

GOVERNMENT POLYTECHNIC SHEOHAR



LABORATORY MANUAL

DEPARTMENT OF MECHANICAL ENGINEERING

FIRST SEMESTER

ENGINEERING DRAWING

SUBJECT CODE: P2425105

SESSION: 2025-28

TEACHING AND LEARNING SCHEME: -

Course Code	Course Title	Scheme of Study (Hours/Week)					
		Classroom Instruction (CI)		Lab Instruction (LI)	Notional Hours (TW+SL)	Total Hours (CI+LI+TW+SL)	Total Credits (C)
		C	T				
2425105	Engineering Drawing	3	-	4	2	9	6

COURSE OBJECTIVES

- To understand engineering drawing as a means of technical communication.
- To develop visualization and drafting skills for 2D and 3D objects.
- To apply standard drawing practices, symbols, and conventions.
- To prepare and interpret engineering drawings used in industry.

COURSE OUTCOMES

- **CO-1:** Use drawing instruments, drawing codes, dimensioning, conventions and symbols as per IS SP-46(2003) in engineering drawing.
- **CO-2:** Draw geometrical figures, engineering curves and scales.
- **CO-3:** Draw the orthographic projection of points, lines and planes under different conditions.
- **CO-4:** Draw orthographic views of sectioned and un-sectioned regular solids.
- **CO-5:** Draw isometric views of components directly or from orthographic projections.
- **CO-6:** Draw development of lateral surfaces of primitive solids.
- **CO-7:** Draw free hand sketches of engineering elements, their orthographic and isometric views.

LABORATORY SCHEDULE

DAY	1ST (10:00 AM- 11:00 AM)	2ND (11:00 AM- 12:00 PM)	3RD (12:00PM - 01:00PM)	4TH (01:00 PM- 02:00PM)	5TH (02:30 PM- 03:30PM)	6TH (03:30PM- 04:30PM)
MONDAY						
TUESDAY						
WEDNESDAY	ENGINEERING DRAWING LAB					
THURSDAY						
FRIDAY	ENGINEERING DRAWING LAB					
SATURDAY						

MR. KAPIL DEO KUMAR

Faculty In-charge

MR. Rohit Kumar

Instructor In-charge

General Instructions

- Always keep the drawing board, instruments, and workspace clean and properly arranged before starting the work.
- Handle sharp instruments such as compass, divider, and cutter carefully to avoid injury.
- Ensure that drawing sheets are properly fixed on the board using clips or pins to prevent slipping.
- Use pencils of appropriate grade (H, 2H, HB, etc.) and keep them well sharpened for accurate drawing.
- Avoid applying excessive force while using instruments to prevent damage to tools and drawing sheet.
- Maintain correct posture while drawing to avoid fatigue and ensure accuracy.
- Do not share or misuse instruments; use them responsibly and return them safely after use.
- Keep eraser and tools clean to avoid smudging and maintain neatness of the drawing.
- Follow standard BIS conventions and instructions while performing practical work.
- Avoid unnecessary movement and maintain discipline in the lab environment.
- Store all instruments properly in the instrument box after completion of work.
- In case of any injury or issue, inform the instructor immediately.

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Exp. No.	Experiment Name	Mapped CO	PO Mapping	PSO Mapping
Exp-I	Geometric Construction	CO1, CO2	PO1(3), PO4(3), PO5(2), PO6(1)	–
Exp-II	Conic Sections & Engineering Curves	CO2	PO1(3), PO4(3), PO6(1)	–
Exp-III	Orthographic Projection (Points, Lines, Planes)	CO3	PO1(3), PO2(1), PO3(1), PO4(3), PO6(1), PO7(2)	–
Exp -IV	Orthographic Projection of Solids	CO3, CO4	PO1(3), PO2(1), PO3(1), PO4(3), PO6(1), PO7(2)	–
Exp-V	Isometric Drawing	CO5	PO1(3), PO2(1), PO3(1), PO4(3), PO6(1), PO7(2)	–
Exp-VI	Orthographic to Isometric Conversion	CO4, CO5	PO1(3), PO2(1), PO3(1), PO4(3), PO6(1), PO7(2)	–
Exp-VII	Freehand Sketching	CO7	PO1(3), PO6(1), PO7(2)	–

Experiment-I

Geometric Construction

1) Name of Experiment: Geometric Construction

2) Practical Significance:

Geometric construction forms the fundamental basis of all engineering drawings. It develops accuracy, precision, and proper handling of drawing instruments. These skills are essential for preparing complex engineering drawings and design layouts used in industry.

2) Aim of Experiment:

To construct basic geometrical figures such as lines, circles, arcs, polygons, and tangents using standard drawing instruments.

