21MES102L
Engineering Graphics and Design
School of Mechanical Engineering

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21MES102L
Engineering Graphic and Design

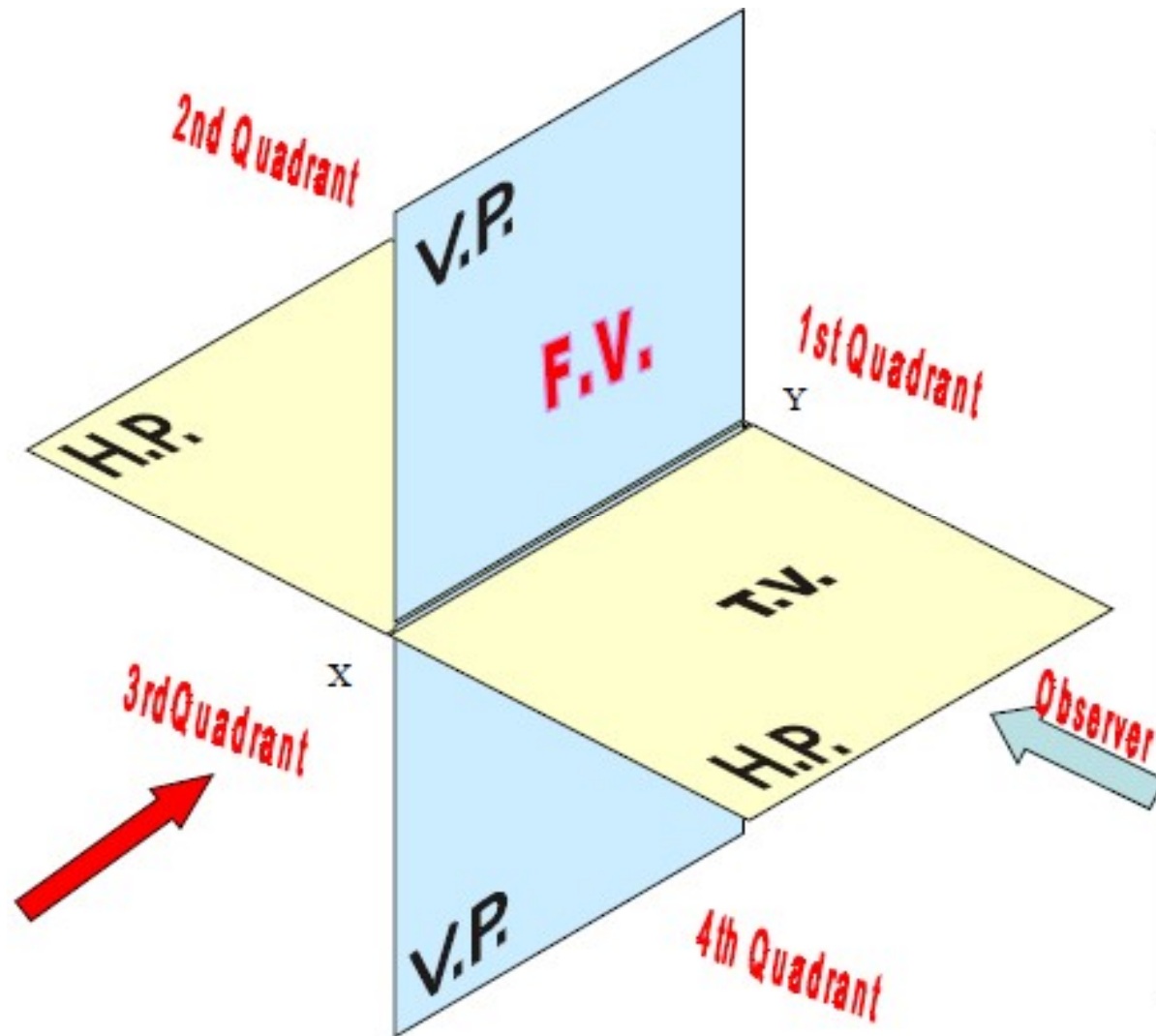## E3 Projection of Points and Straight Lines Inclined to One Plane

Topics Covered

➤Principles of Projection

➤Types of Projection, First angle and Third angle Projection

➤Principles of Projection of Straight line

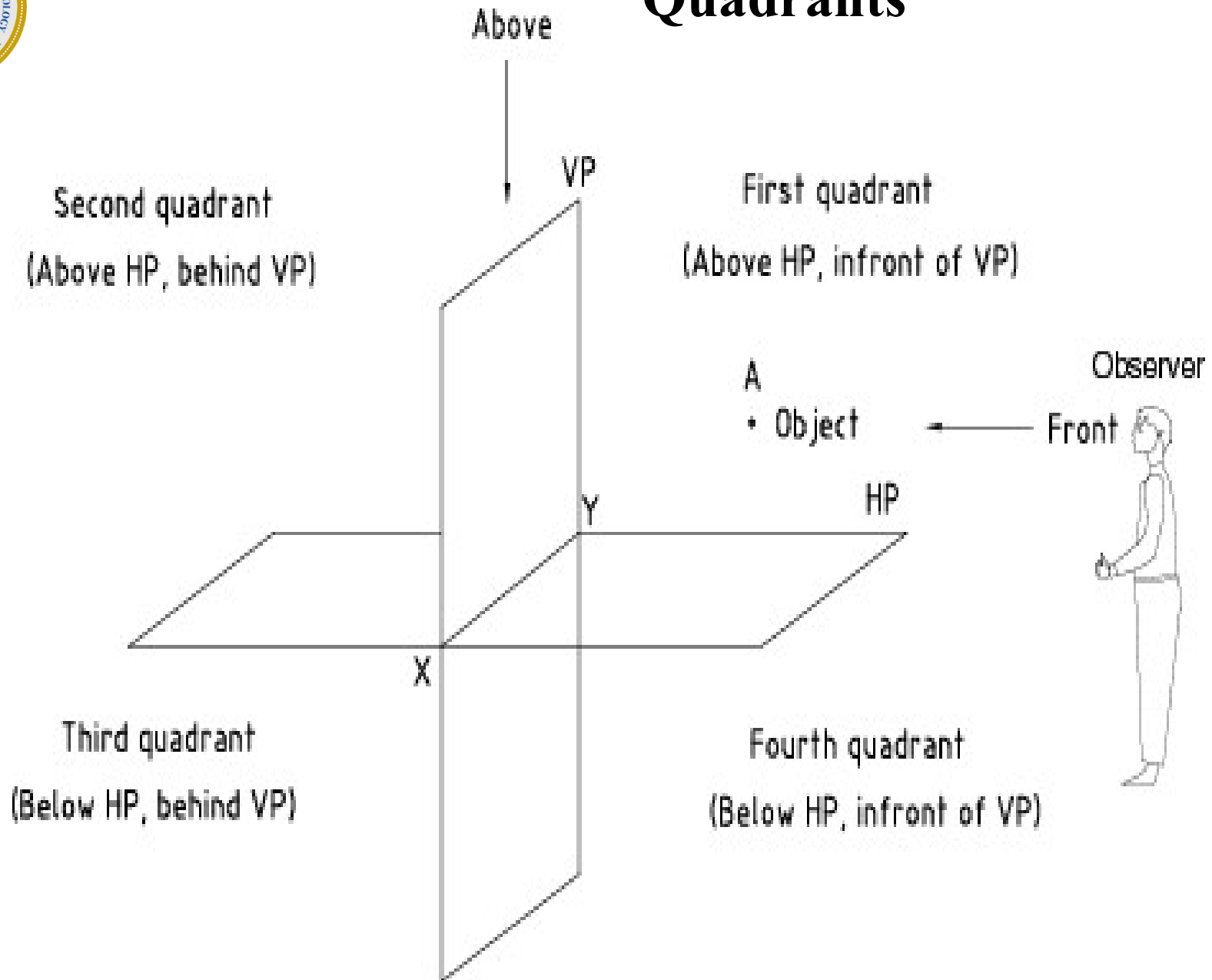➤Projection of Straight Lines Inclined to one Plane and Parallel to another Plane

Quadrants

Quadrants

Above

VP

Second quadrant

(Above HP, behind VP)

First quadrant

(Above HP, infront of VP)

