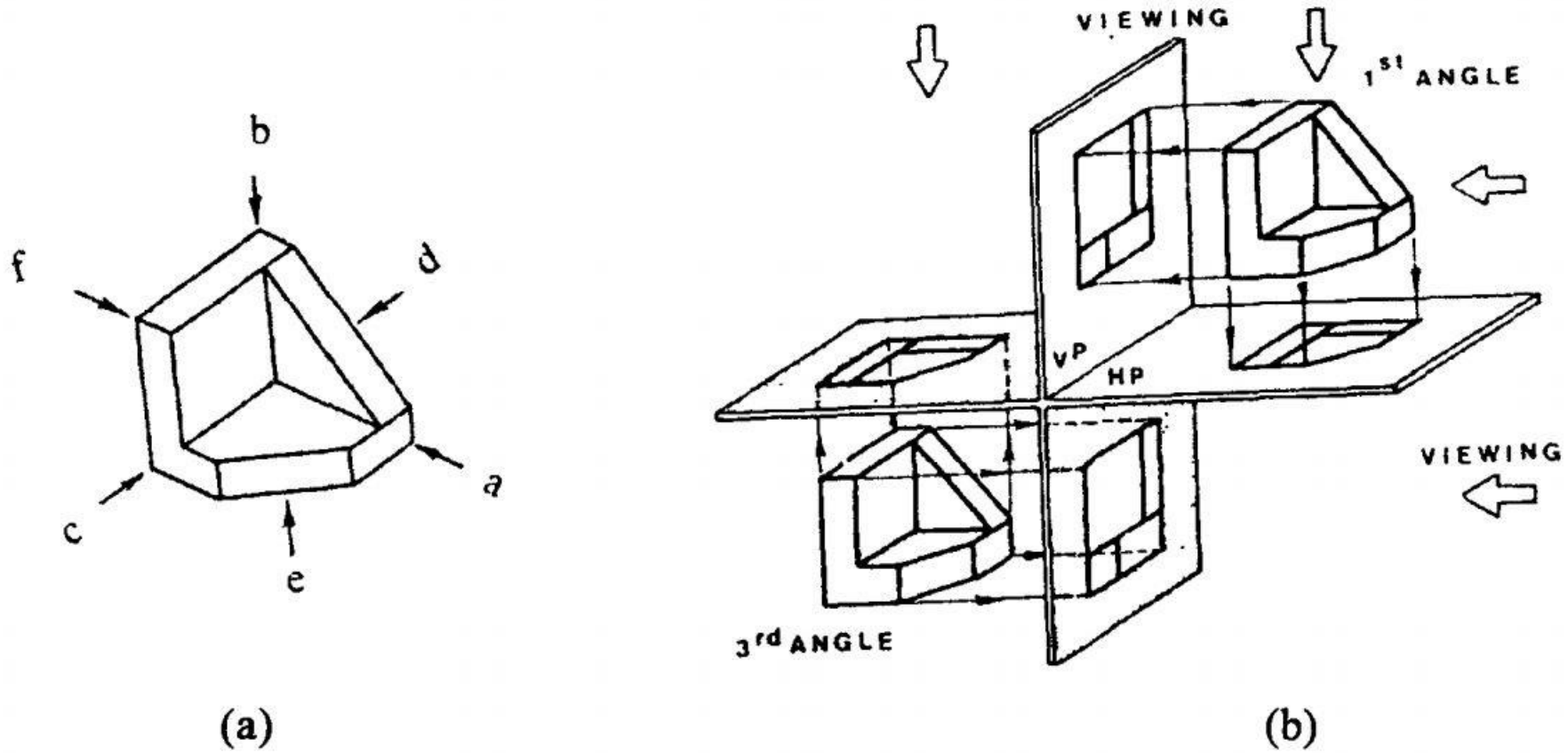Orthographic Projection of Front, Top and Side views

Third Angle Projection

✓ In this, the object is situated in Third Quadrant.

✓ The Planes of projection lie between the object and the observer.

✓ The front view comes below the xy line and the top view about it.

Third Angle Projection

(a)

(b)

Principles of orthographic projection.

