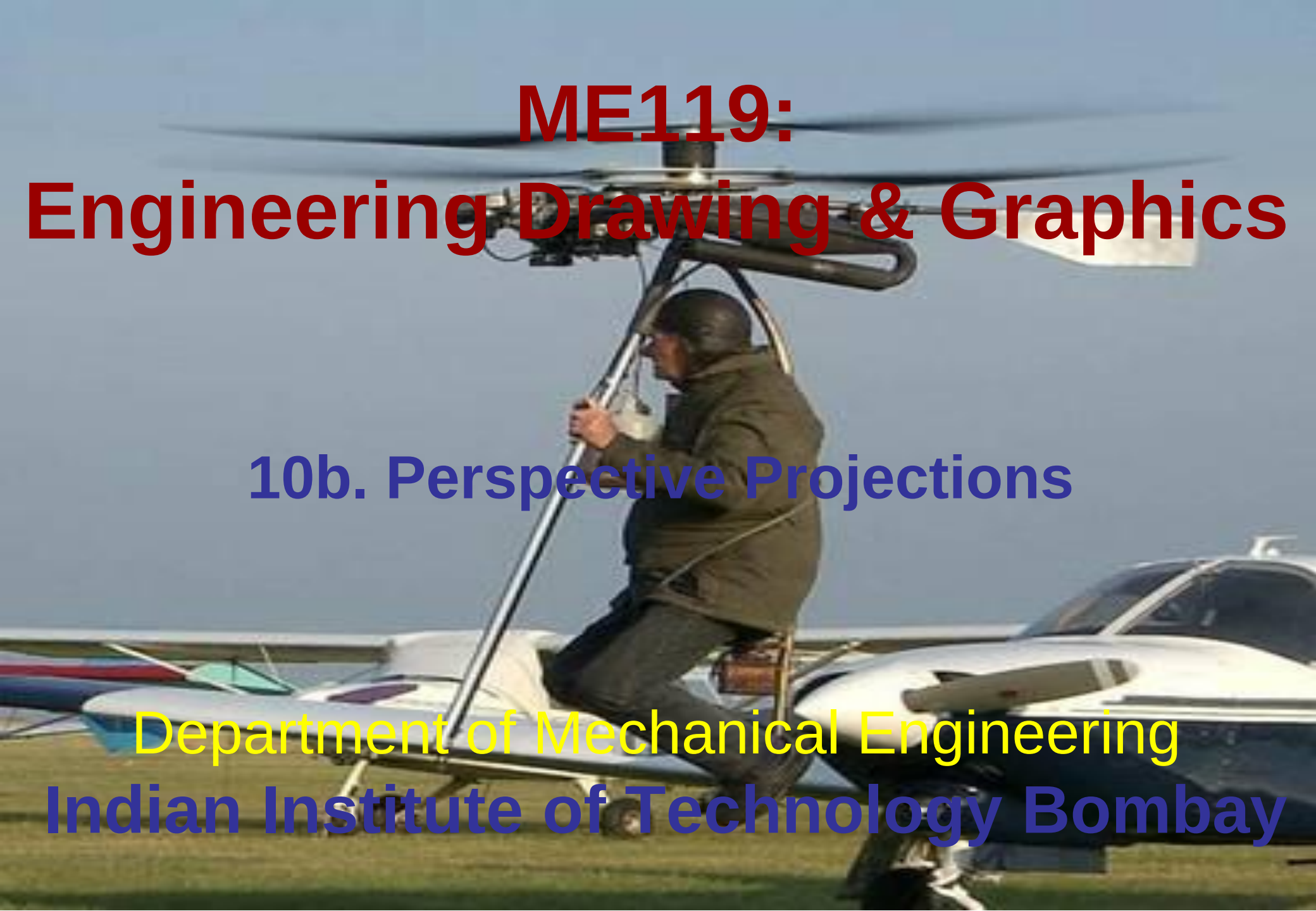


ME119:
Engineering Drawing & Graphics

10b. Perspective Projections

Department of Mechanical Engineering
Indian Institute of Technology Bombay

Outline

- Perspective Projections
- Conclusions

Perspective Projections

Projections

- The media available for storing design is only surface.
- This surface is not necessarily plane always although we shall deal with planes (paper).
- The task here is to render 3D objects (3 parameters) onto this surface (2 parameters).
- Furthermore, we are constrained to use only points and curves and not shades (gray levels) and colors. In other words, the views we use are only silhouettes (which simply the borders of the object) and distinct edges.
- Due to these limitations, we may need more than one view to render an object completely.

Projections

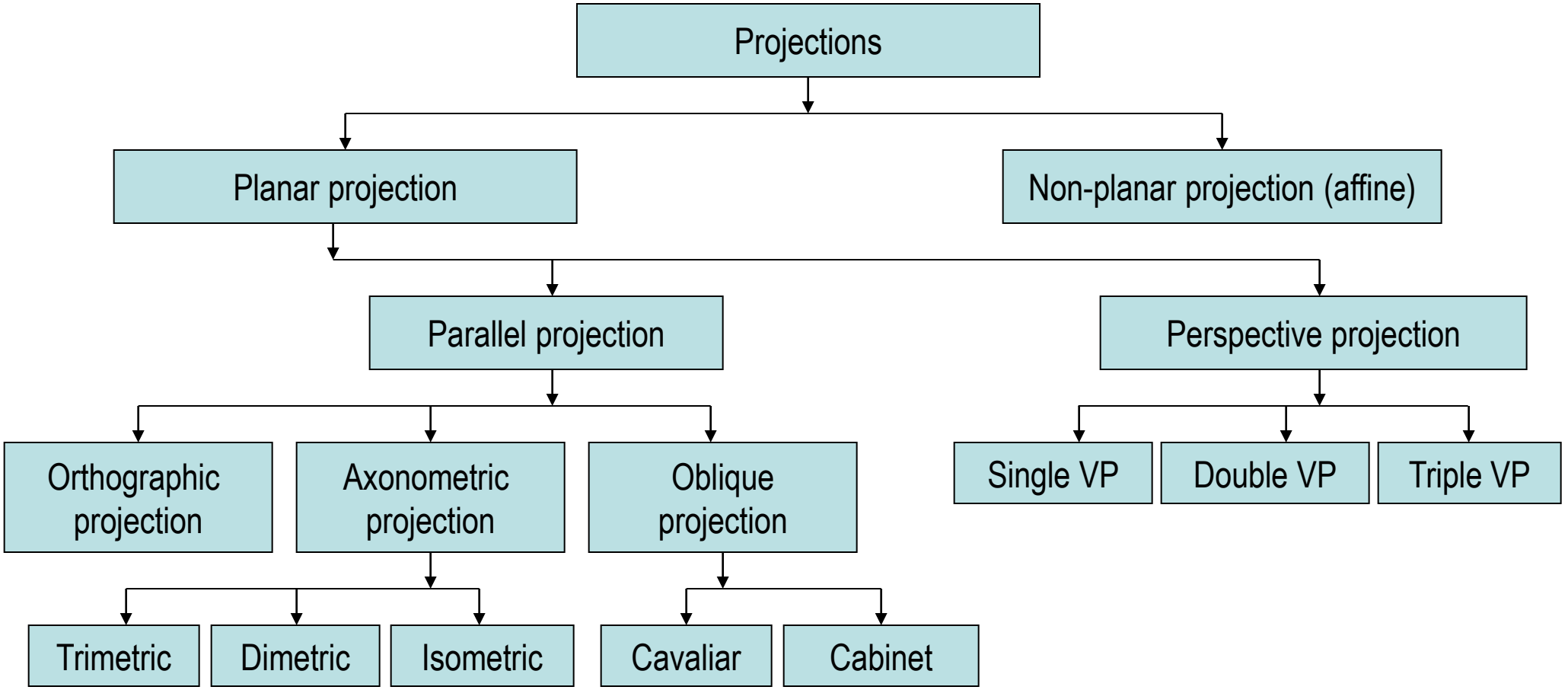
We deal with the following:

- Observer
- 3D object(s)
- Rays emanating from them called projection lines or projectors. The rays may emanate from a point (such as a bulb) and hence are divergent or may come from an infinite source and hence are parallel rays.
- The surface on which the view is captured called projection surface, in our case, it is a projection plane.
- View(s).

The type of view depends on the characteristics of the projectors, projection surface and their relative orientation.