A

Observer

• Object

Front

Y

HP

X

Third quadrant

(Below HP, behind VP)
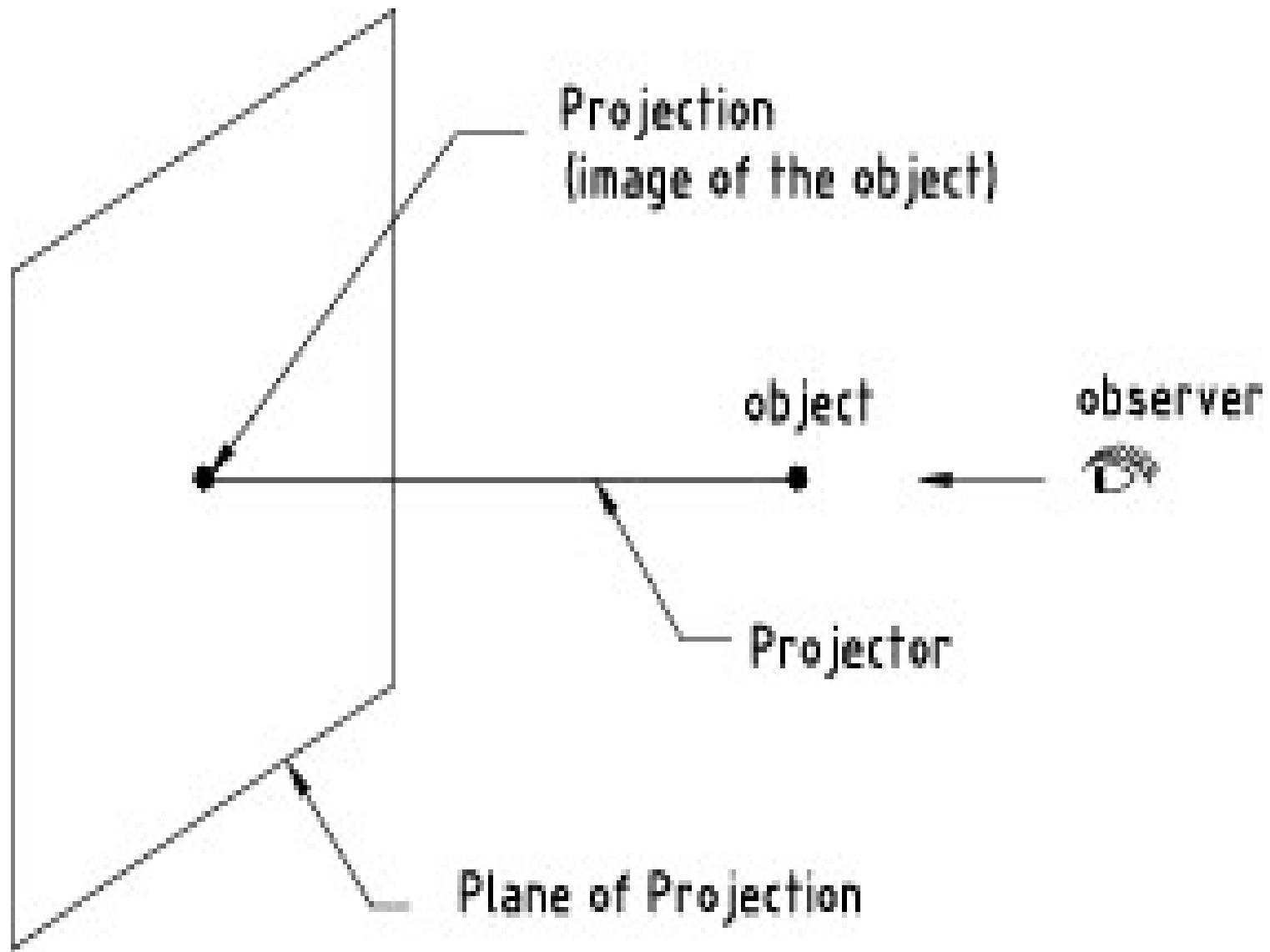
Fourth quadrant

(Below HP, infront of VP)

Principles of Projection

Principles of Projection

Projection: Projecting the image of an object to the Plane is known as **Projection**.

Plane of Projection: The Plane on which the Projection of object is obtained is called **Plane of Projection**.

Projector: The Straight Line from the object to the Plane of Projection is called **Projector**.

Principles of Projection

Orthographic Projection: Projecting the image of an object by drawing Projectors from the Corners Parallel to each other & Perpendicular to the Plane of Projection is called as **Orthographic Projection**.

Conventions to be Observed in Projections

➢ In Orthographic Projections Space is divided into Four Quadrants.

➢ By two Reference **VP** (Floor) and **HP** (Wall).

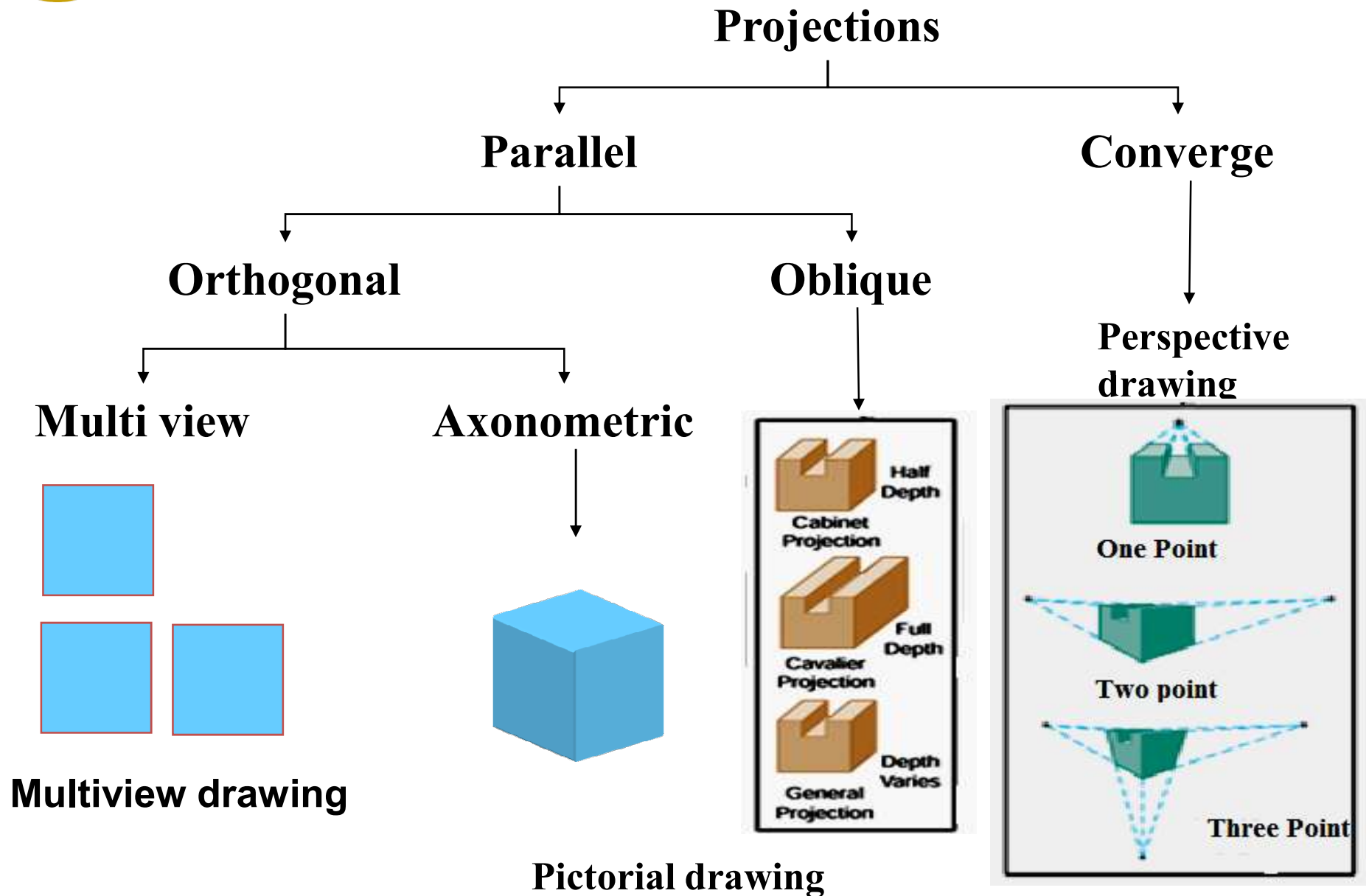➢ Point may be situated in any one of these Quadrants.

Conventions to be Observed in Projections

➢ It may also be on any one of the References.

➢ To Obtain the **Orthographic views** in a single plane Always **ROTATE** the **Horizontal Plane** for 90° only in **CLOCK WISE** direction.

➢ The **Top Views** are to be represented by **Lower case** Letters (**a,b…**)

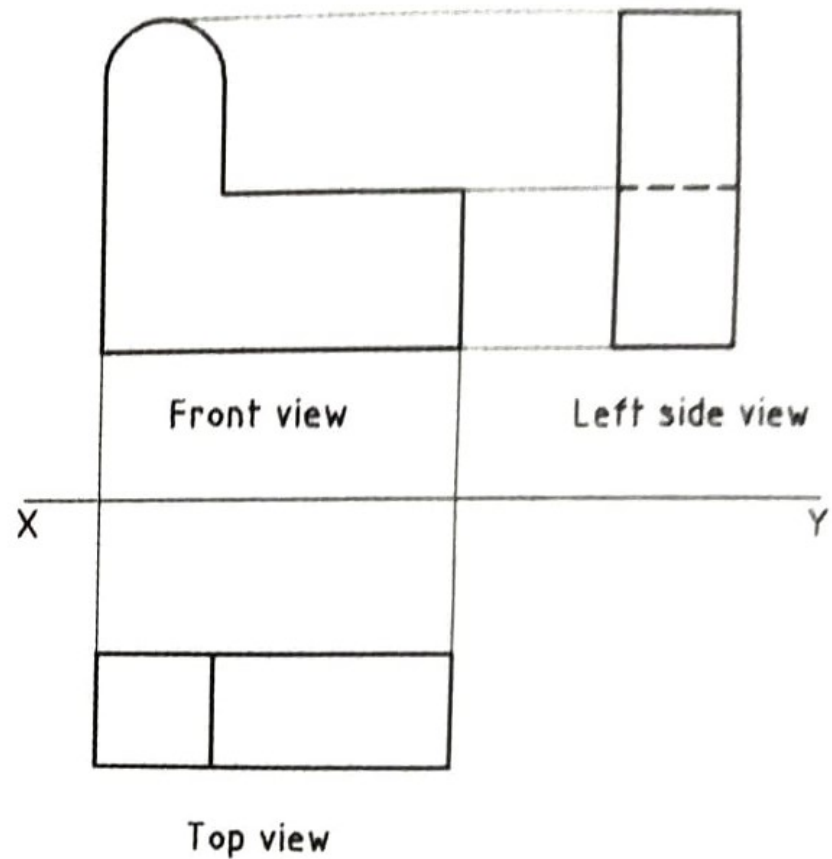➢ The **Front Views** are to be represented by **Lower case** letters **with dashes** (**a', b'…**).