Designation and Relative Position of Views

- An object in space may be imagined as surrounded by six mutually perpendicular planes.
- So, it is possible to obtain six different views by viewing the object along the six directions, normal to the six planes.
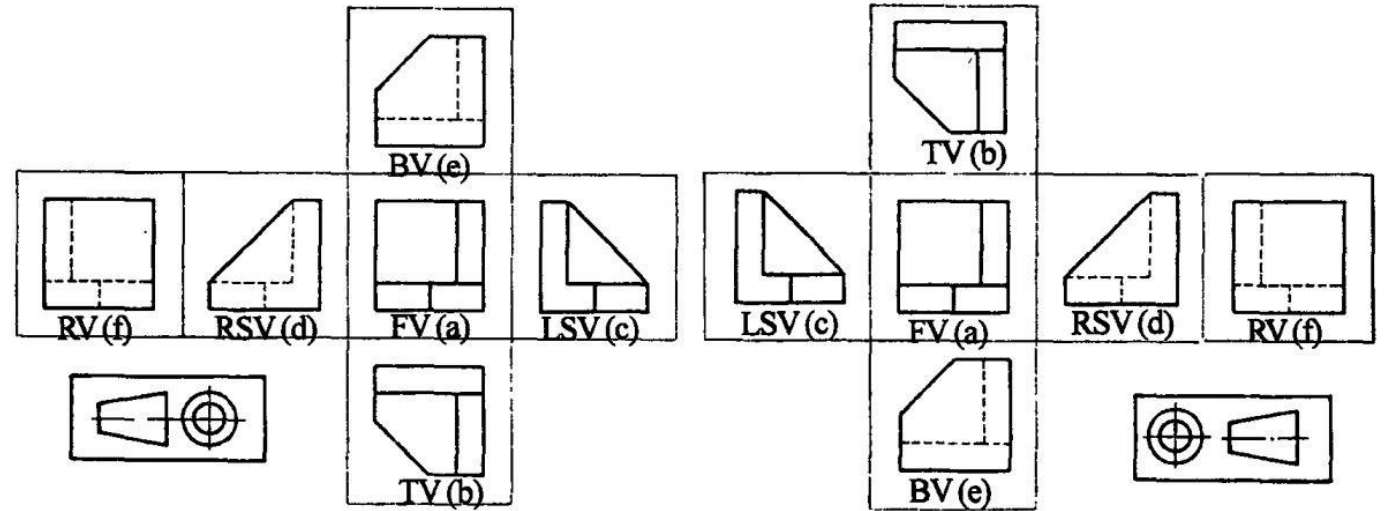
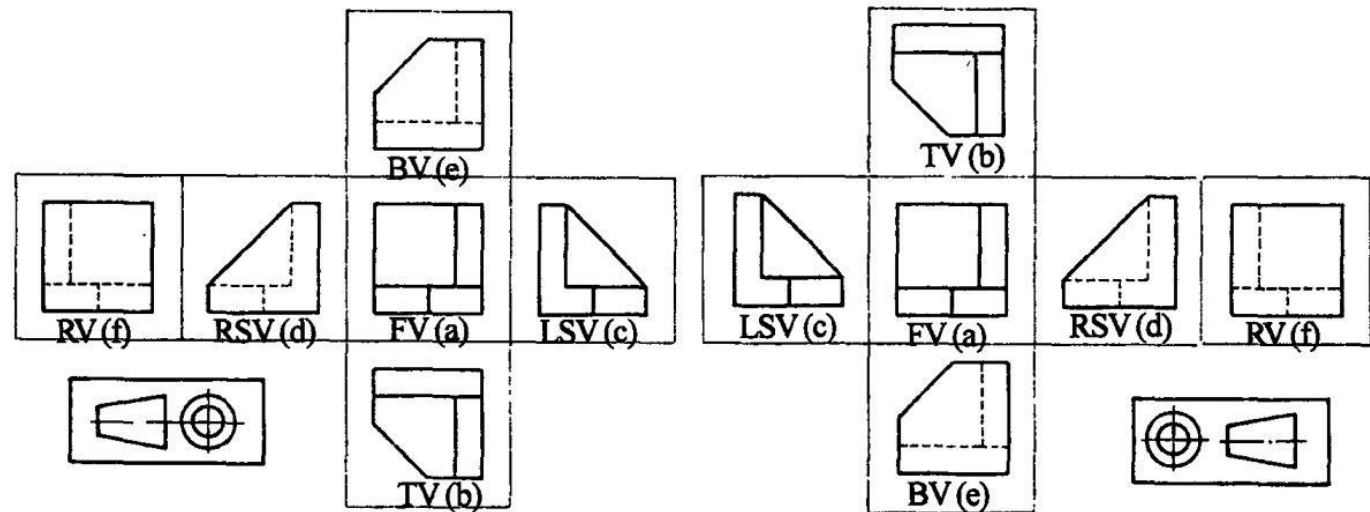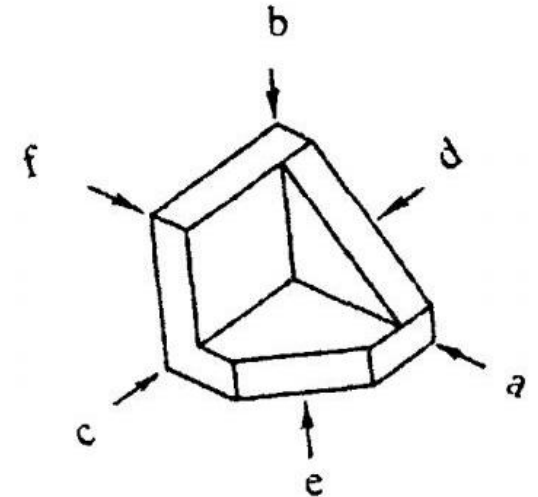