Projections

Types



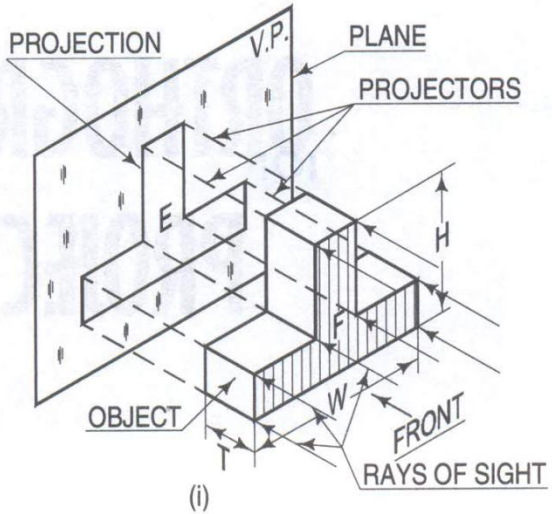
Projections

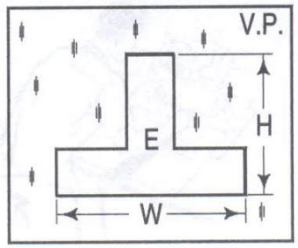
Types

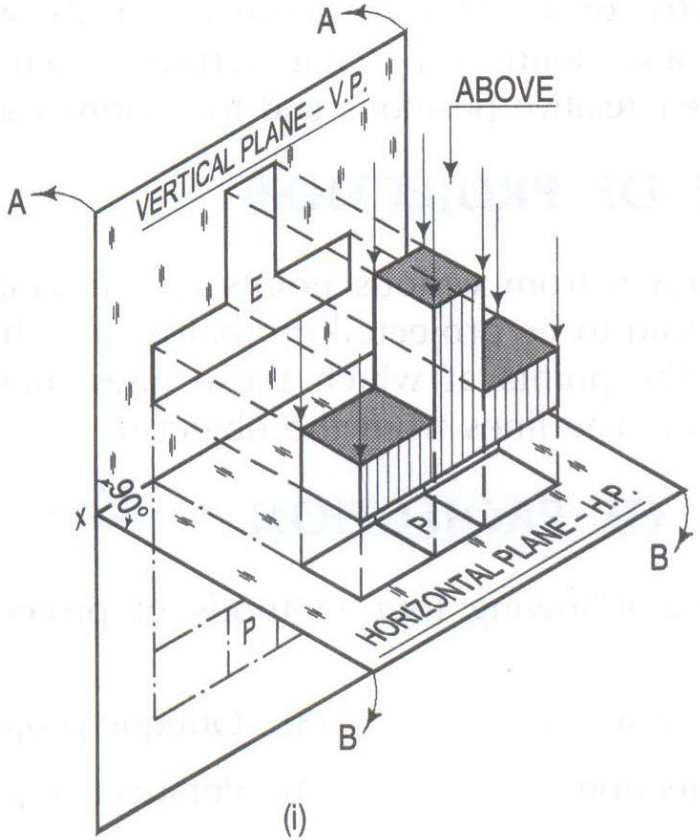
Orthographic projections	Parallel projectors; projection on plane; both orthogonal. Hypothetical! Multiple views (At least 2) on mutually perpendicular planes.
Auxiliary projections	Parallel projectors; projection on plane; both orthogonal. Hypothetical! This too is orthographic. Views on any other plane in which the additional details are visible.
Sectional views	Parallel projectors; projection on plane; both orthogonal. Hypothetical! Cut-views to depict the interior features. This is mostly orthographic. However, the pictorial views also can use sectional views.
Isometric/ Dimetric/ Trimetric projections	Parallel projectors; projection on plane; both orthogonal. Hypothetical! Pictorial; so, single view in general. Isometric view is also an orthographic view after rotating the object appropriately in two directions!
Oblique projections	Parallel projectors; projection on plane; both not orthogonal. Hypothetical! Pictorial; so, single view in general.
Perspective projections	Non-parallel projectors; projection on plane; both orthogonal. Real (3VP alone). Pictorial; so, single view in general.
Affine projections	Projection on non-planar surface. Real.

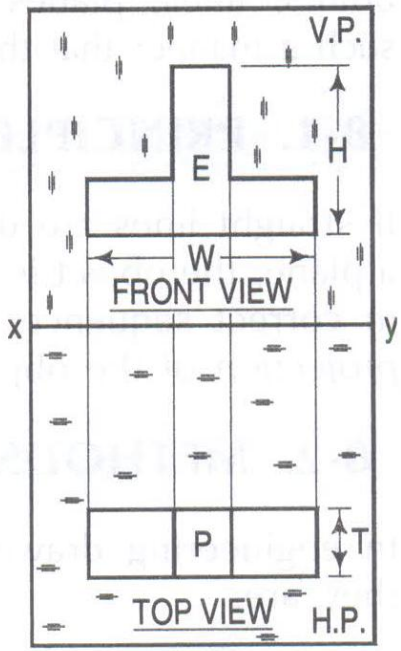
Orthographic Projections

Parallel projectors; projection on plane; both orthogonal. Hypothetical!







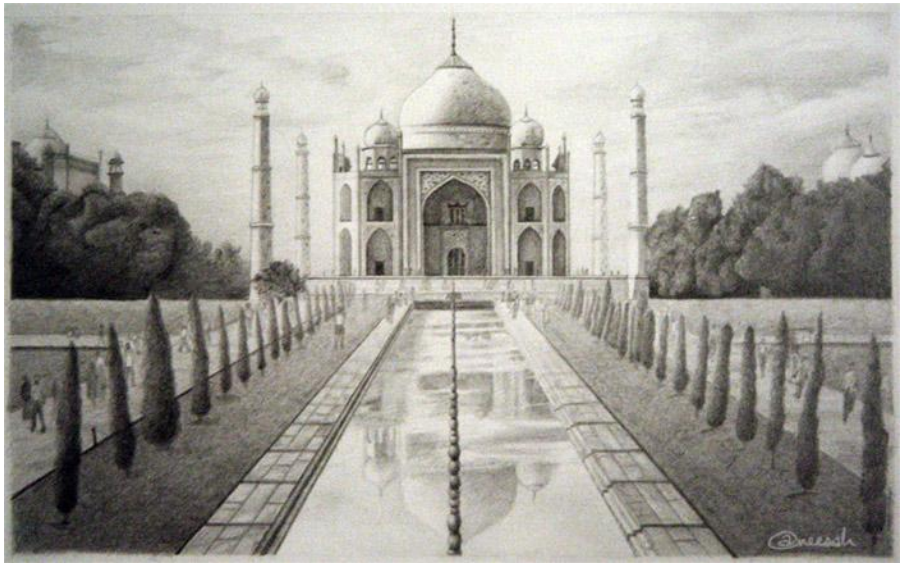


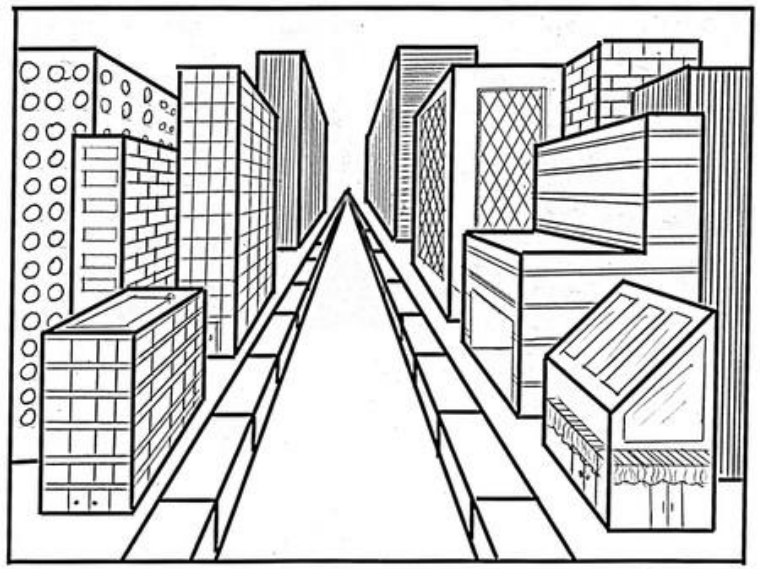
Single view does not capture all features. So, multiple views on mutually perpendicular planes are used. Even the simplest object of symmetry, viz., sphere, requires 2 views.

Perspective Projections

- The rays are not parallel.
- Perspective view becomes relevant when dealing with large objects or close up views where the assumption of “parallel rays” or “rays emanating from an infinite light source from infinity” becomes completely unacceptable. Eg.: architectures, ships, close up views of automobiles, planes etc.
- In perspective projection, the eye is of finite or semi-finite size, the distance between the eye and the object is finite and a vertical transparent picture plane is between them.