Types of Projections

Projections

Parallel

Converge

Orthogonal

Oblique

Perspective drawing

Multi view

Axonometric

Multiview drawing

Pictorial drawing

Half Depth

Cabinet Projection

Full Depth

Cavalier Projection
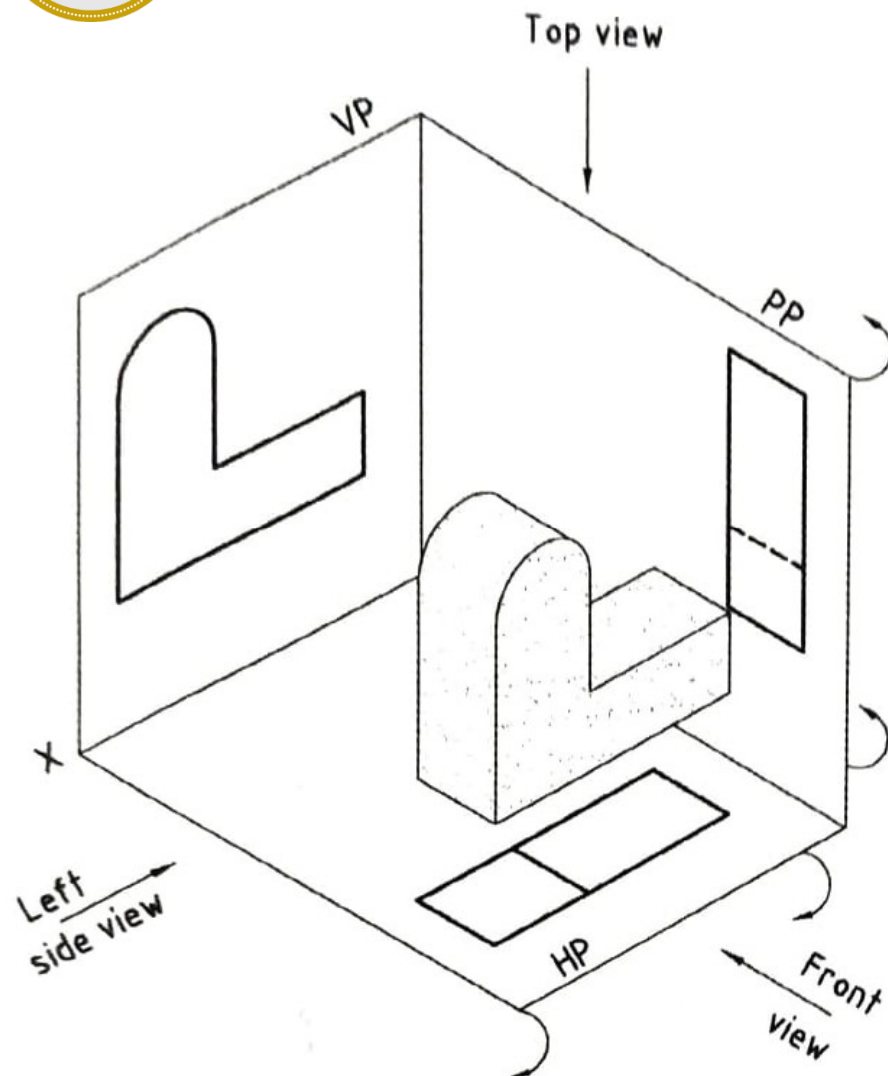
Depth Varies

General Projection

One Point

Two point

Three Point

First Angle Projection

First Angle Projection

➢ In First Angle Projection the object is assumed to be placed in First Quadrant i.e Above **Horizontal Plane (HP)** & in Front of **Vertical Plane (VP)**

➢ The Object is lying between **Observer & Plane of Projection**.

➢ The **Top View** of the object is projected on to the **HP.**

➢ The **Front View** of the object is projected on to the **VP.**

➢ The **Top View** appears **below** the **Front View**.

➢ The **Left side View** appears on **Right** side of the **Front View**.

Third Angle Projection

Top view

HP

Left side view

PP

VP

Front view

X

Y

Top view

X — Y

Left side view   Front view
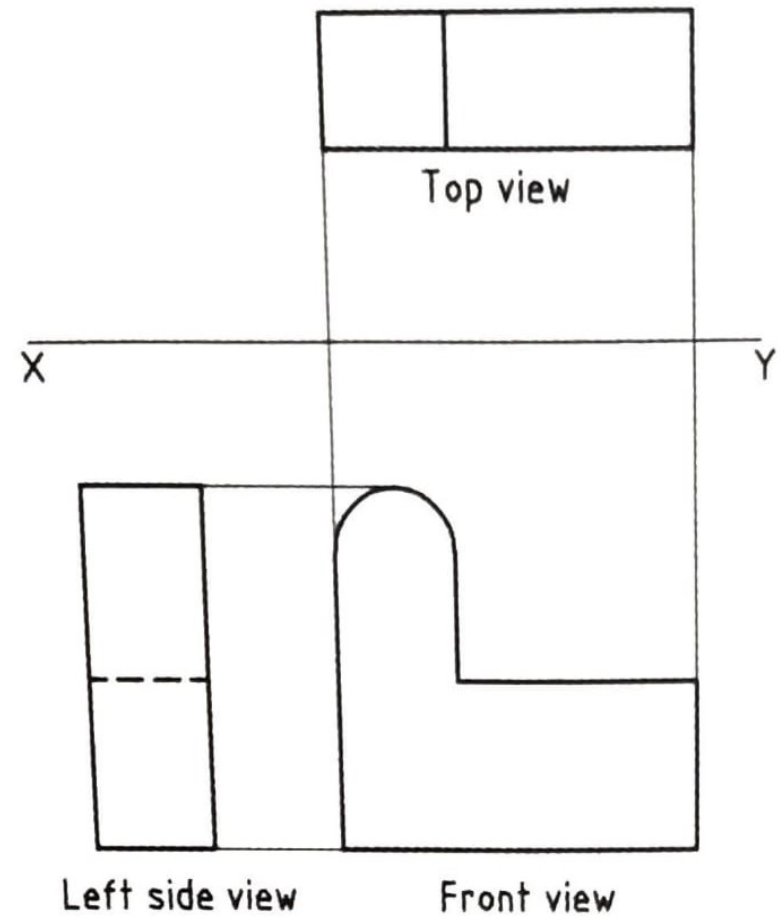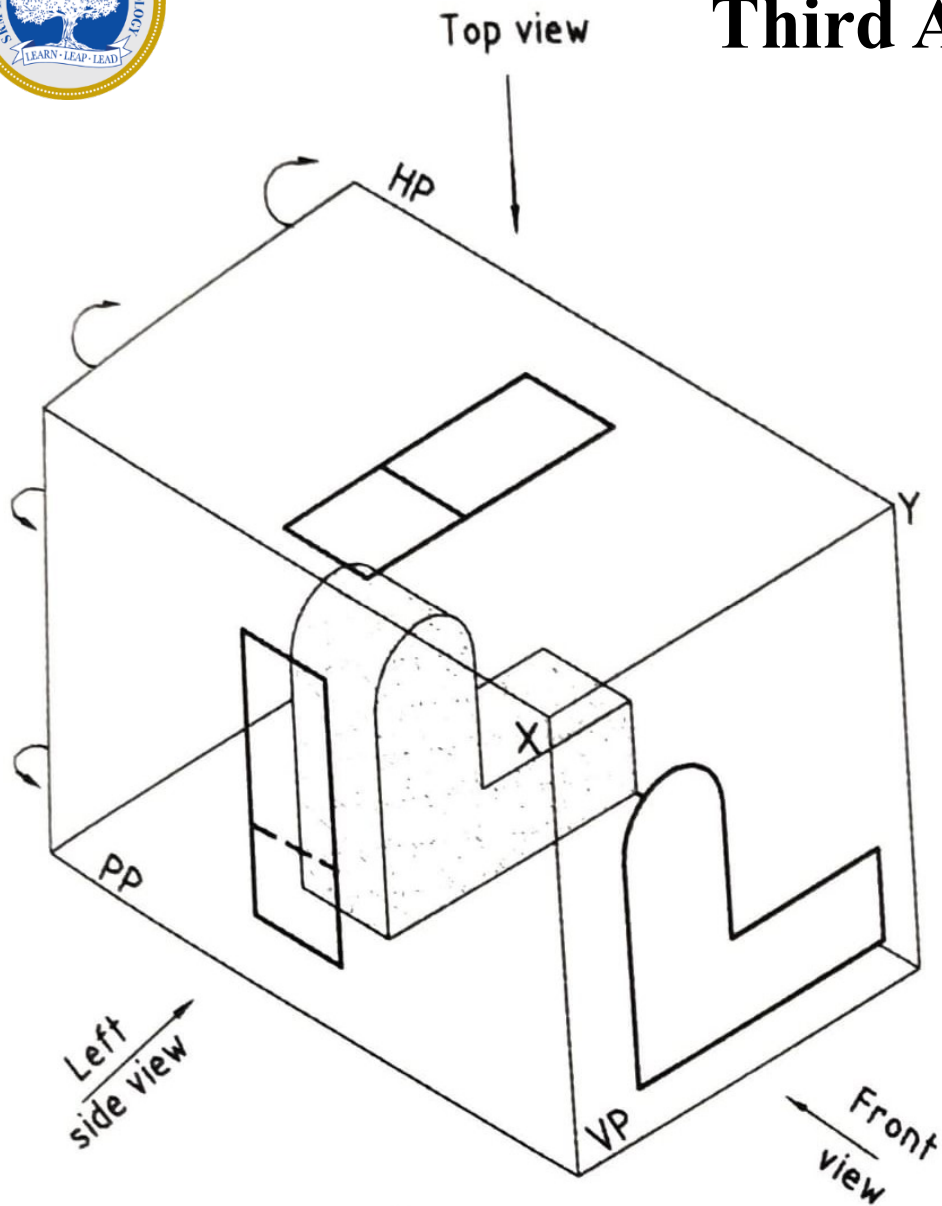
Third Angle Projection

- In **Third** Angle Projection the object is assumed to be placed in **Third** Quadrant i.e Below **HP** & Behind **VP**

- The **Plane of Projection** is lying between **Observer & Object.**

- The **Top View** of the object is Projected on to the **HP.**

- The **Front View** of the object is Projected on to the **VP.**

- The **Top View** appears **above** the **Front View**.