a - First Angle projection

b - Third Angle projection

Relative Positions of Views

Designation and Relative Position of Views

✓ Figure shows an object with the six possible directions to obtain the six different views which are designated as follows.

1. View in the direction a = front view

2. View in the direction b = top view

3. View in the direction c = left side view

4. View in the direction d = right side view

5. View in the direction e = bottom view
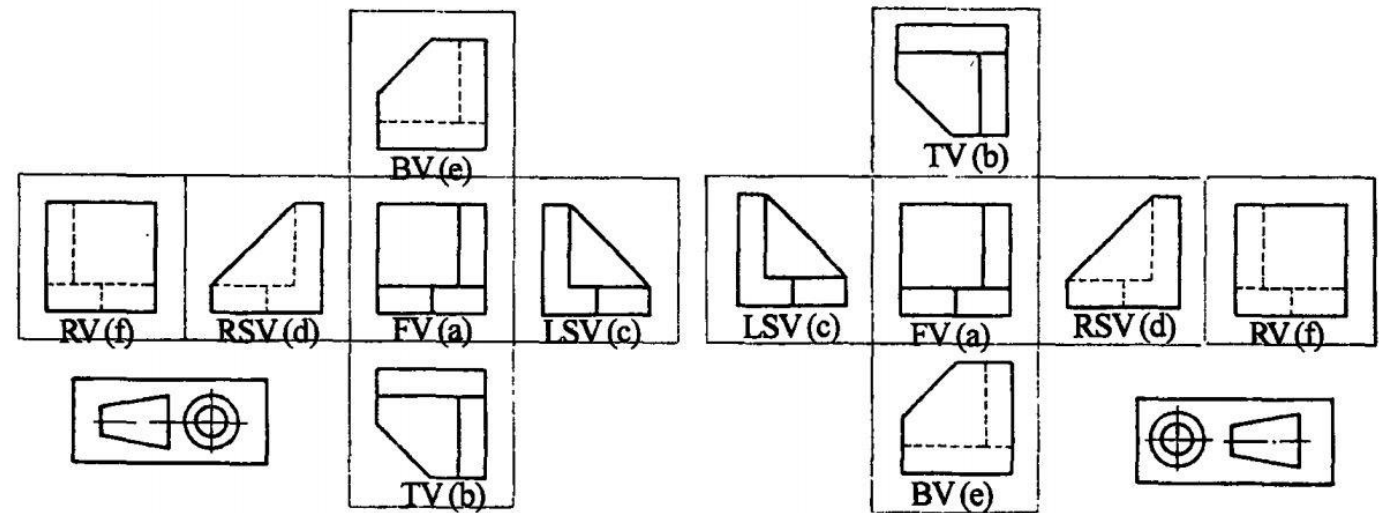
6. View in the direction f = rear view

a - First Angle projection

b - Third Angle projection

Relative Positions of Views

Designation and Relative Position of Views

✓ **Note:** A study of the Figure reveals that in both the methods of projection, the views are identical in shape and size but their location with respect to the front view only is different.