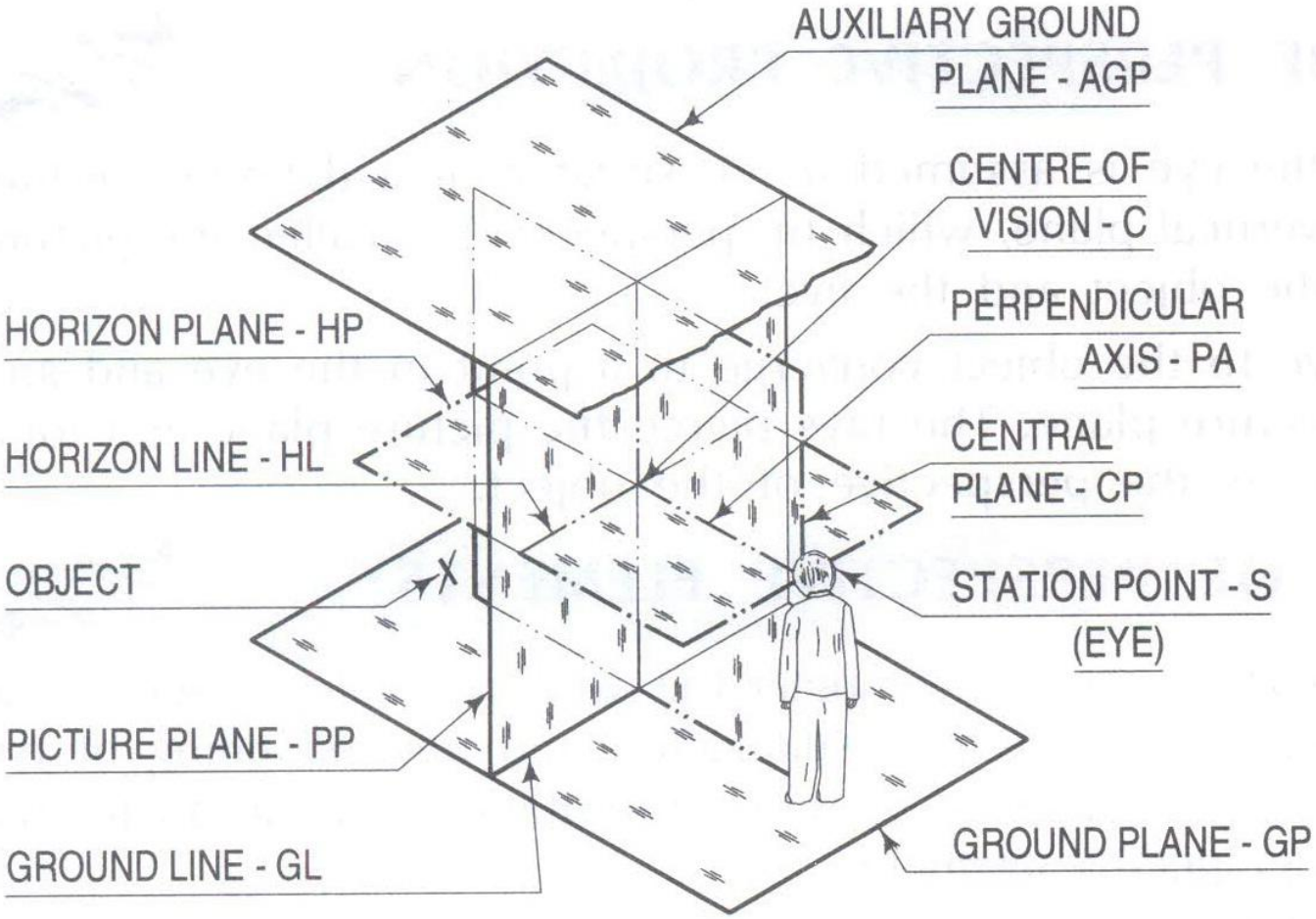
Perspective Projections

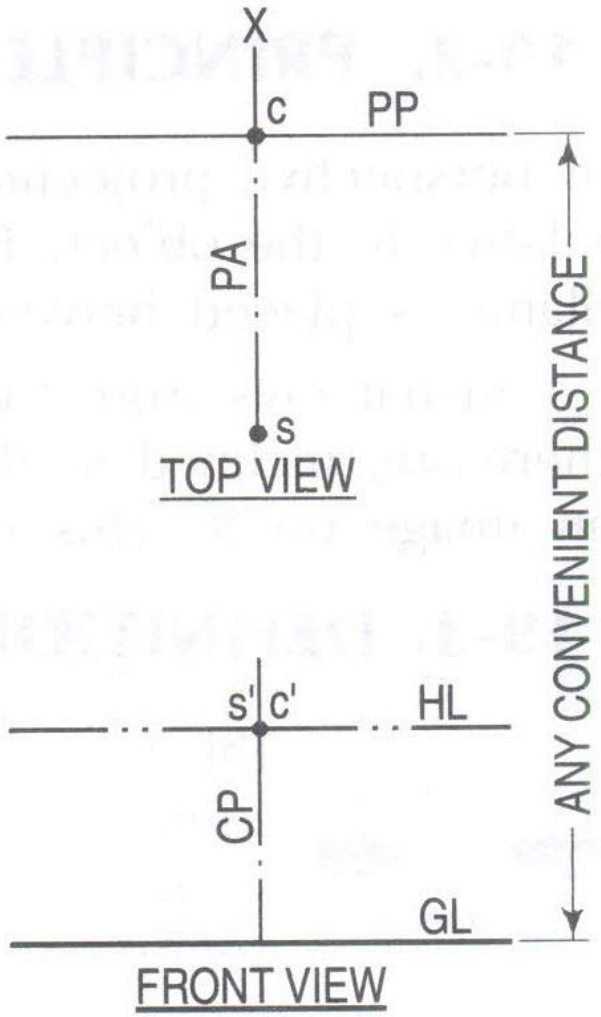




Perspective Projections

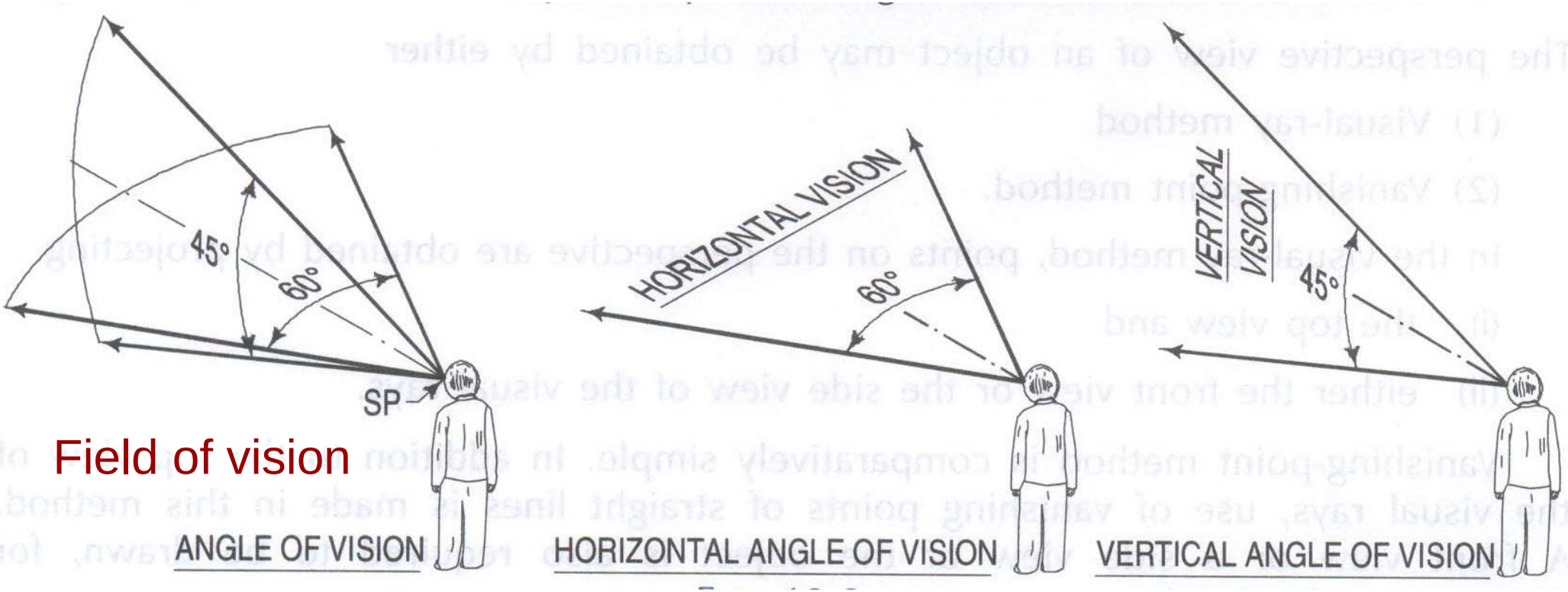
Definition of terms





Perspective Projections

Field of view

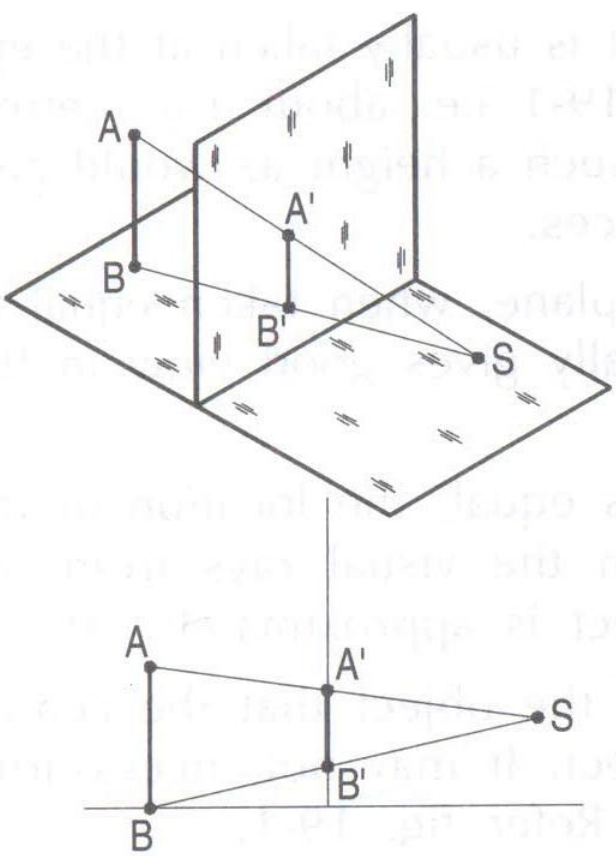


Field of vision

Note: The values of 45° and 60° are quite arbitrary.