- The **Left side View** appears on **Left** side of the **Front View**.

Projection of Points

➢ Point has **simply position** but **no Magnitude**

➢ Generally represented by a very small **circle** or a **dot**.

Location of Points

➢ Point situated **above Floor (HP)** and **in front of Wall (VP)** is in **First Quadrant**.

➢ Point situated **above Floor** and **behind Wall** is in **Second Quadrant.**

➢ Point situated **below Floor** and **behind Wall** is in **Third Quadrant.**

➢ Point situated **below Floor** and **in front of Wall** is in **Fourth Quadrant.**

Projection of Point in First Quadrant.
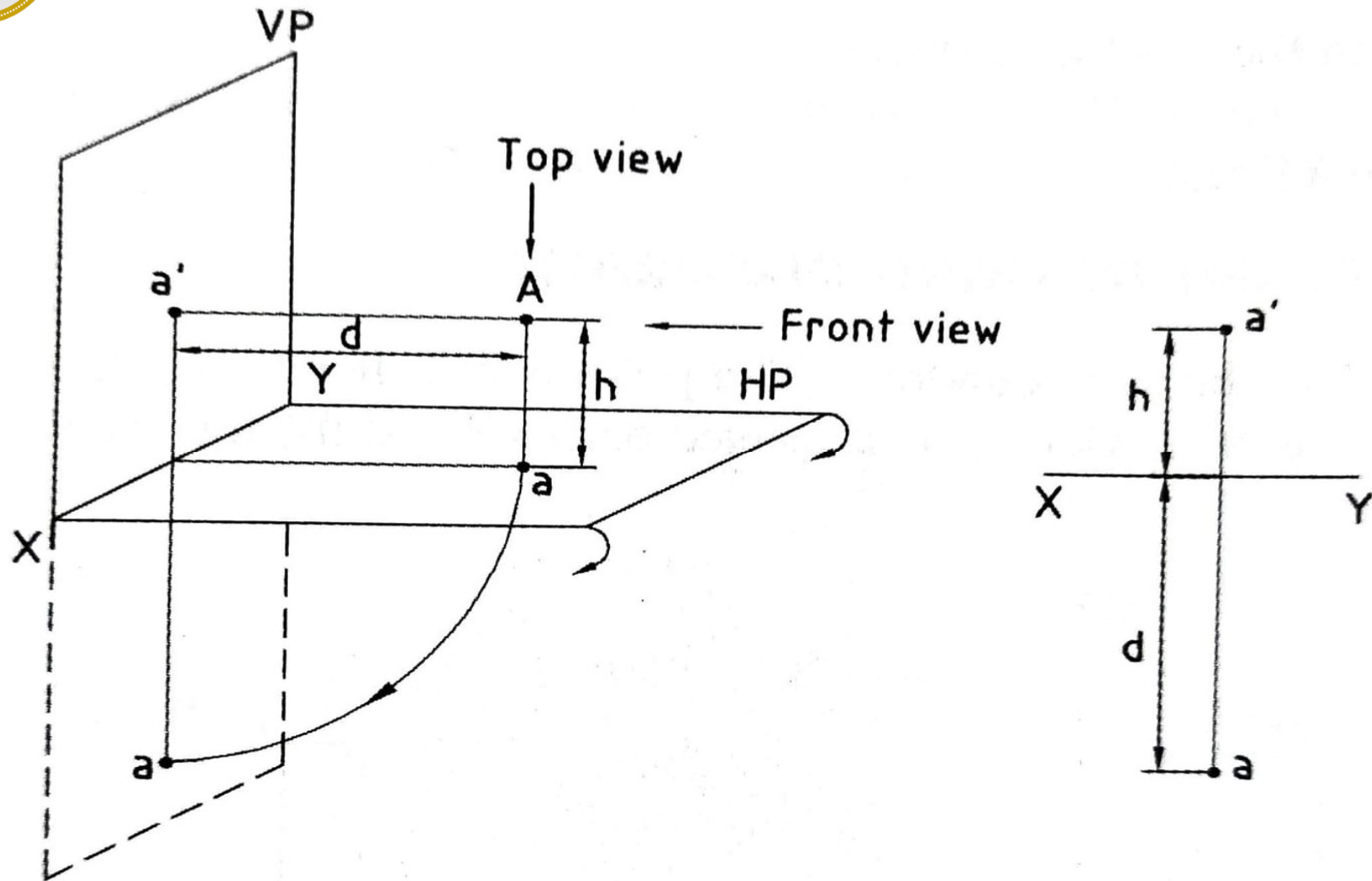
A POINT A is located **h** mm **ABOVE HP** & **d** mm **in FRONT** of **VP**

➢ As the Point **A** is situated above Floor (**HP**) and in front of Wall (**VP**) so the point is in **First Quadrant**.

➢ The **FRONT VIEW** of the point **A** is viewed **h** mm above **HP** to be denoted as **a'**

➢ The **TOP VIEW** of the point **A** is viewed **d** mm in front of **VP** to be denoted as **a**
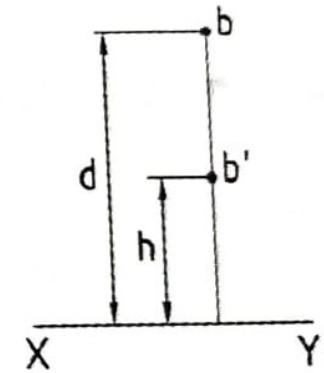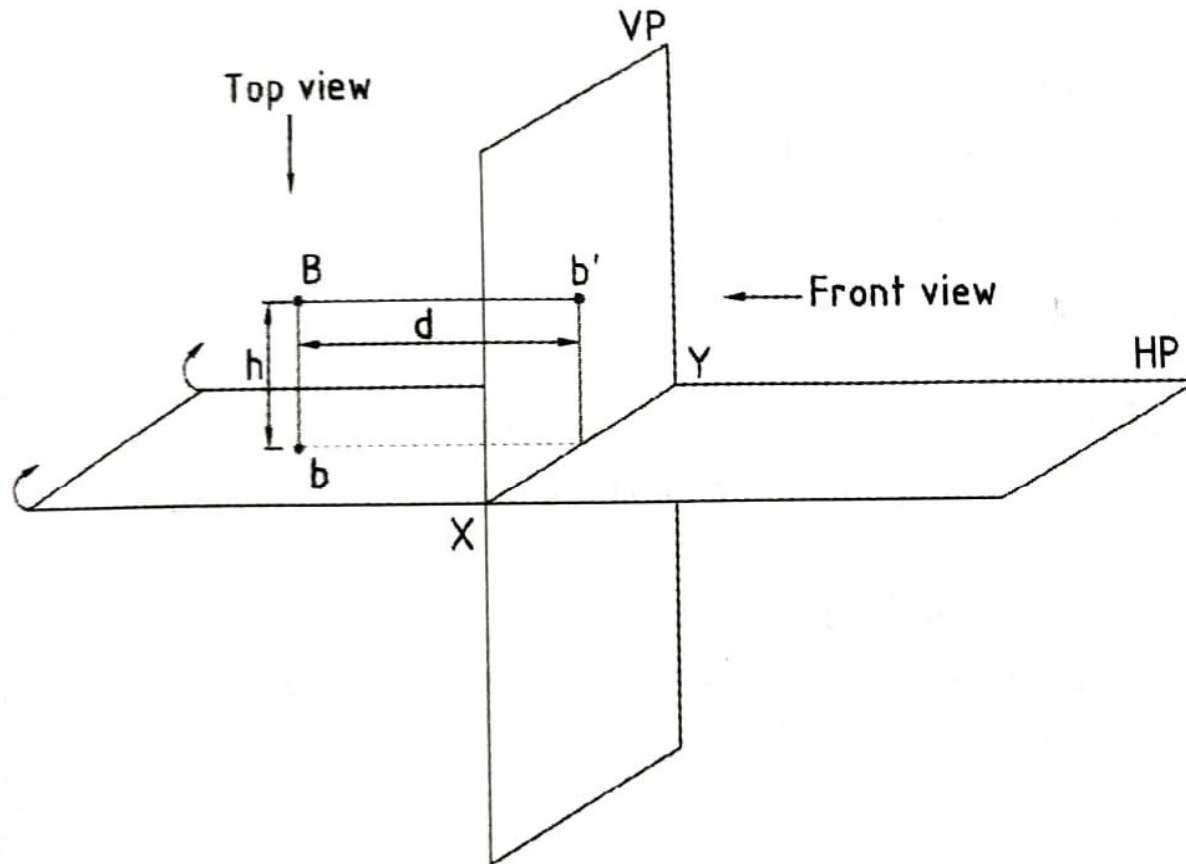
- ➢   Initial setup of workspace **Drafting & Annotation** Mode

  - ➢ Type UN or **UNITS**

  - ➢ Set the Precision for **0**

  - ➢ Set the Units in Millimeters

- ➢ Type **LIMITS** Press Enter

  - ➢ Specify the Lower Left Corner as **0,0** Press Enter

  - ➢ Specify the Upper Right Corner as **210,297** Press Enter

- ➢ Type **ZOOM** Press Enter

- ➢ Type **ALL** Press Enter

- ➢ Use **LINE** command (**ORTHO ON**) draw the Reference line **XY**.