3) Theory:

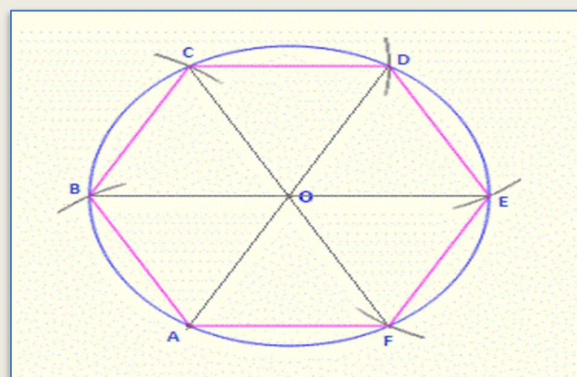
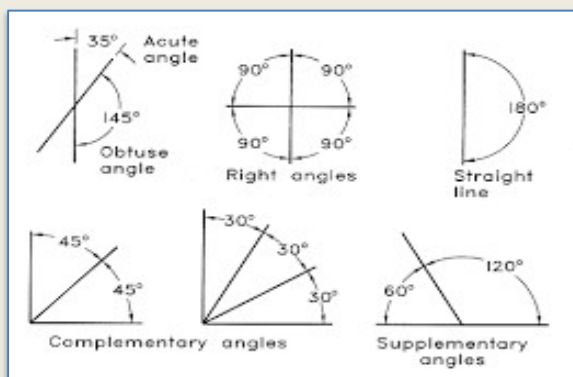
Geometric construction forms the foundation of engineering drawing. It involves accurate drawing of basic shapes using instruments while following standard conventions. These constructions are essential for developing complex engineering drawings.

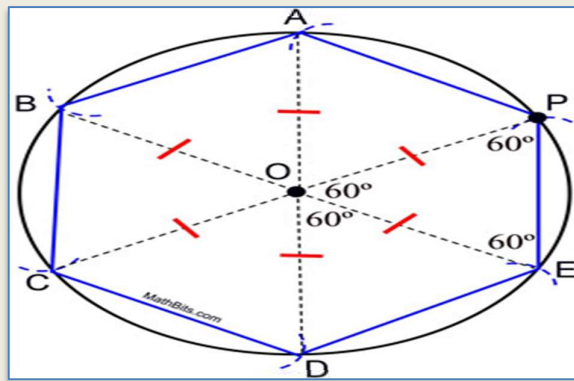
4) Apparatus Required:

Drawing board, T-square, set squares, compass, divider, protractor, pencils, eraser, drawing sheet.

5) Procedure:

1. Fix the drawing sheet on the board.
2. Draw different types of lines.
3. Construct circles and arcs using compass.
4. Draw polygons using standard methods.
5. Construct tangents and normals.





6) Conclusion:

Geometrical constructions were performed accurately using standard drawing instruments.

Conic Sections and Engineering Curves

2) Practical Significance:

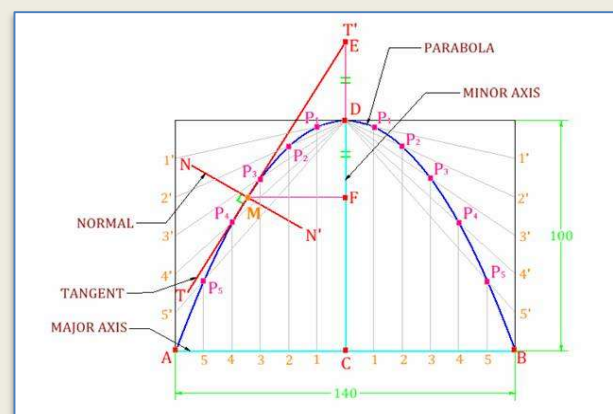
3) Aim of Experiment:

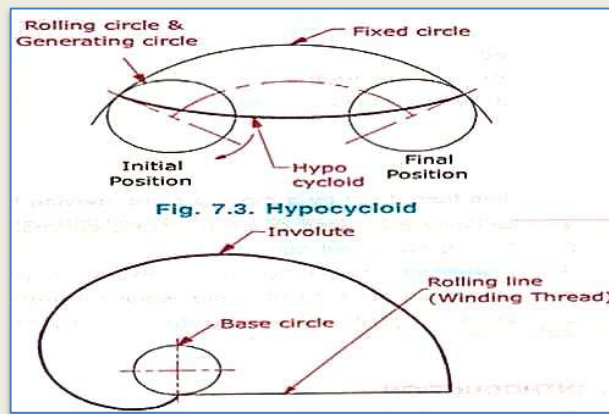
4) Theory:

5) Apparatus Required:

6) Methodology/Procedure:

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7) Conclusion:

Conic sections and engineering curves were constructed successfully.

Experiment III

Orthographic Projection of Points, Lines and Planes

1) Name of Experiment: Orthographic Projection of Points, Lines and Planes

2) Practical Significance:

Orthographic projection is essential for representing 3D objects in 2D views. This experiment develops the ability to visualize spatial relationships and is widely used in engineering drawings, manufacturing, and construction.