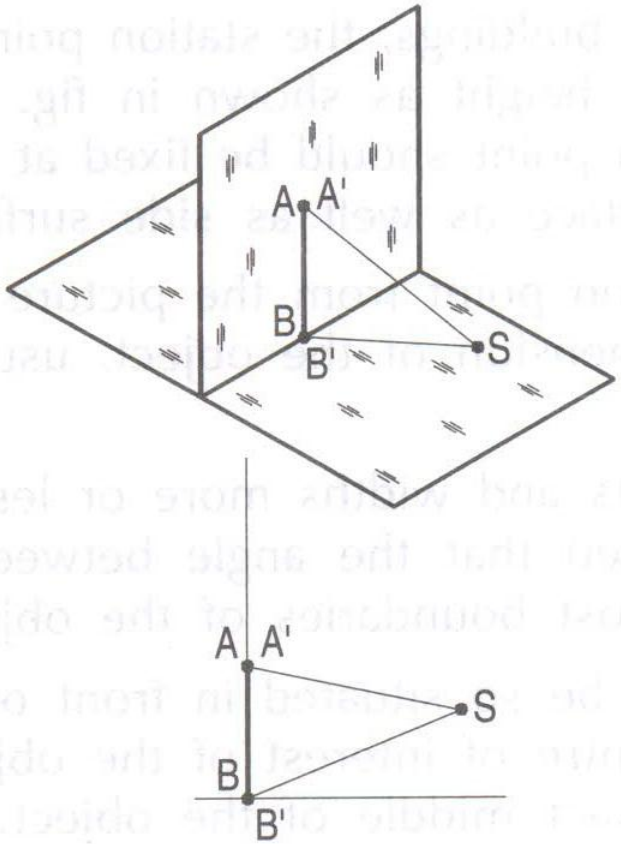
Perspective Projections

Size of object in perspective view



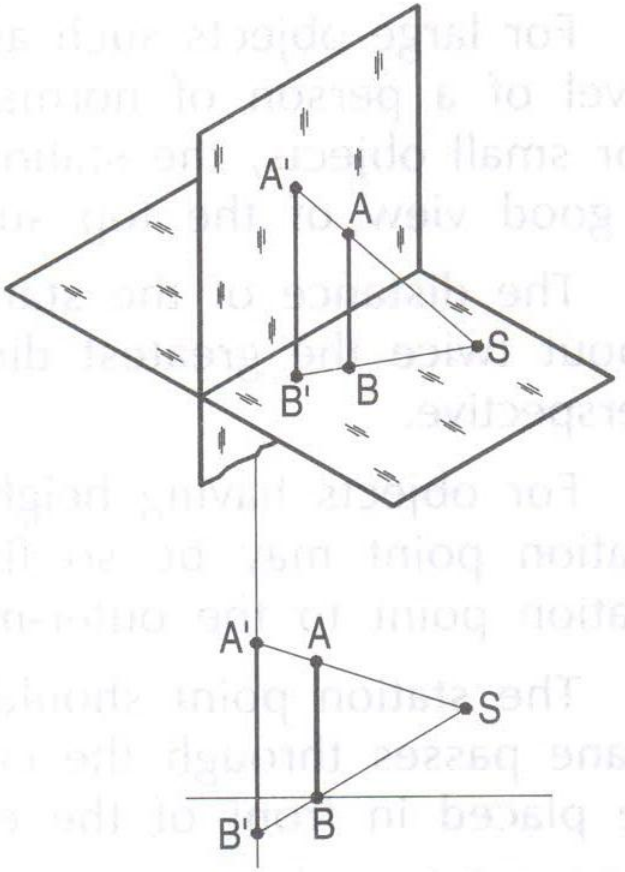
(i)

When the object is behind PP:
It looks smaller



(ii)

When the object is on PP:
It is of same size



(iii)

When the object is in front of PP:
It looks larger

Farther the object, smaller it looks!

Perspective Projections

Two methods

1. Visual ray method
2. Vanishing point method

Visual Ray Method

Perspective Projections
Example-1 (Solved Pb. 19-1, pp. 481)

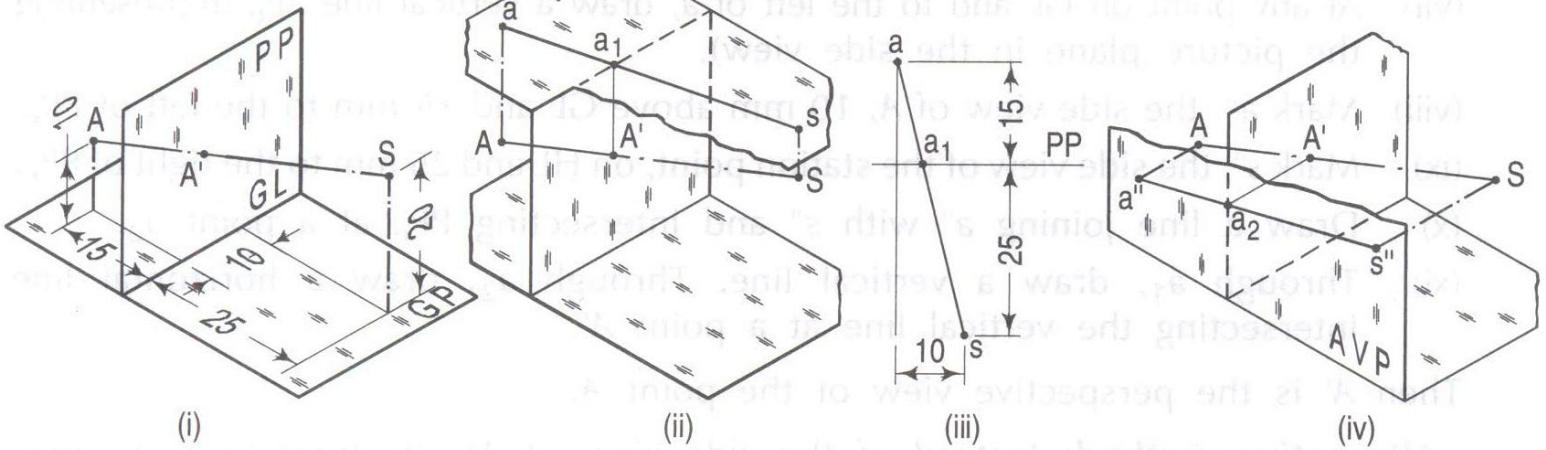
A point A is situated 15 mm behind the picture plane and 10 mm above the ground plane. The station point S is 25 mm in front of the picture plane, 20 mm above the ground plane and lies in a central plane 10 mm to the right of the point. Draw the perspective of the point A.

You will be given the object definition and the location of the observer. PP is VP.

Since VP is same as PP (Picture Plane), we are interested in the perspective view of the front view type although the same can be seen in top view also.

Perspective Projections

Example-1 (Solved Pb. 19-1, pp. 481)



(i) (ii) (iii) (iv)

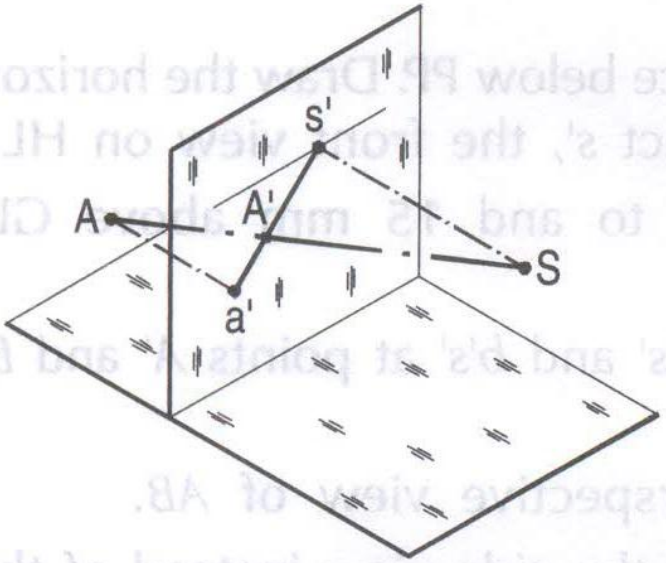
(v) (vi) (vii)

Visual ray method: Using top and side views.

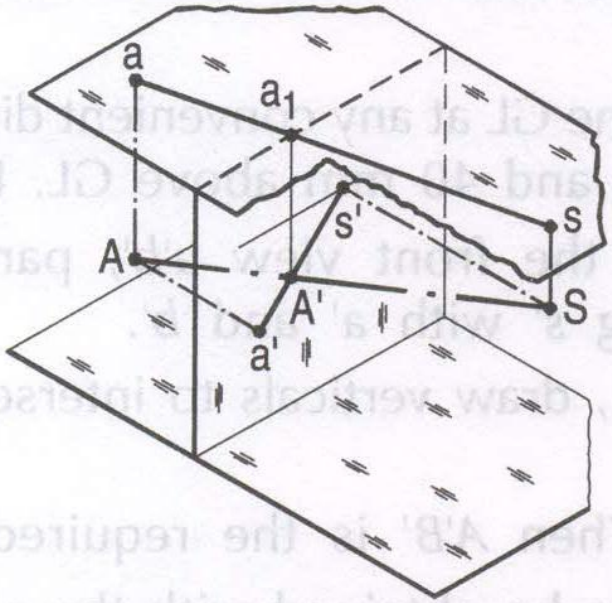
Third angle is used here.

Perspective Projections

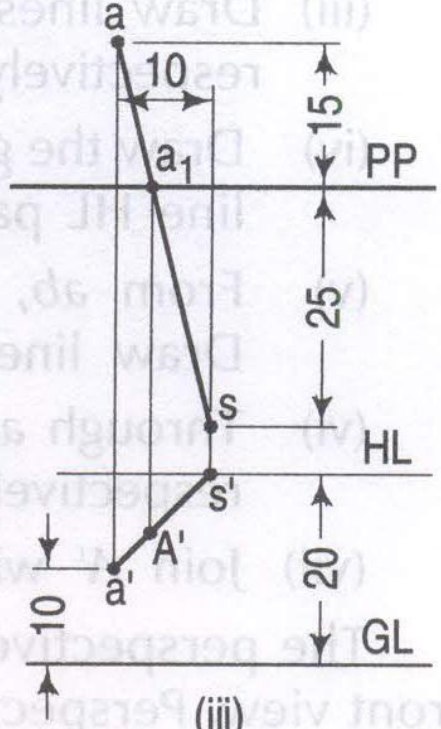
Example-1 (Solved Pb. 19-1, pp. 481)



(i)



(ii)



(iii)

Visual ray method: Using top and front views.

Third angle is used here.

Perspective Projections

Example-2 (Solved Pb. 19-2, pp. 483)

A straight line AB, 40 mm long, is parallel to and 15 mm above the ground plane, and inclined at 30° to the picture plane. The end A is 20 mm behind the picture plane. The station point is 40 mm above the ground plane, 50 mm in front of the picture plane and lies in a central plane which passes through the midpoint of AB. Draw its perspective view.

You will be given the object definition and the location of the observer. PP is VP.