- ➢ Use **POINT** command to locate the **a' , h** mm **ABOVE** the Reference line **XY**.

- ➢ Use **LINE** command (**ORTHO ON**) to draw a Vertical line downward from **a'** for the given (**h+d**) mm distance.

- ➢ Use **POINT** command to locate **a** at the end of the vertical line.

- ➢ Use **Annotation** tool bar to mark the dimensions between reference line **XY** to **a'** & line **XY** to **a**

Projection of Point in Second Quadrant

A POINT **B** is located **h** mm **ABOVE HP** & **d** mm **BEHIND VP**

➢ As the Point **B** is situated above Floor (**HP**) and behind the Wall (**VP**) so the point is in **Second Quadrant**.

➢ The **FRONT VIEW** of the point **B** is viewed **h** mm above **HP** to be denoted as **b'**

➢ The **TOP VIEW** of the point **B** is viewed **d** mm behind **VP** to be denoted as **b**
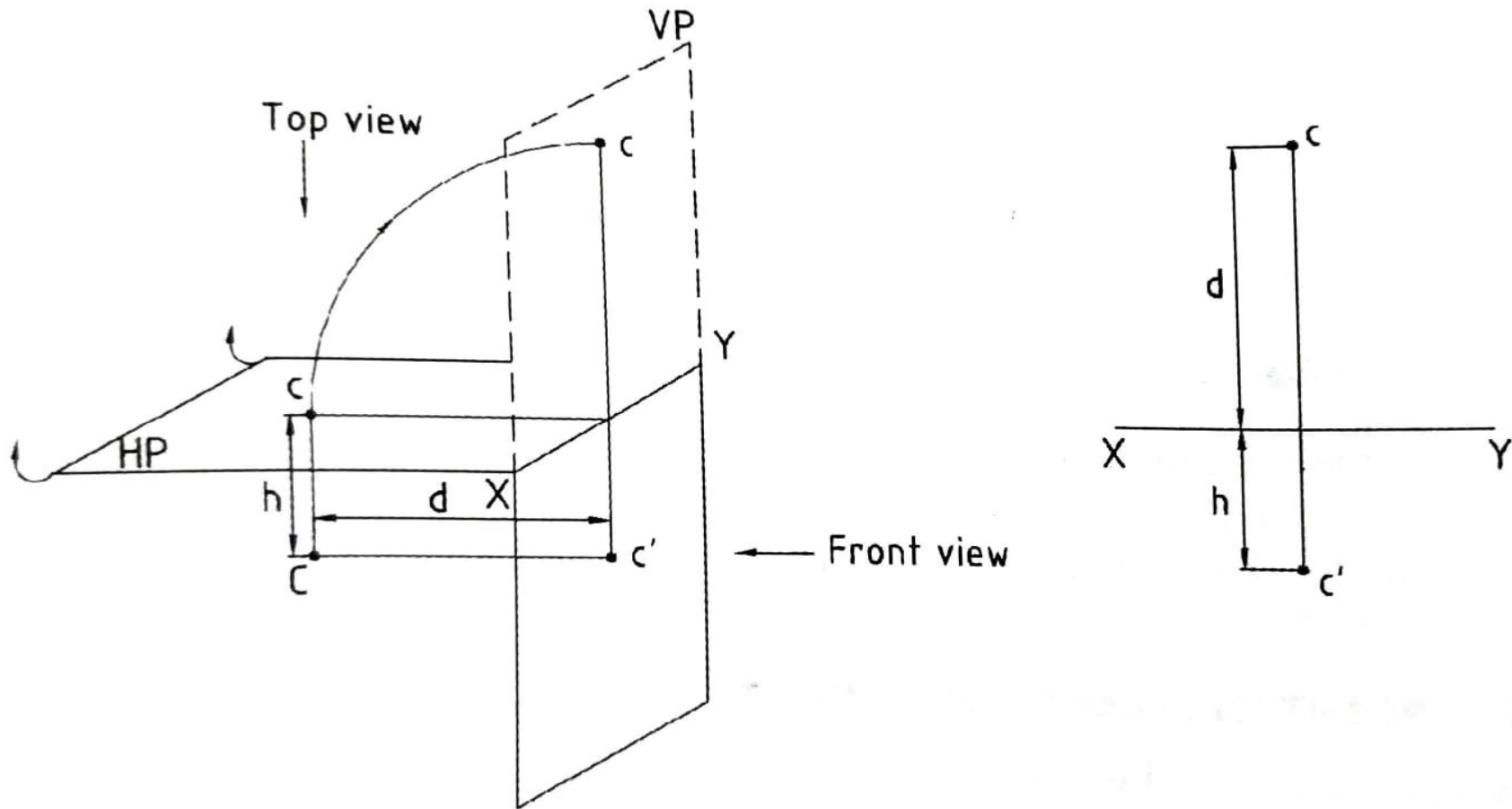
➢ Initial setup of workspace **Drafting & Annotation** Mode

➢Type UN or **UNITS**

➢Set the Precision for **0**

➢Set the Units in Millimeters

➢Type **LIMITS** Press Enter

➢Specify the Lower Left Corner as **0,0** Press Enter

➢Specify the Upper Right Corner as **210,297** Press Enter

➢Type **ZOOM** Press Enter

➢Type **ALL** Press Enter

- ➢ Use **LINE** command (**ORTHO ON**) draw the Reference line **XY**.

- ➢ Use **POINT** command to locate the **b'** , **h** mm **ABOVE** the Reference line **XY**.

- ➢ Use **LINE** command (**ORTHO ON**) to draw a Vertical line upward from **b'** for the given (**d-h**) mm distance.

- ➢ Use **POINT** command to locate **b** at the end of the vertical line.

- ➢ Use **Annotation** tool bar to mark the dimensions between reference line **XY** to **b'** & line **XY** to **b**

Projection of Point in Third Quadrant

A POINT **C** is located **h** mm **BELOW HP** & **d** mm **BEHIND VP**

A POINT **C** is located **h** mm **BELOW HP** & **d** mm **BEHIND VP**

➢ As the Point **C** is situated below the Floor (**HP**) and behind the Wall (**VP**) so the point is in **Third Quadrant**.

➢ The **FRONT VIEW** of the point **C** is viewed **h** mm below **HP** to be denoted as **c'**

➢ The **TOP VIEW** of the point **c** is viewed **d** mm behind **VP** to be denoted as **c**
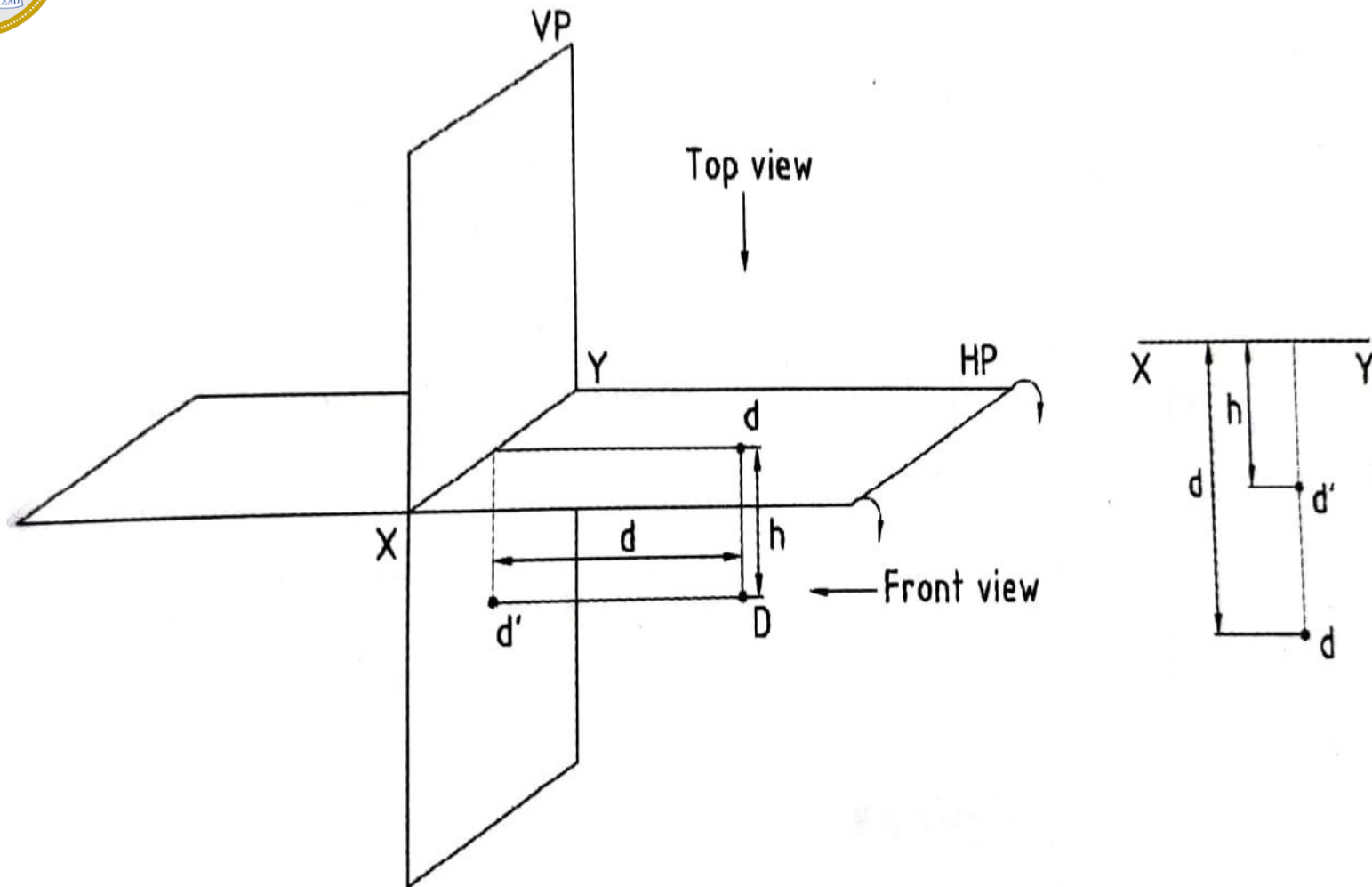
- Initial setup of workspace **Drafting & Annotation** Mode