3) Aim of Experiment:

To draw orthographic projections of points, lines, and planes in different positions with respect to reference planes (HP and VP).

4) Theory:

Orthographic projection is a method used to represent three-dimensional objects in two-dimensional views by projecting them onto reference planes. The two principal planes are:

- **Horizontal Plane (HP)**
- **Vertical Plane (VP)**

The intersection of these planes is represented by the **XY reference line**.

- A **point** is projected as a single point in both views.
- A **line** may appear in true length or foreshortened depending on its inclination to HP and VP.
- A **plane** (like triangle, square, etc.) is represented by its projections, and its true shape is visible when it is parallel to a reference plane.

Orthographic projection follows **first angle projection method** as per BIS standards.

5) Apparatus Required:

Drawing board, T-square, set squares (45° , 30° – 60°), compass, scale, pencils (H, 2H), eraser, drawing sheet.

6) Methodology/Procedure:

1. Fix the drawing sheet properly on the drawing board.
2. Draw a horizontal **reference line (XY line)** to separate HP and VP.
3. **Projection of Point:**
 - Mark the given position of the point.
 - Draw its front view and top view based on its location in quadrant.

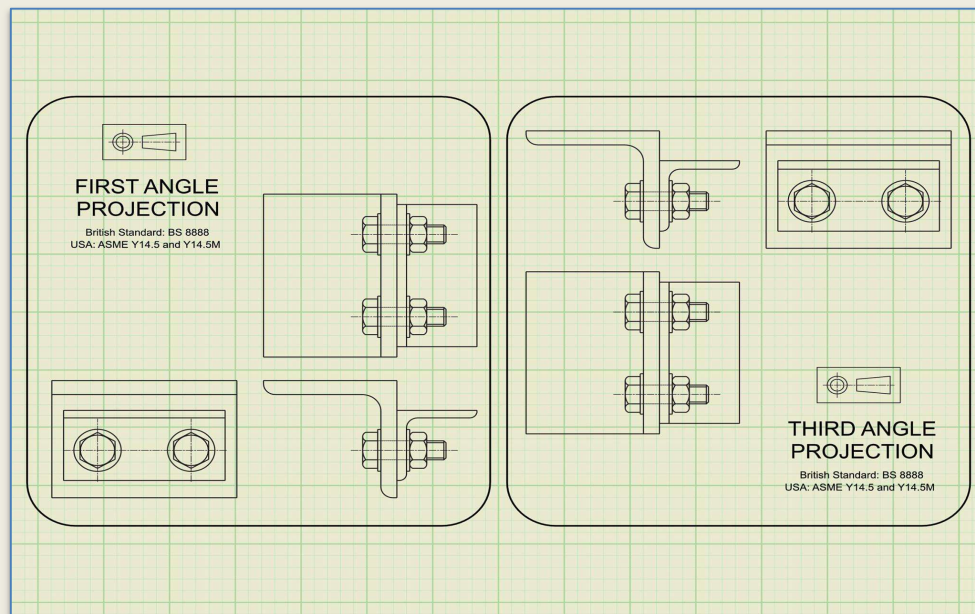
4. Projection of Line:

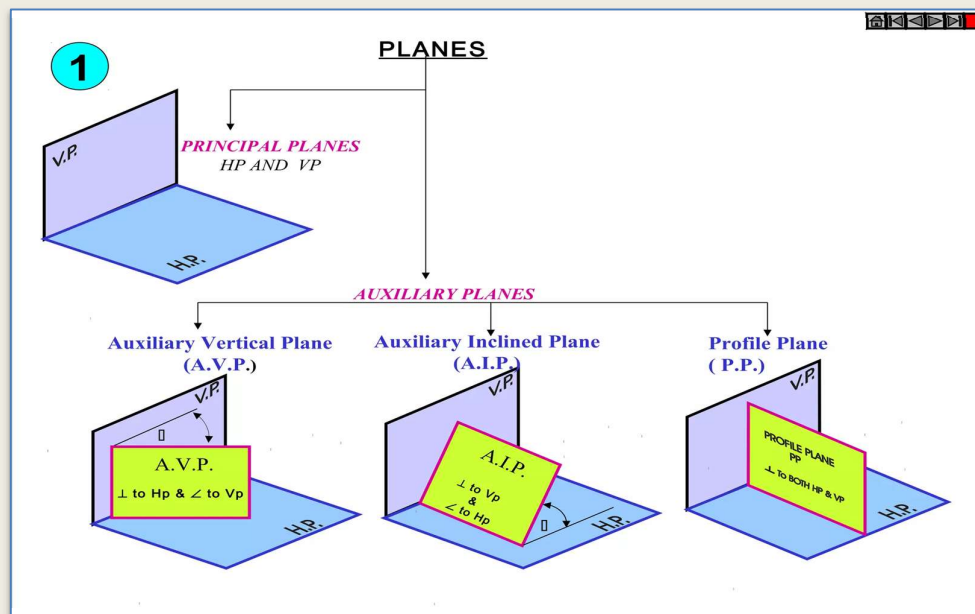
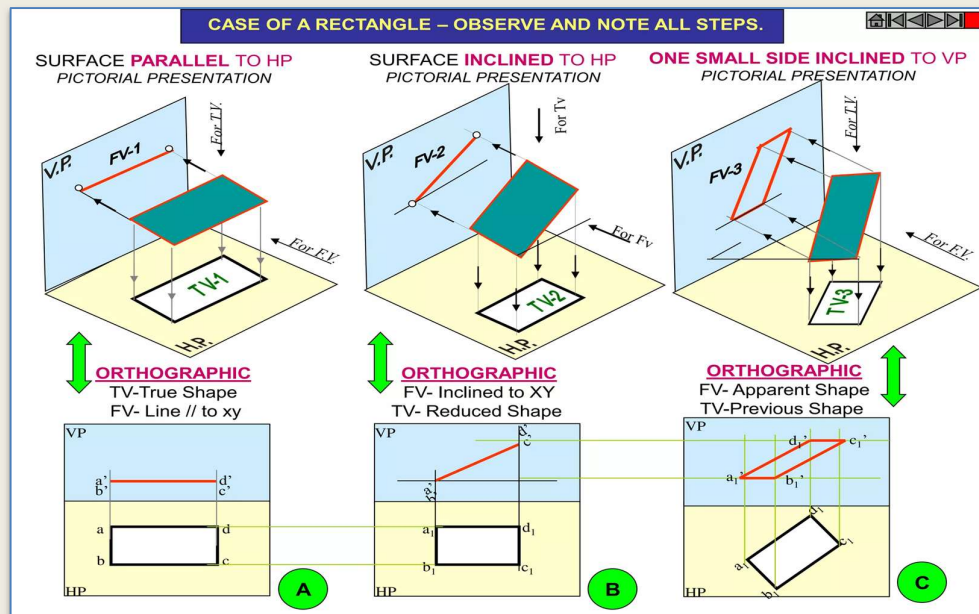
- Draw the line in given orientation (parallel, inclined, or perpendicular).
- Project its endpoints onto HP and VP.
- Join the projections to obtain front and top views.

5. Projection of Plane:

- Draw the given plane shape (triangle, square, etc.).
- Project all its corners onto HP and VP.
- Join the projected points to complete views.

6. Use proper dimensioning, labelling, and BIS conventions.





7) Conclusion:

Orthographic projections of points, lines, and planes were drawn accurately using first angle projection method, and their spatial positions with respect to HP and VP were clearly understood.

Experiment IV

Orthographic Projection of Solids

1) Name of Experiment: Orthographic Projection of Solids

2) Practical Significance:

This experiment enables students to represent solid objects in different views, which is crucial for manufacturing and assembly processes. It helps in understanding object geometry and improves technical communication skills.

3) Aim of Experiment:

To draw orthographic projections of different solids.

4) Theory:

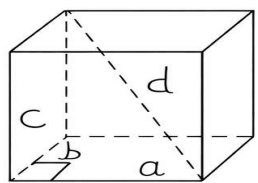
Solids such as prisms, pyramids, cylinders, and cones are represented in orthographic views to show their shape and dimensions clearly in engineering drawings.

5) Apparatus Required:

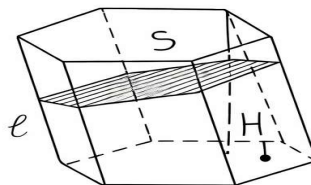
Drawing board, T-square, set squares, compass, pencils, eraser.

6) Methodology/Procedure:

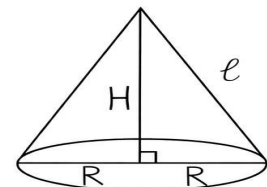
1. Draw projections of given solids.
2. Consider orientation of solids.
3. Complete front, top, and side views.