Since VP is same as PP (Picture Plane), we are interested in the perspective view of the front view type although the same can be seen in top view also.

Perspective Projections

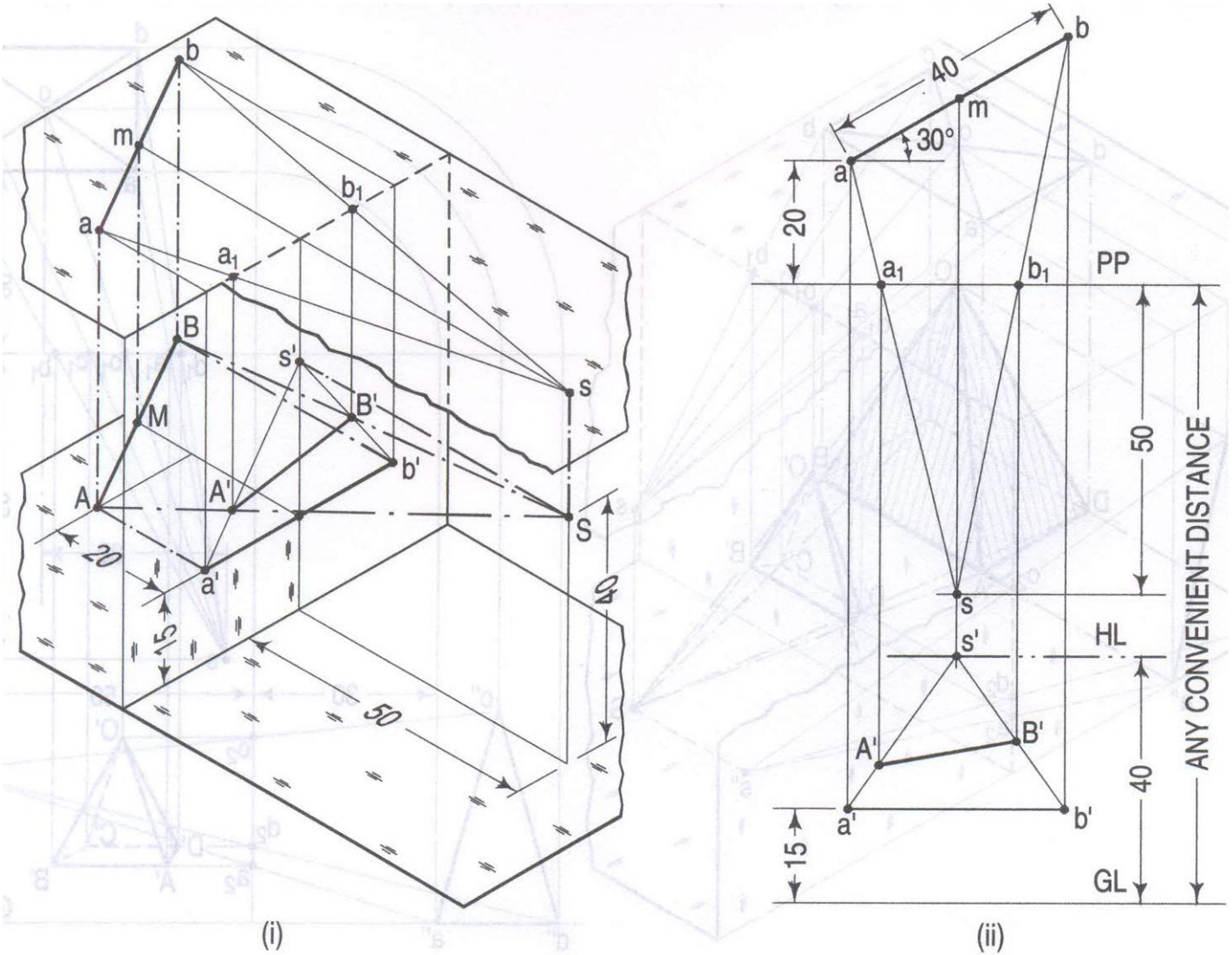
Example-2 (Solved Pb. 19-2, pp. 483)

Visual ray method:
Using top and front views.

First angle is used here for the same problem.

Perspective Projections

Example-2 (Solved Pb. 19-2, pp. 483)



Visual ray method: Using top and front views.

Third angle is used here.

Perspective Projections

Example-3 (Solved Pb. 19-3, pp. 484)

A rectangular pyramid, base 30mm x 20mm and axis 35 mm long, is placed on the ground plane on its base, with the longer edge of the base parallel to and 30 mm behind the picture plane. The central plane is 30 mm to the left of the apex and the station point is 50 mm in front of the picture plane and 25 mm above the ground plane. Draw the perspective view of the pyramid.

Perspective Projections

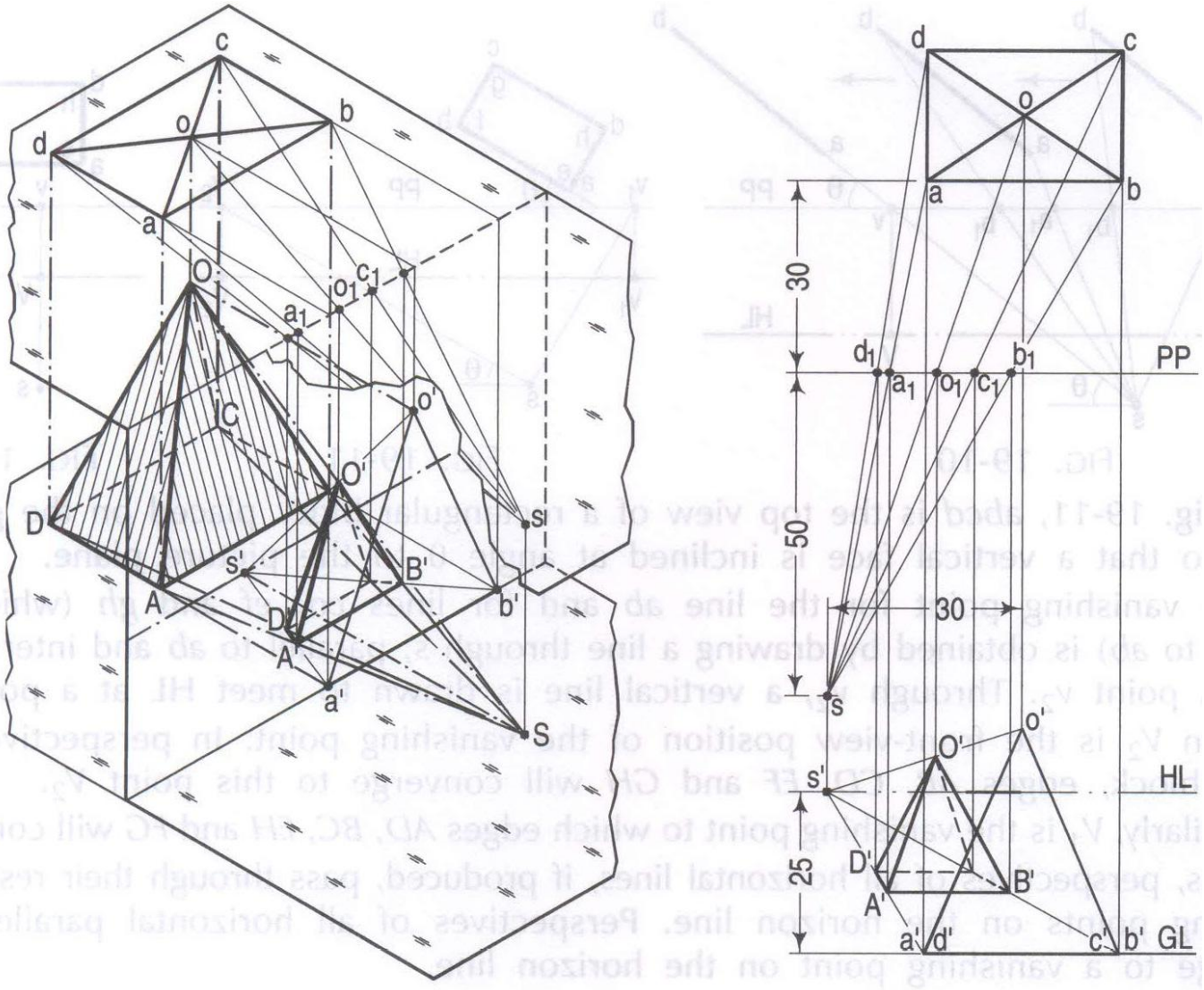
Example-3 (Solved Pb. 19-3, pp. 484)

Visual ray method: Using top and front views.

First angle is used here.