    - Type UN or **UNITS**

    - Set the Precision for **0**

    - Set the Units in Millimeters

- Type **LIMITS** Press Enter

    - Specify the Lower Left Corner as **0,0** Press Enter

    - Specify the Upper Right Corner as **210,297** Press Enter

- Type **ZOOM** Press Enter

- Type **ALL** Press Enter

- ➢ Use **LINE** command (**ORTHO ON**) draw the Reference line **XY**.

- ➢ Use **POINT** command to locate the **c'** , **h** mm **BELOW** the Reference line **XY**.

- ➢ Use **LINE** command (**ORTHO ON**) to draw a Vertical line upward from **c'** for the given (**d+h**) mm distance.

- ➢ Use **POINT** command to locate **c** at the end of the vertical line.

- ➢ Use **Annotation** tool bar to mark the dimensions between reference line **XY** to **c'** & line **XY** to **c**

Projection of Point in Fourth Quadrant

A POINT **D** is located **h** mm **BELOW HP** & **d** mm **in FRONT** of **VP**

➤ As the Point **D** is situated **below the Floor (HP)** and **in front of the Wall (VP)** so the point is in **Fourth Quadrant**.

➤ The **FRONT VIEW** of the point **D** is viewed **h** mm **below HP** to be denoted as **d'**

➤ The **TOP VIEW** of the point **D** is viewed **d** mm **in front of VP** to be denoted as **d**

➢ Initial setup of workspace **Drafting & Annotation** Mode

  ➢Type UN or **UNITS**

  ➢Set the Precision for **0**

  ➢Set the Units in Millimeters

➢Type **LIMITS** Press Enter

  ➢Specify the Lower Left Corner as **0,0** Press Enter

  ➢Specify the Upper Right Corner as **210,297** Press Enter

➢Type **ZOOM** Press Enter

➢Type **ALL** Press Enter

- Use **LINE** command (**ORTHO ON**) draw the Reference line **XY**.

- Use **POINT** command to locate the **d' , h** mm **BELOW** the Reference line **XY**.

- Use **LINE** command (**ORTHO ON**) to draw a Vertical line downward from **d'** for the given (**d-h**) mm distance.

- Use **POINT** command to locate **d** at the end of the vertical line.

- Use **Annotation** tool bar to mark the dimensions between reference line **XY** to **d'** & line **XY** to **d**
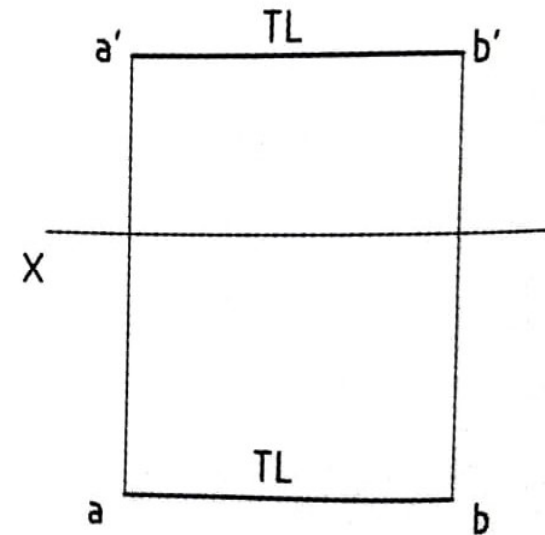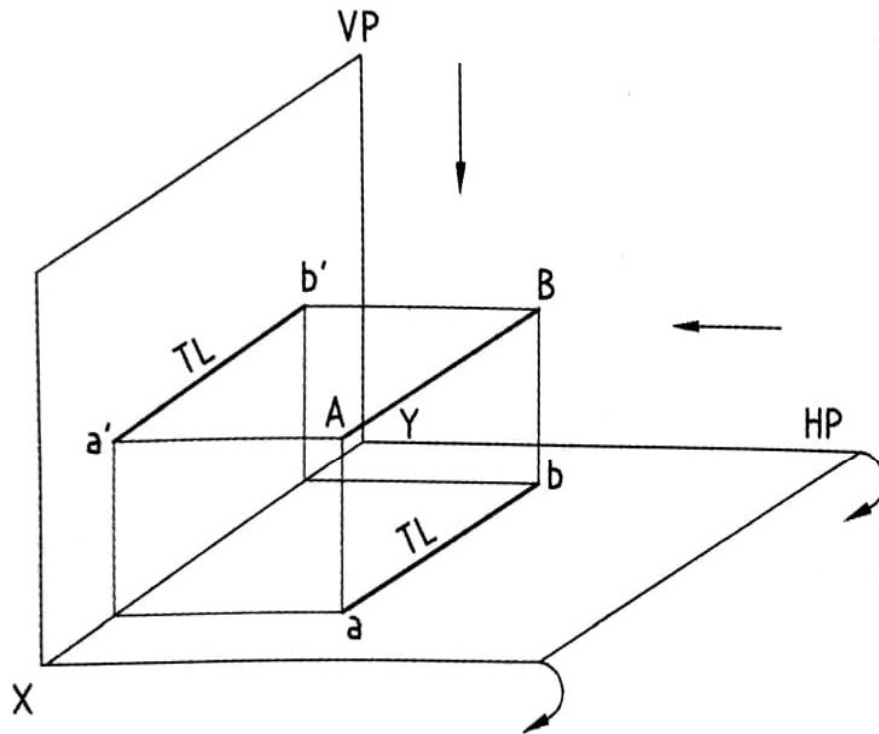
Projection of Straight Lines

➢ A Straight Line is the shortest distance between two points.

➢ Projections of the ends of any Line can be drawn using the Principles of **Projections of Points**.

➢ The Line in space may be **Parallel**, **Perpendicular** or **Inclined** to **Either** the **Floor** or the **Wall** or **Both Floor & Wall**

Straight Line Parallel to Both HP & VP

When a line **AB** is **Parallel to both HP & VP**

➢ Initial setup of workspace **Drafting & Annotation** Mode

➢Type UN or **UNITS**

➢Set the Precision for **0**

➢Set the Units in Millimeters

➢Type **LIMITS** Press Enter

➢Specify the Lower Left Corner as **0,0** Press Enter

➢Specify the Upper Right Corner as **210,297** Press Enter
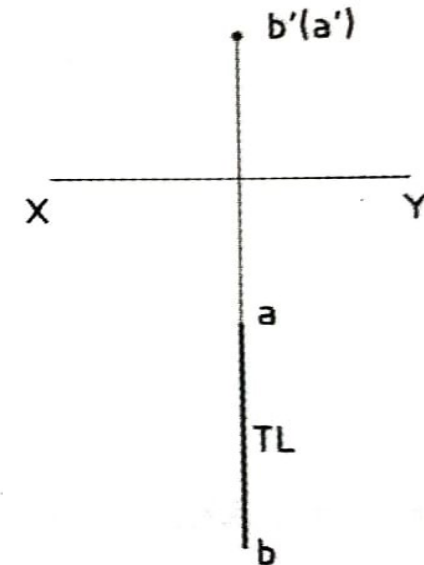
➢Type **ZOOM** Press Enter

➢Type **ALL** Press Enter

➢ Use **LINE** command (**ORTHO ON**) draw the Reference line **XY**.

➢ Use **POINT** command to locate the **a' , h** mm above the Reference line & From **a'** draw a Horizontal line for given True length & name the end point as **b'**

➢ Use **LINE** command (**ORTHO ON**) to draw Vertical lines (Projector) downward from **a'** & **b'** for the given (**h+d**) mm distance & the end points of the lines named as **a** & **b**

➢ Use **LINE** command (**ORTHO ON**) to connect the end points **a** & **b**.