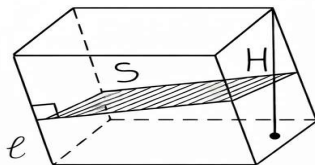
Rectangular parallelepiped



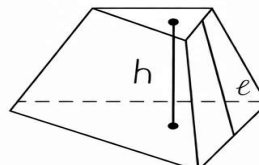
Inclined prism



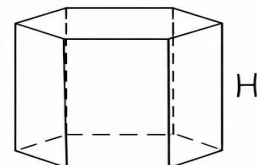
Cone



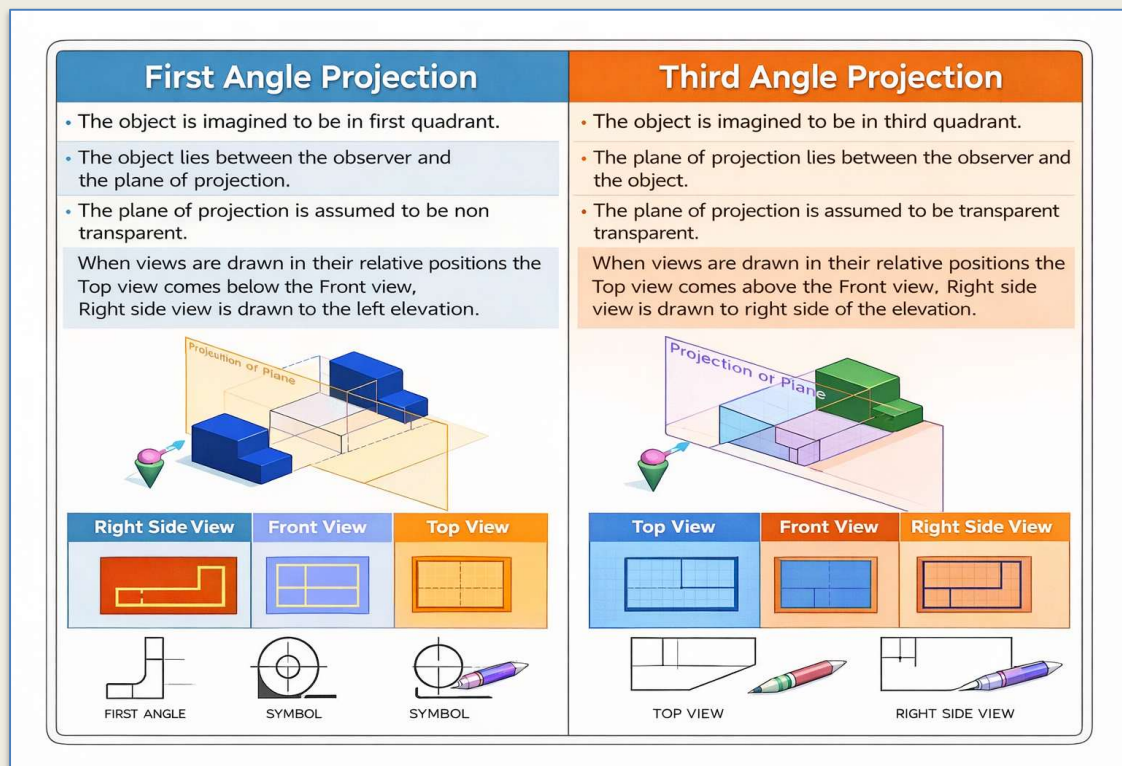
Inclined parallelepiped



Truncated pyramid



Direct Prism



7) Conclusion:

Orthographic views of solids were obtained correctly.

Experiment V

Isometric View of Simple Objects

1) Name of Experiment: Isometric View of Simple Objects

2) Practical Significance:

Isometric drawing helps in visualizing 3D objects clearly and is widely used in engineering design, presentation, and communication. It enables better understanding of object shape and structure compared to 2D drawings.

3) Aim of Experiment:

To draw the isometric view of simple objects containing plain and slant surfaces using correct proportions.

4) Theory:

Isometric drawing is a type of pictorial projection in which all three dimensions of an object are represented in a single view. In isometric projection, the three principal axes are equally inclined at 120° to each other, and dimensions are taken along these axes.

Unlike orthographic projection, isometric drawing provides a clear visualization of the object. Circles appear as ellipses, and all edges parallel to isometric axes are drawn in true length (in isometric view) or reduced length (in isometric projection).

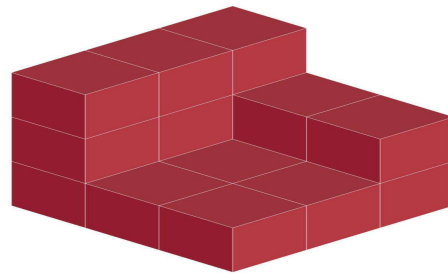
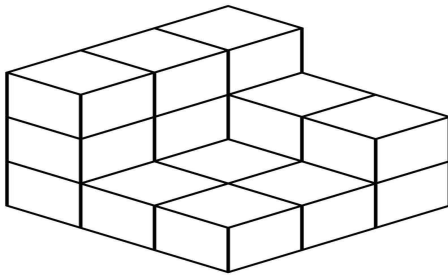
This method is widely used in engineering for visualization, design representation, and communication of ideas.

5) Apparatus Required:

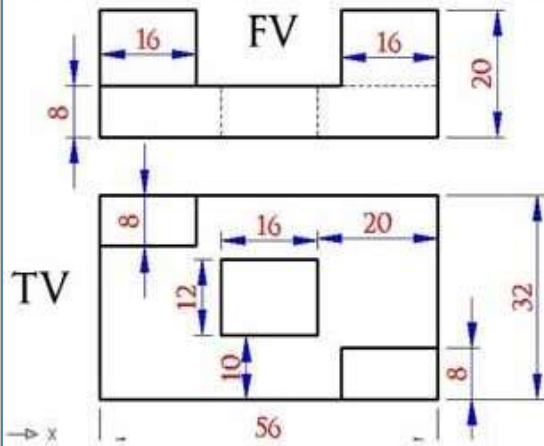
Drawing board, T-square, set squares (30° – 60°), scale, pencils (H, HB), eraser, drawing sheet.