a - First Angle projection   b - Third Angle projection
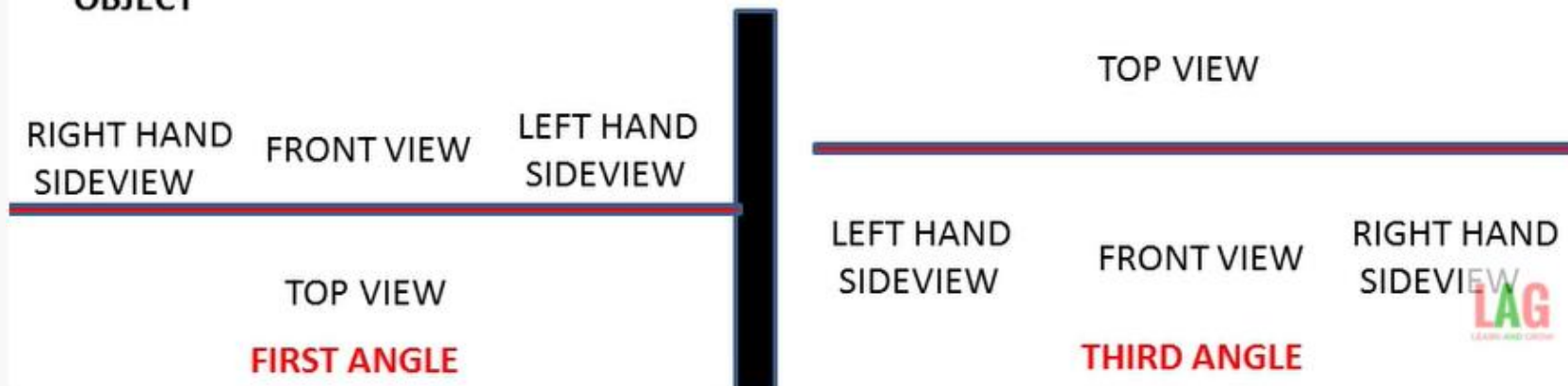
Relative Positions of Views

First Angle Vs. Third Angle Projection

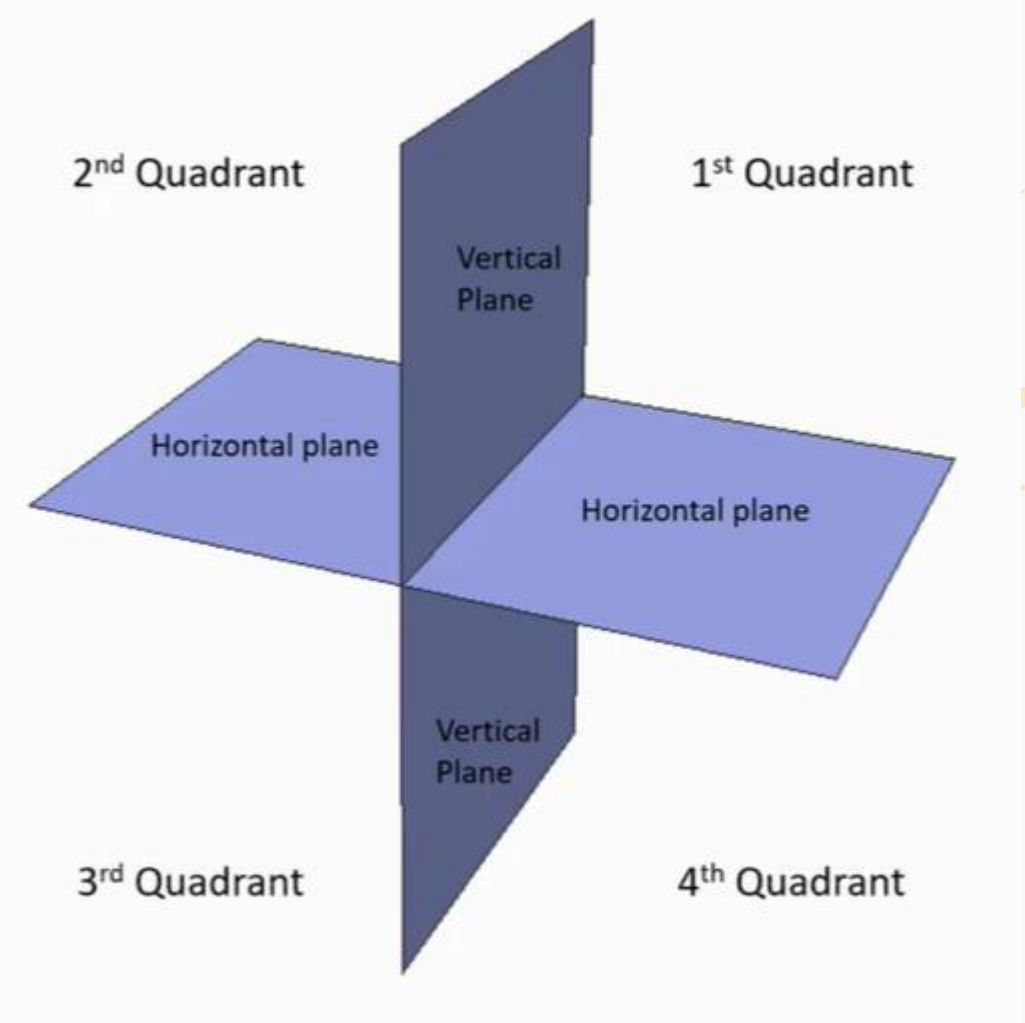FIRST ANGLE PROJECTION, WILL BE IN 1ST QUARDANT