➢ Use **Annotation** tool bar to mark the dimensions between reference line **XY** to **a'** & line **a'** to **b'** & **XY** to **a**

Straight Line Parallel to HP & Perpendicular to VP

When a line **AB** is **Parallel** to **HP** & **Perpendicular** to **VP**

➢ Initial setup of workspace **Drafting & Annotation** Mode

  ➢Type UN or **UNITS**

  ➢Set the Precision for **0**

  ➢Set the Units in Millimeters

➢Type **LIMITS** Press Enter

  ➢Specify the Lower Left Corner as **0,0** Press Enter

  ➢Specify the Upper Right Corner as **210,297** Press Enter
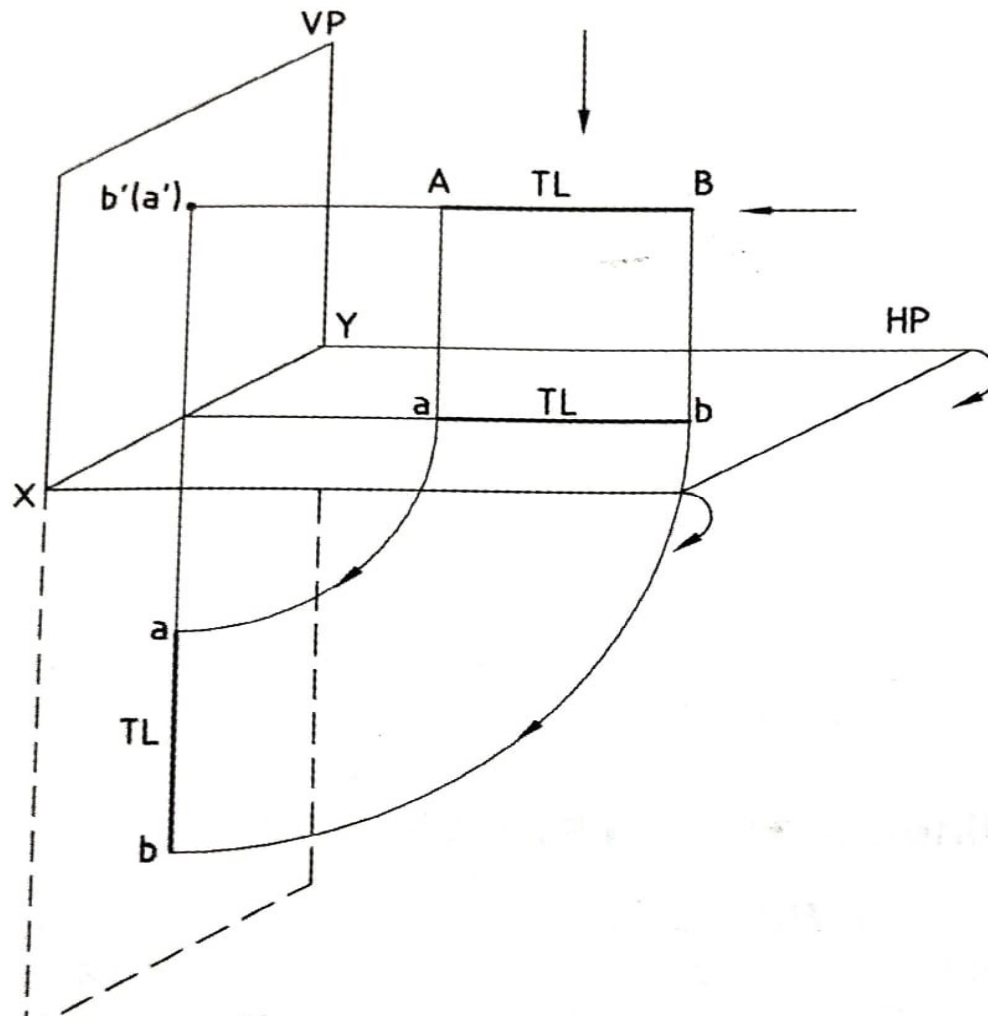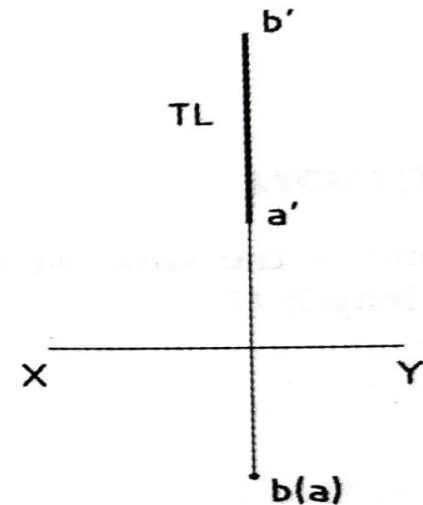
➢Type **ZOOM** Press Enter

➢Type **ALL** Press Enter

- ➢ Use **LINE** command (**ORTHO ON**) draw the Reference line **XY**.

- ➢ Use **POINT** command to locate the (**a'**)**b'** , **h** mm above the Reference line & From **b'** draw a Vertical line downward to locate **a** for given (**h+d**) mm distance.

- ➢ Use **LINE** command (**ORTHO ON**) to draw Vertical line downward from **a** for the given True length & name the end point as **b** .

- ➢ Use **Annotation** tool bar to mark the dimensions between reference line **XY** to (**a'**)**b'** & line **XY** to **a** & **a** to **b**

Straight Line Parallel to VP & Perpendicular to HP

When a line **AB** is **Parallel to VP** & **Perpendicular to HP**
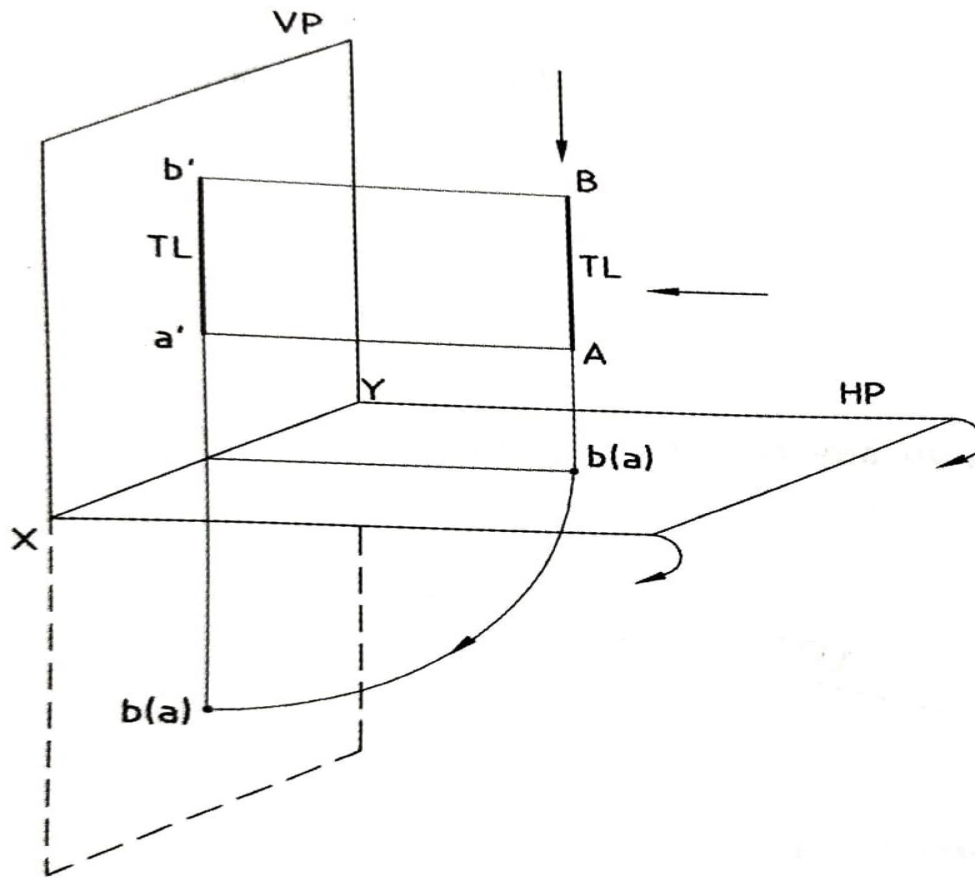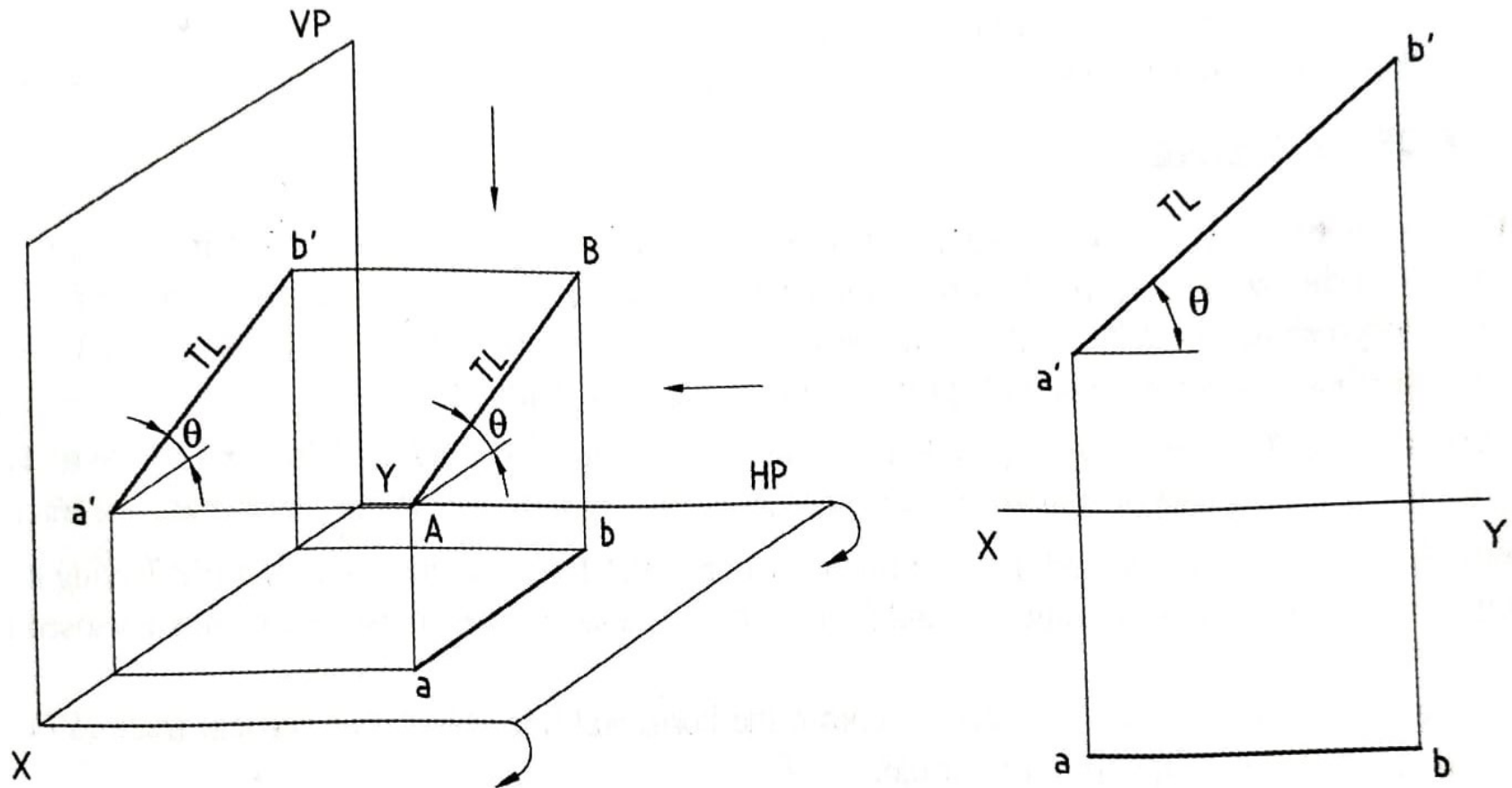
- ➢ Initial setup of workspace **Drafting & Annotation** Mode