6) Methodology/Procedure:

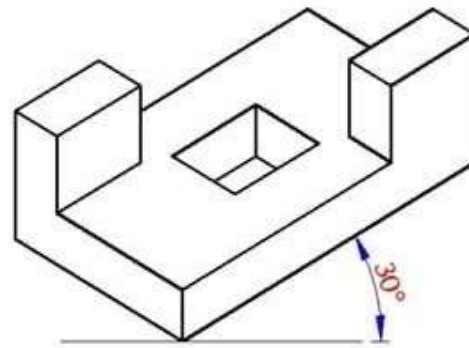
1. Fix the drawing sheet properly on the drawing board.
2. Draw the **isometric axes** (three axes at 120° using 30° – 60° set square).
3. If required, construct the **isometric scale**.
4. Draw a **box (enclosing rectangle)** to represent the overall dimensions of the object.
5. Construct the object inside the box using given dimensions.
6. For circular features, draw **isometric circles (ellipses)** using approximate methods.
7. Complete all edges and surfaces carefully.
8. Darken the final lines and erase construction lines.



ORTHOGRAPHIC PROJECTION



ISOMETRIC VIEW



6) Conclusion:

The isometric view of the given simple object was drawn accurately using correct proportions and standard drawing techniques.

Experiment VI

Orthographic to Isometric Conversion

1) Name of Experiment: Conversion of Orthographic Views into Isometric View

2) Practical Significance:

This experiment enhances the ability to convert 2D views into 3D representation, which is essential for design interpretation, modeling, and understanding complex components in engineering practice.

3) Aim of Experiment: To convert orthographic views into isometric view.

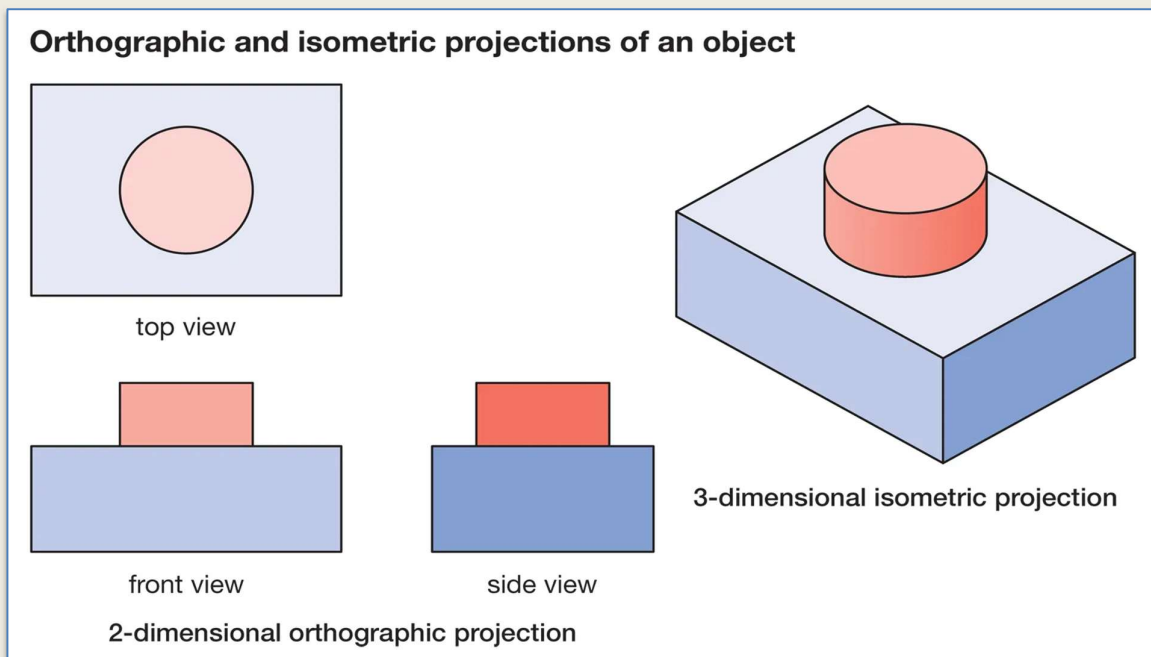
4) Theory: Conversion helps in visualizing 3D objects from 2D drawings, improving understanding of object geometry.