Perspective Projections

Example-3 (Solved Pb. 19-3, pp. 484)

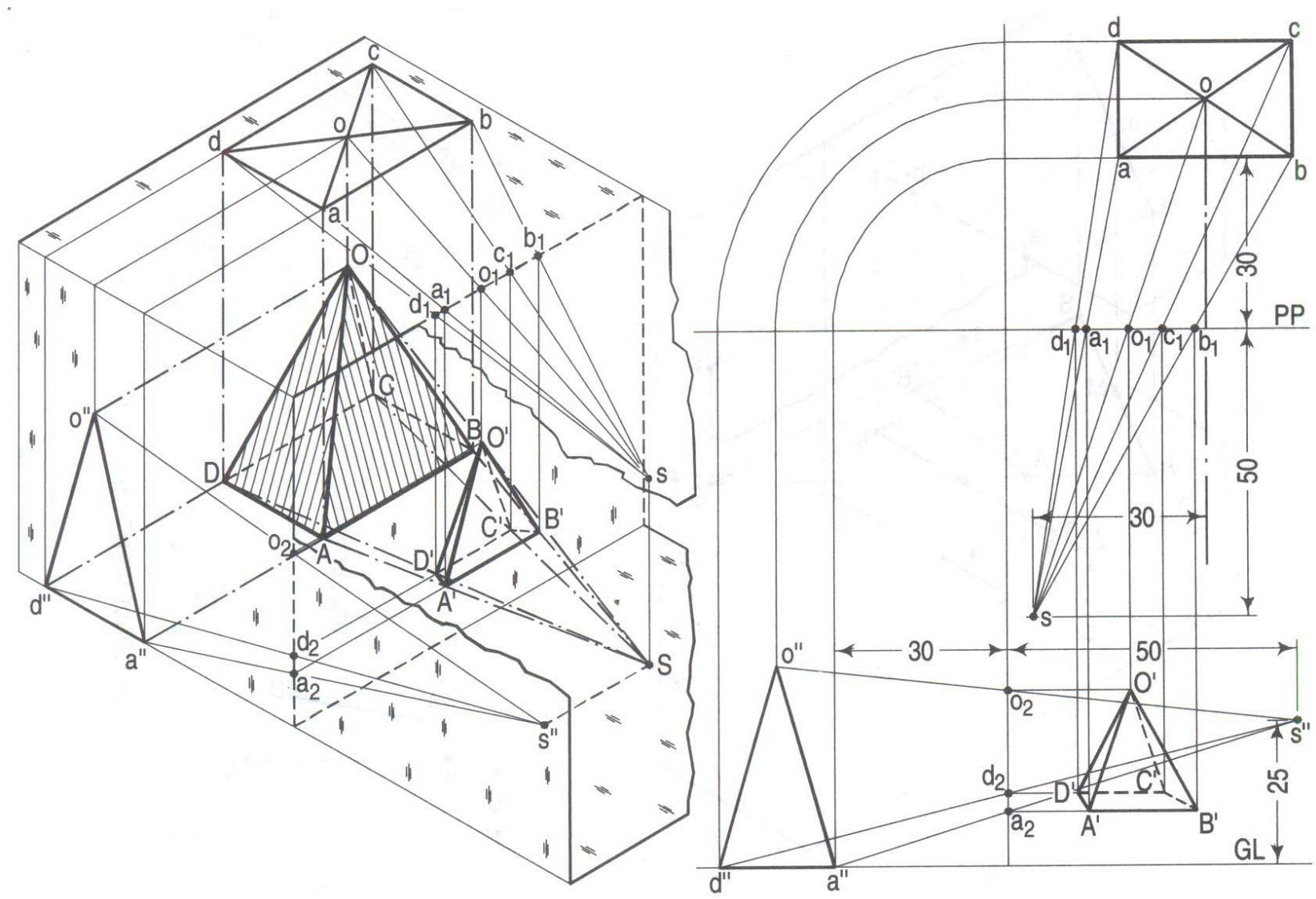


Visual ray method: Using top and front views.

Third angle is used here.

Perspective Projections

Example-3 (Solved Pb. 19-3, pp. 484)



Visual ray method: Using top and side views.

Third angle is used here.

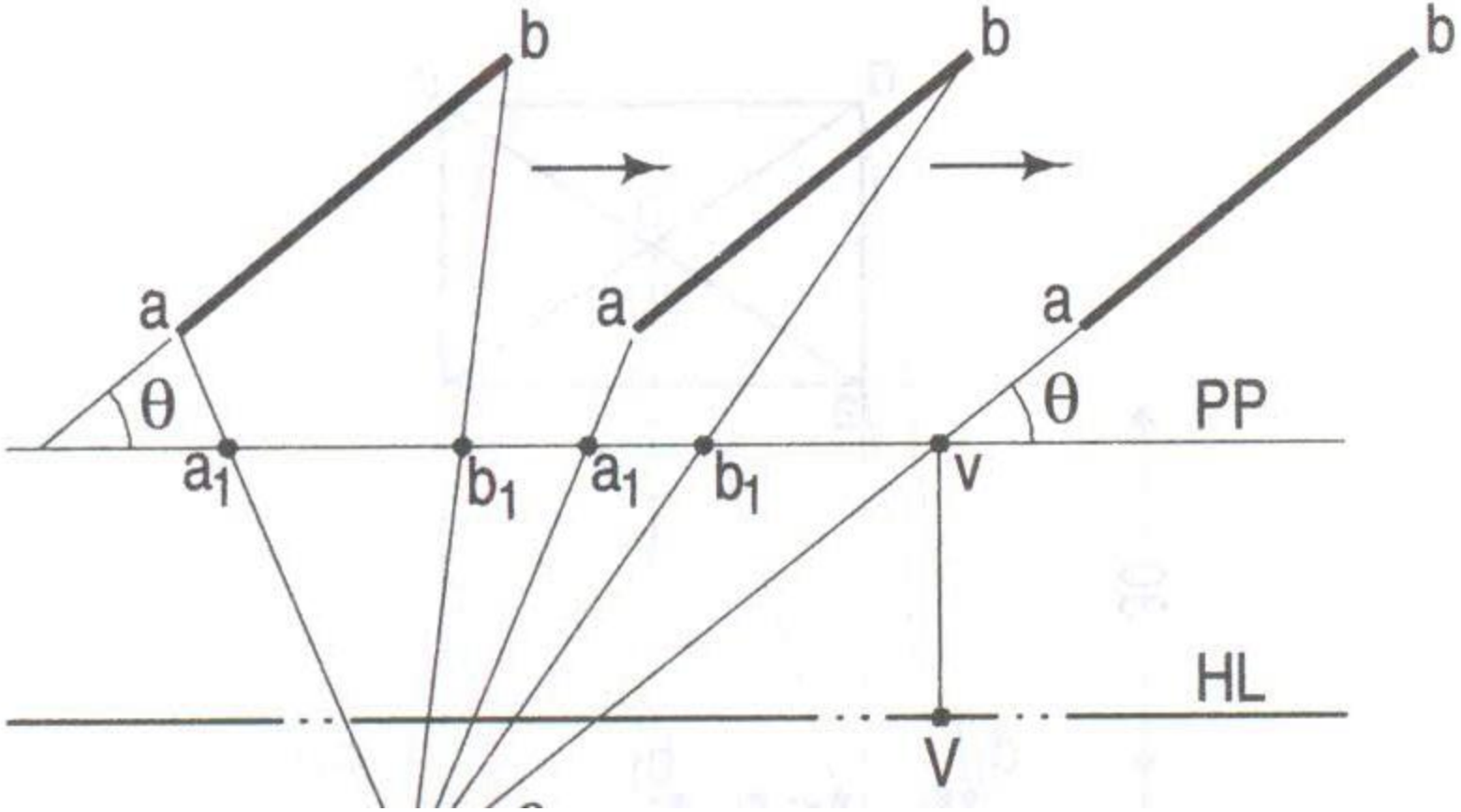
Vanishing Point Method

Perspective Projections
Vanishing Point Method

- The object moves away from the observer, it appears to grow(?) smaller and smaller and vanishes at a point. This is a vanishing point. Example is the pair of rails.
- For a line perpendicular to PP, vanishing point is along eye. So, perspective to these lines are vertical.
- Lines parallel to PP will have no vanishing point. So, perspective to these lines are horizontal.
- Considering only the bounding box of the object, we may arrive at 1, 2 or 3 vanishing points. The number of finite Vs decide the type of projection.
- Single VP : One or more faces of bounding box is parallel to PP.
  Double VP : No face is parallel to PP but an edge is parallel to PP.
  Triple VP : No face or edge of the bounding box is parallel to PP.