THIRD ANGLE PROJECTION, WILL BE IN 3RD QUARDANT

IN FIRST ANGLE PROJECTION, OBJECT WILL BE IN BETEWEEN OBSERVER AND PROJECTION PLANE

IN THIRD ANGLE PROJECTION, PROJECTION PLANE WILL BE IN BETWEEN OBSERVER AND OBJECT

|					
			TOP VIEW		
RIGHT HAND SIDEVIEW	FRONT VIEW	LEFT HAND SIDEVIEW			
	TOP VIEW		LEFT HAND SIDEVIEW	FRONT VIEW	RIGHT HAND SIDEVIEW
FIRST ANGLE				**THIRD ANGLE**	

LAG

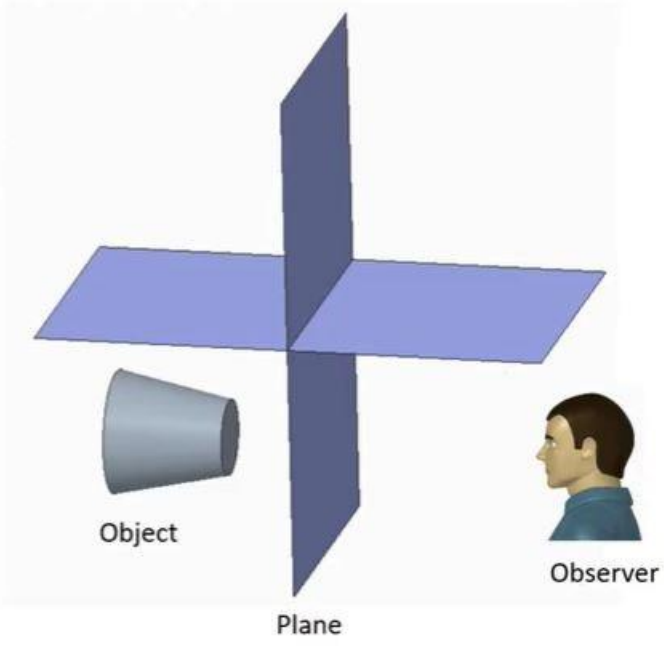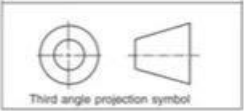# First Angle Vs. Third Angle Projection

First Angle Vs. Third Angle Projection

First angle projection
- ✓ Widely use in India and European country
- ✓ Plane-object-observer

First angle projection symbol

Plane
Object
Observer
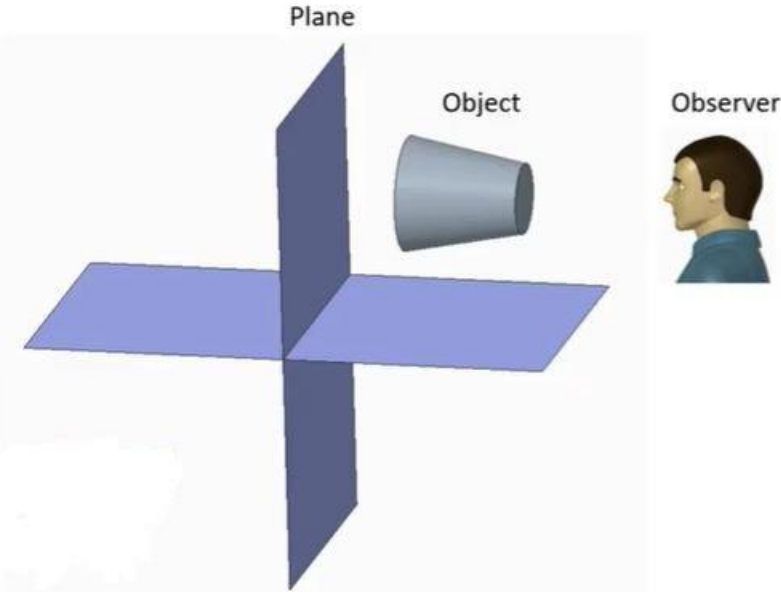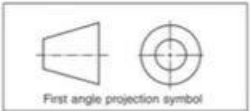
Third angle projection
- ✓ Widely use in US and Australia
- ✓ object-plane-observer

Third angle projection symbol

Object
Observer
Plane

First Angle Vs. Third Angle Projection