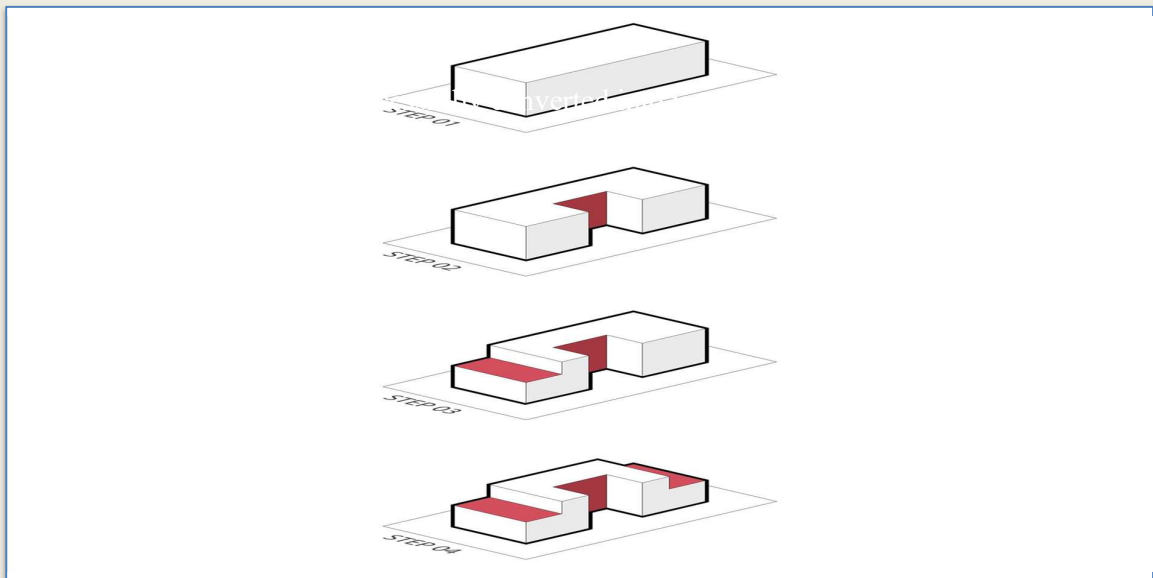
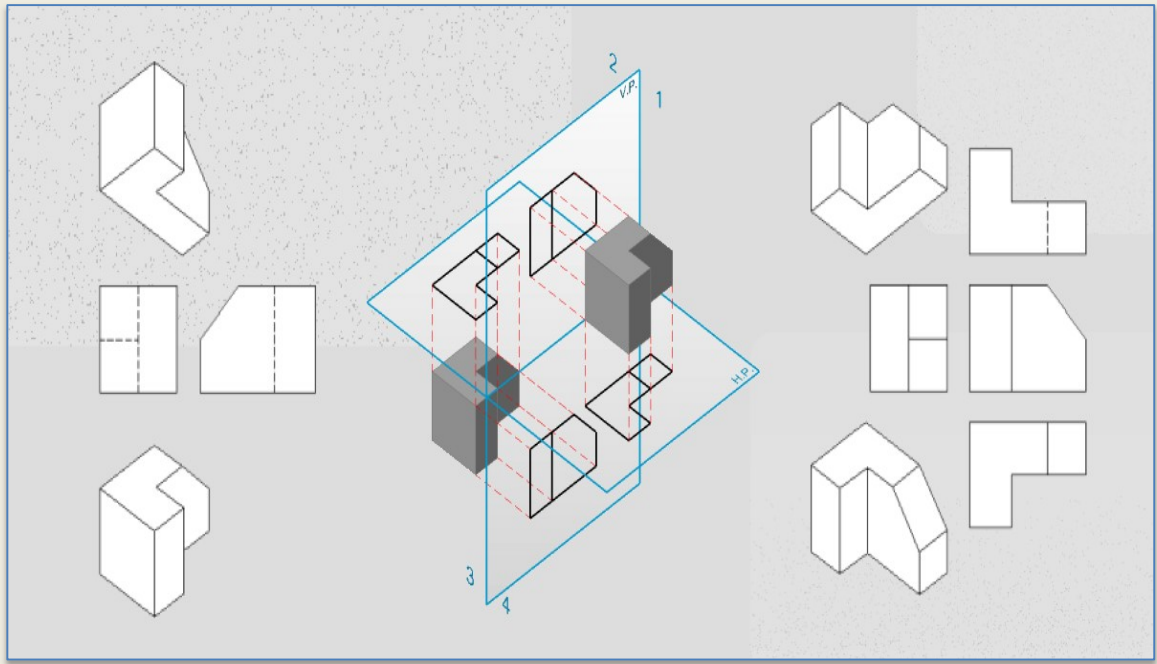
5) Apparatus Required:

Drawing board, set squares, pencils, eraser.

6) Methodology/Procedure:

1. Study given orthographic views.
2. Visualize object.
3. Draw isometric axes.
4. Construct isometric drawing.





7) Conclusion:

Orthographic views were successfully converted into isometric form.