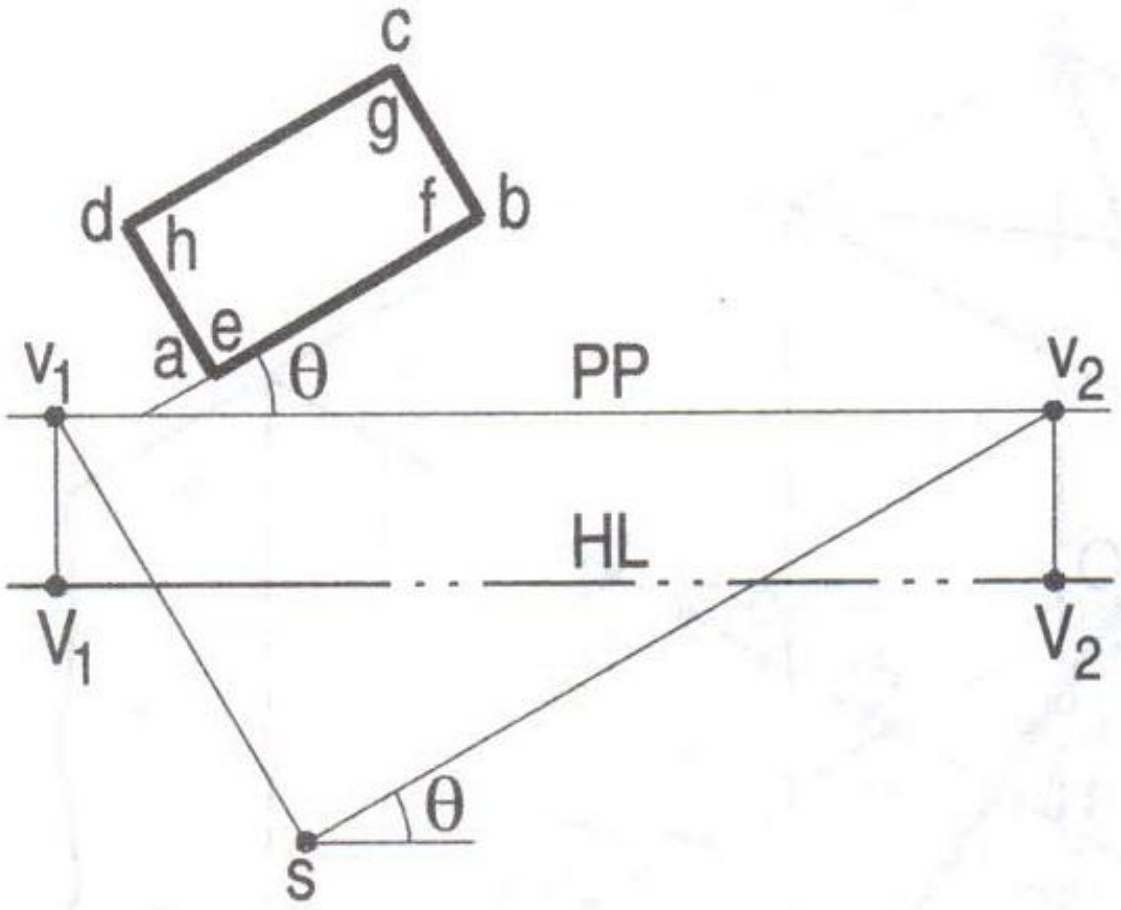
Perspective Projections

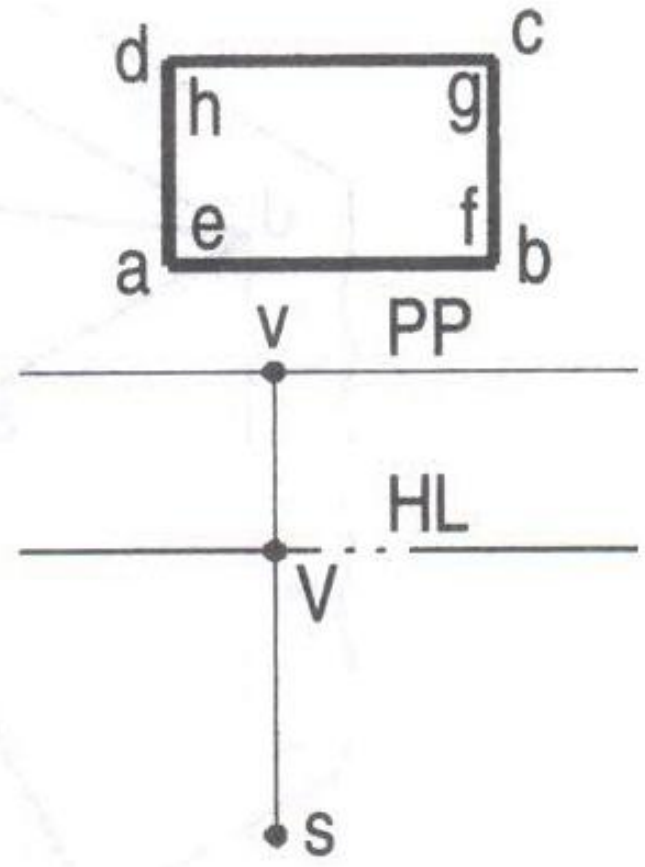
Vanishing Point Method



Perspective Projections

Vanishing Point Method

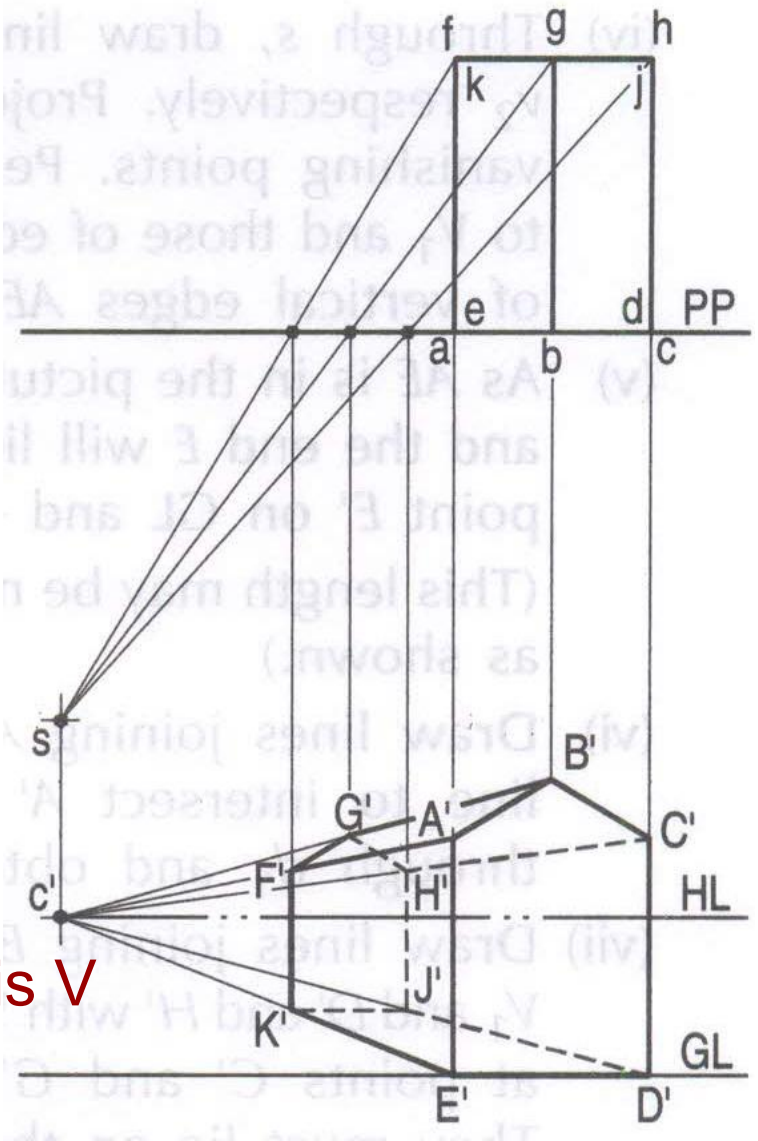




Perspective Projections

Single Vanishing Point (One point perspective)

This is also known as parallel perspective. This happens when the object has one or more faces parallel to PP.



c‘ is V

Perspective Projections

Example-4 (Solved Pb. 19-4, pp. 487)

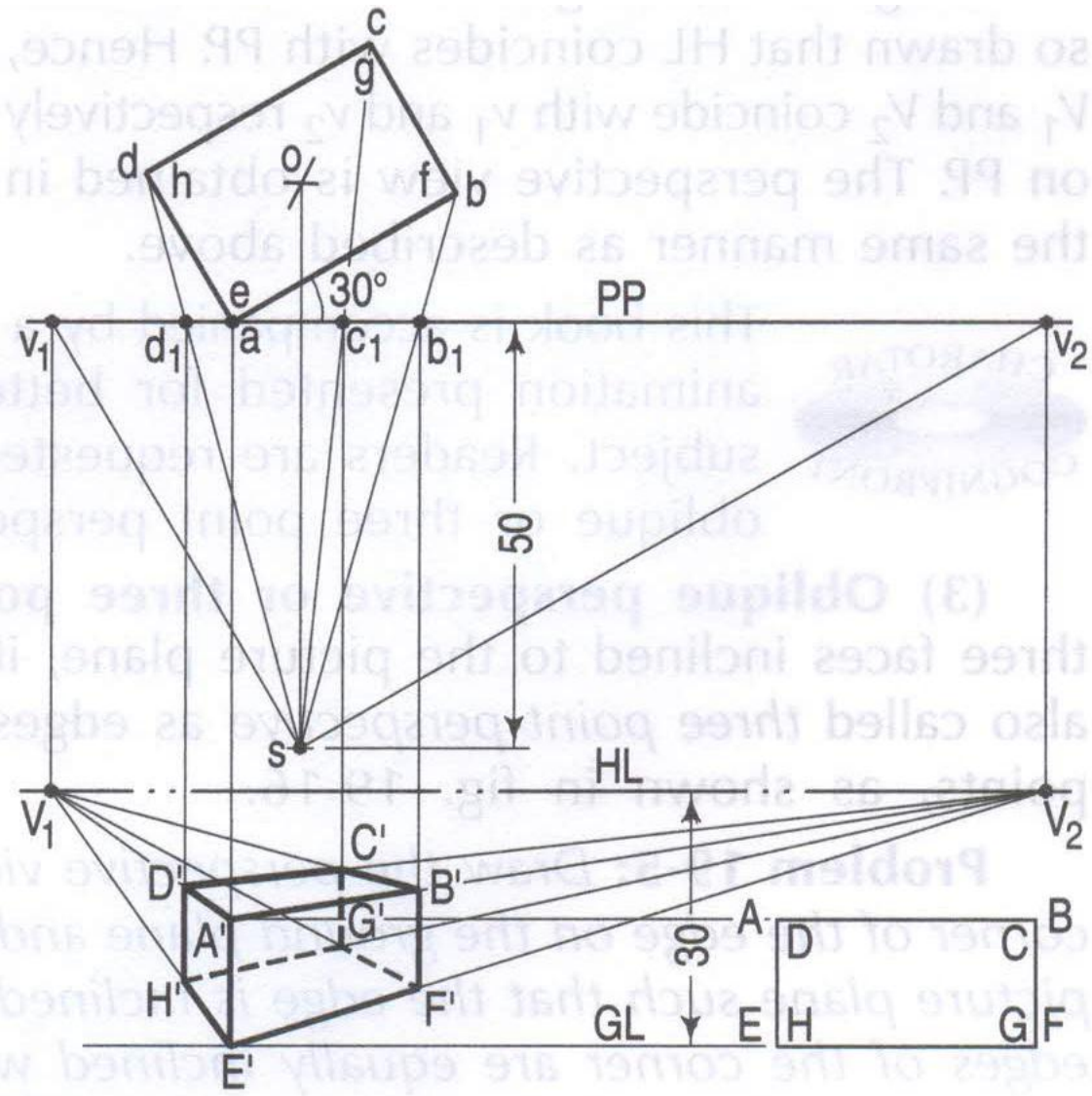
A rectangular block, 30mm x 20mm x 15mm is lying on the ground plane on one of its largest faces. A vertical edge is in the picture plane and the longer face containing that edge makes an angle of 30° with the picture plane.