  - ➢Type UN or **UNITS**

  - ➢Set the Precision for **0**

  - ➢Set the Units in Millimeters

- ➢Type **LIMITS** Press Enter

  - ➢Specify the Lower Left Corner as **0,0** Press Enter

  - ➢Specify the Upper Right Corner as **210,297** Press Enter

- ➢Type **ZOOM** Press Enter

- ➢Type **ALL** Press Enter

- Use **LINE** command (**ORTHO ON**) draw the Reference line **XY**.
- Use **POINT** command to locate the **a' h** mm above the Reference line & From **a'** draw a Vertical line for given True length upward to locate **b'**.
- Use **LINE** command (**ORTHO ON**) to draw Vertical line downward from **a'** for the given (**h+d**) mm & name the end point as **b(a)** .
- Use **Annotation** tool bar to mark the dimensions between reference line **XY** to **a'** & **a'** to **b'** & line **XY** to **b(a)**

Straight Line Inclined to HP & to Parallel VP

When a line **AB** is **Inclined to HP** & to **Parallel VP**

➢ Initial setup of workspace **Drafting & Annotation** Mode

  ➢Type UN or **UNITS**

  ➢Set the Precision for **0**

  ➢Set the Units in Millimeters

➢Type **LIMITS** Press Enter

  ➢Specify the Lower Left Corner as **0,0** Press Enter

  ➢Specify the Upper Right Corner as **210,297** Press Enter
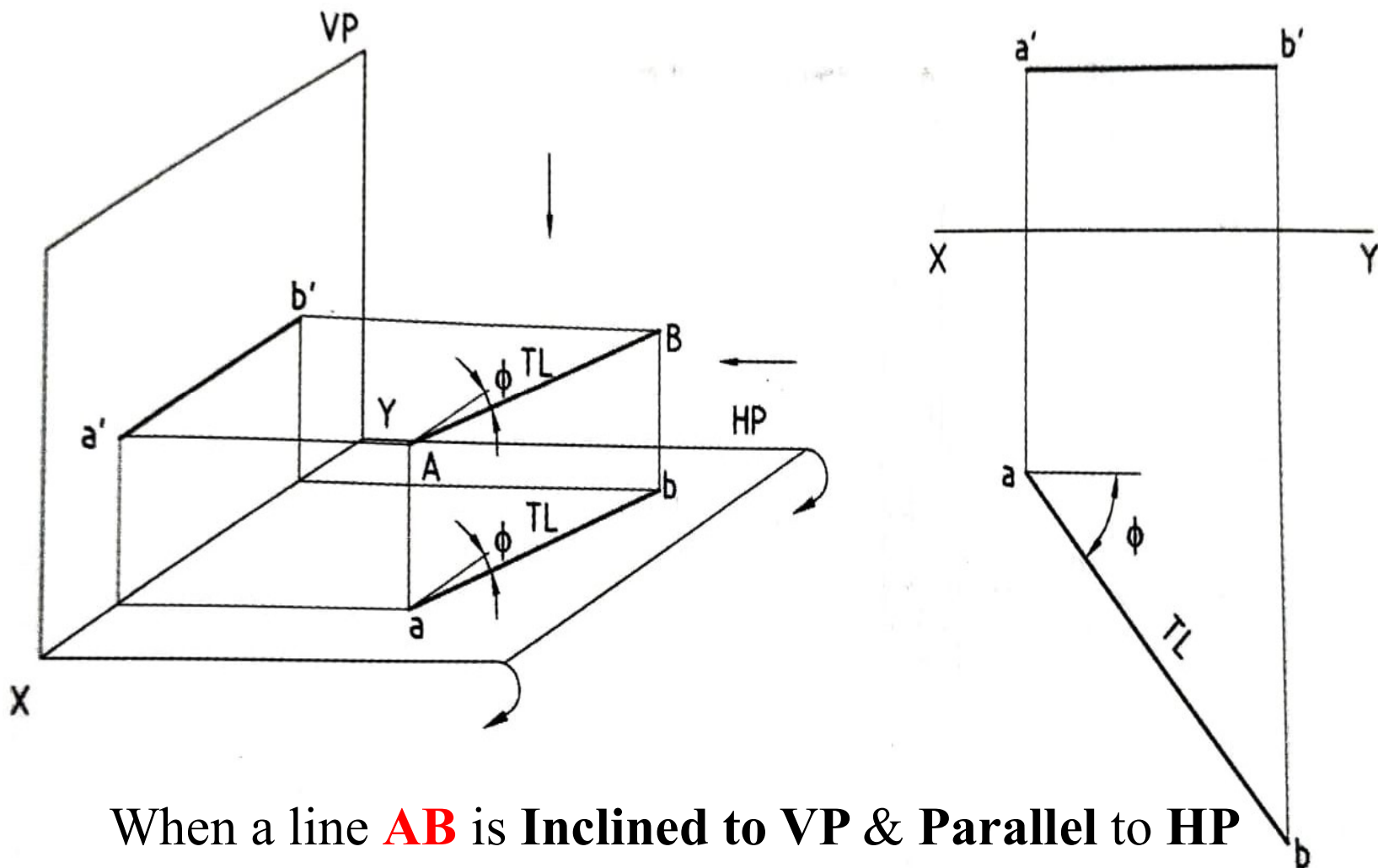
➢Type **ZOOM** Press Enter

➢Type **ALL** Press Enter

- Use **LINE** command (**ORTHO ON**) draw the Reference line **XY**.

- Use **POINT** command to locate the **a' , h** mm above the Reference line & From **a'** draw a Vertical line downward (**h+d**) mm to locate **a**.

- Use **LINE** command (**ORTHO OFF**) to draw inclined line from **a'** for the given **Ө** & name the end point as **b'**

- ➢ Use **LINE** command (**ORTHO ON**) draw a horizontal line from **a** & vertical line downward from **b'** to intersect the horizontal line drawn from **a** & name the intersecting point as **b** .

- ➢ Use **Annotation** tool bar to mark the dimensions between reference line **XY** to **a'** & **a'** to **b'** & measure the inclination angle of line **a'b'** wrt. **XY** line & **XY** to **a**.

Straight Line Inclined to VP & to Parallel to HP

When a line **AB** is **Inclined to VP & Parallel** to **HP**

- ➢   Initial setup of workspace **Drafting & Annotation** Mode

    - ➢ Type UN or **UNITS**

    - ➢ Set the Precision for **0**

    - ➢ Set the Units in Millimeters

- ➢ Type **LIMITS** Press Enter

    - ➢ Specify the Lower Left Corner as **0,0** Press Enter

    - ➢ Specify the Upper Right Corner as **210,297** Press Enter

- ➢ Type **ZOOM** Press Enter

- ➢ Type **ALL** Press Enter

➢ Use **LINE** command (**ORTHO ON**) draw the Reference line **XY**.

➢ Use **POINT** command to locate the **a' , h** mm above the Reference line & From **a'** draw a Vertical line downward (**h+d**) mm to locate **a**.

➢ Use **LIN**E command (**ORTHO OFF**) to draw inclined line from **a** for the given **Ø** & name the end point as **b**

➢ Use **LINE** command (**ORTHO ON**) draw a horizontal line from **a'** & vertical line upward from **b** to intersect the horizontal line drawn from **a'** & name the intersecting point as **b'** .

➢ Use **Annotation** tool bar to mark the dimensions between reference line **XY** to **a'** & **a** to **b** & measure the inclination angle of line **a b** wrt. **XY** line & **XY** to **a**.

REFERENCE BOOKS

➢ JEYAPOOVAN T, "ENGINEERING GRAPHICS AND DESIGN", 2023, Vikas Publishing House Pvt Ltd,

➢ K.V.NATARAJAN, "Engineering Graphics", 2015, Dhanalakshmi Publishers.