The station point is 50mm in front of the picture plane, 30mm above the ground plane and lies in a central plane which passes through the centre of the block.

Draw the perspective view of the block.

Perspective Projections

Example-4 (Solved Pb. 19-4, pp. 487)



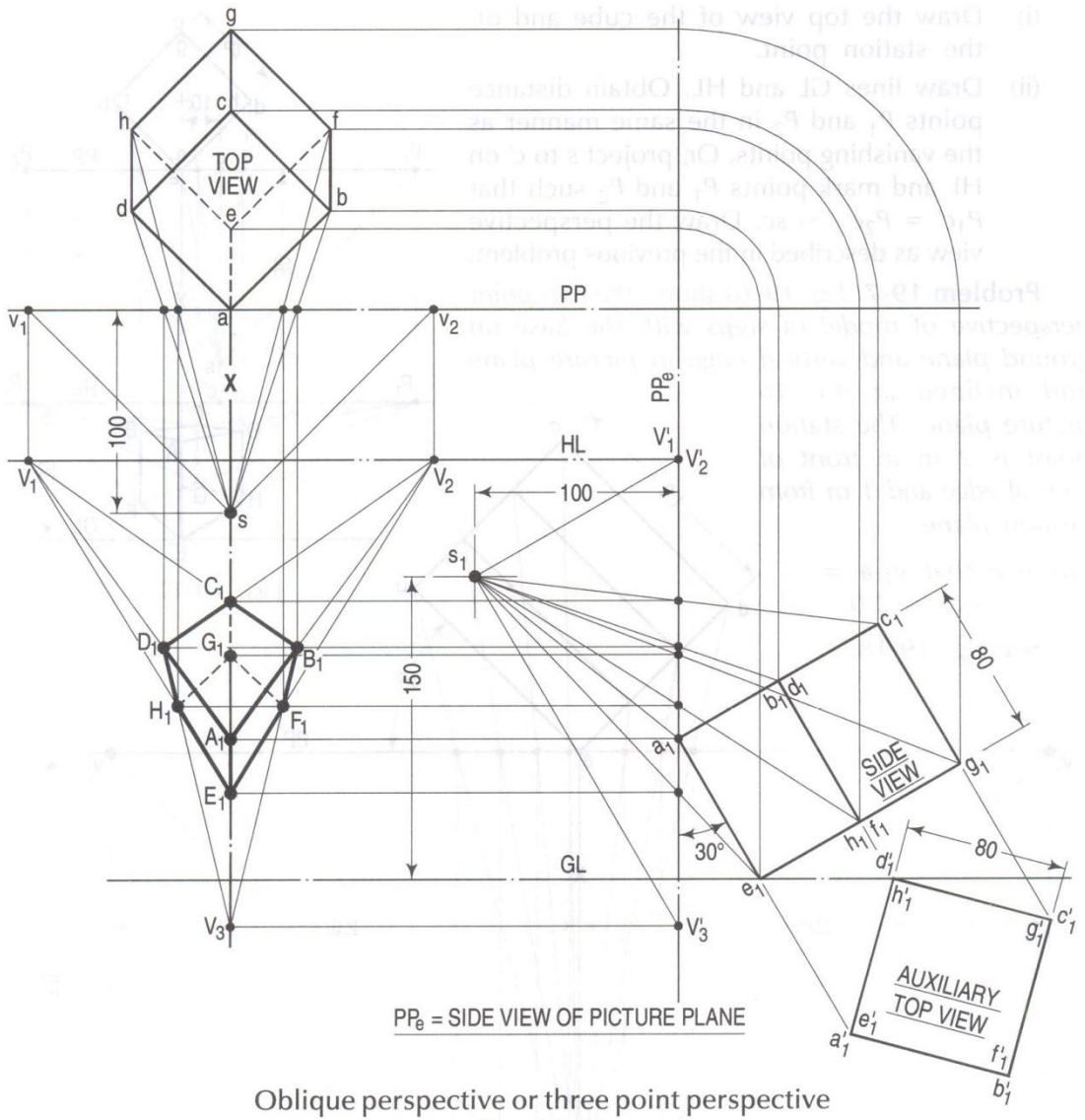
Perspective Projections

Example-5 (Solved Pb. 19-5, pp. 488)

Draw the perspective view of cube 80 mm side having its one corner of the edge on the ground plane and other corner of the edge resting on the picture plane such that the edge is inclined at 30° to the picture plane. The other two edges of the corner are equally inclined with the picture plane. The station point is 100 mm in front of the picture plane, 150 mm above the ground plane and lies in a central plane which passes through the centre of the cube.

Perspective Projections

Example-5 (Solved Pb. 19-5, pp. 488)

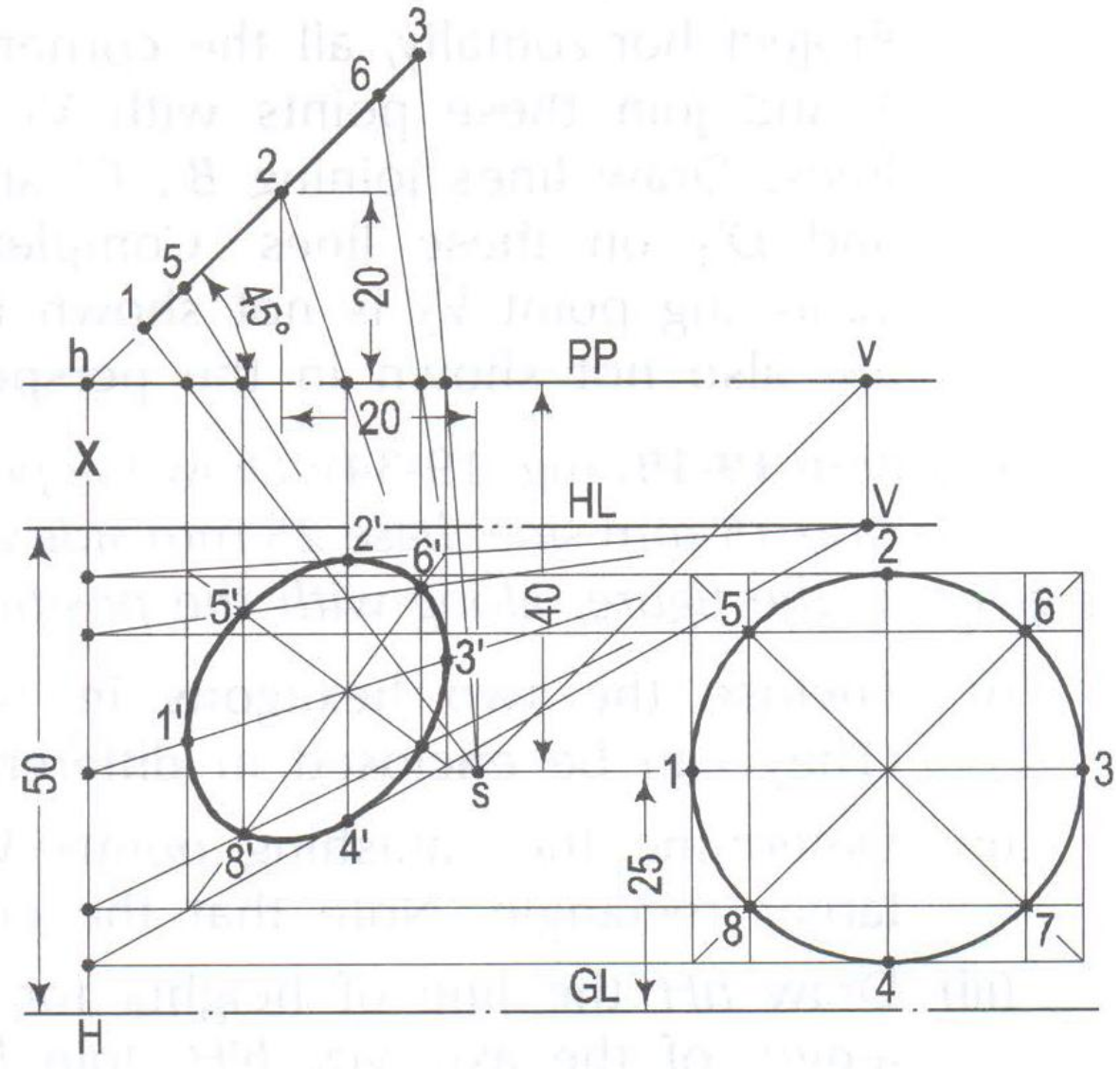


Oblique perspective or three point perspective

Perspective Projections

Example-6 (Solved Pb. 19-17, pp. 497)

Draw the perspective view of a circle of 40mm diameter, having its surface vertical and inclined at 45° to the picture plane. The centre of the circle is 25mm above the ground plane and 20mm behind the picture plane. The station point is 50mm above the ground plane and 20mm to the right of the circle centre.



Conclusions

- All that we have discussed is accomplished using a 4x4 matrix in a CAD system.

Conclusions

- Roughly work out all the problems given to you. Only if you come prepared, you will be able to complete all problems of the sheet in the drawing session.


Thank You!

Perspective Projections

3 Types of perspective projections

- The eye is of a finite or semi-finite size in perspective proj… geometry may be visualized as
  - a narrow slit aligned with one of the six … infinitely wide in single VP
  - an infinite narrow slit inbetw… …ojection planes infinitely wide i…
  - a point (a shape… …ed to the object) within the extents… …n triple VP

Wrong Analogy