Experiment VII

Free Hand Sketching of Engineering Elements

1) Name of Experiment: Free Hand Sketching of Engineering Elements

2) Practical Significance:

Freehand sketching is useful for quick representation of engineering ideas without instruments. It enhances visualization, creativity, and communication skills, especially during design discussions, site work, and field observations.

3) Aim of Experiment:

To draw freehand sketches of basic geometrical shapes and engineering components, and to represent their orthographic and isometric views without using drawing instruments.

4) Theory:

Freehand sketching is the technique of drawing objects without the use of instruments while maintaining correct proportions and shape. It is an essential skill for engineers to quickly communicate ideas, concepts, and designs.

Basic shapes such as lines, circles, rectangles, and arcs form the foundation of sketching. Engineering elements like nuts, bolts, washers, and simple machine parts can be represented through freehand sketches.

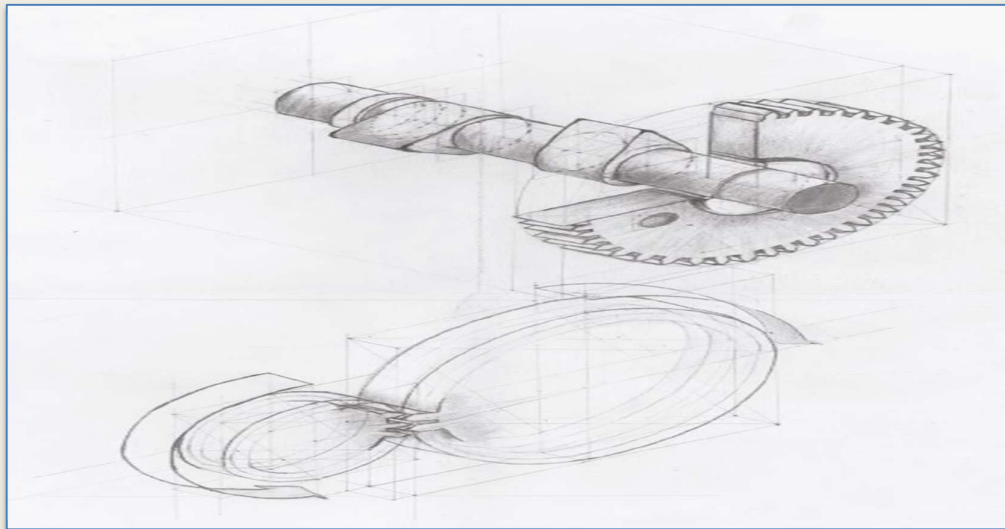
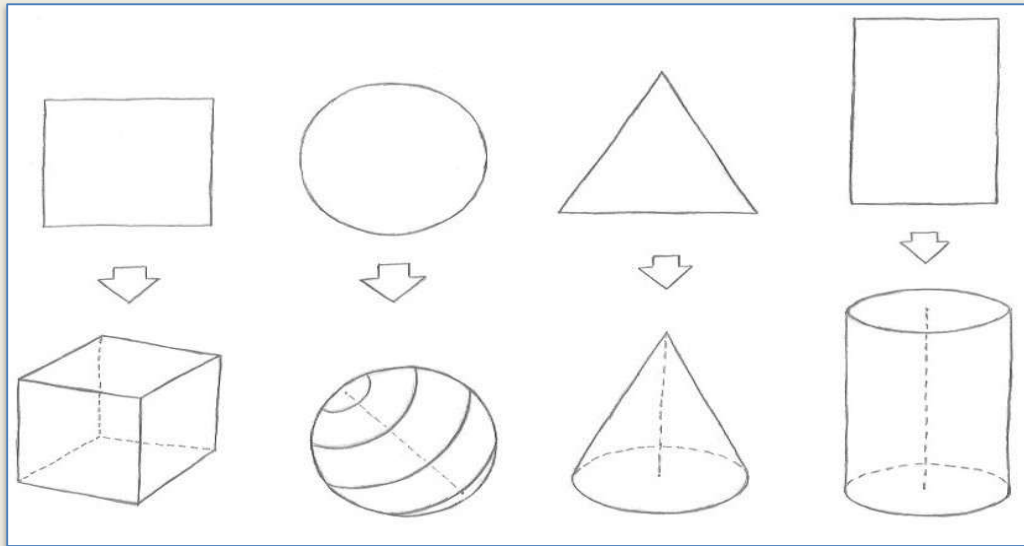
Freehand sketches can also be used to represent orthographic views (front, top, side) and isometric views of objects. Though not perfectly accurate, they should be neat, proportionate, and clearly understandable.

5) Apparatus Required:

Pencil (HB), eraser, sketchbook/drawing sheet.

6) Methodology/Procedure:

1. Observe the given object or component carefully.
2. Start with light freehand lines to outline basic shapes (square, rectangle, circle, etc.).
3. Maintain proper proportions while sketching.
4. Draw straight lines and curves smoothly without using instruments.
5. Sketch simple engineering components (nut, bolt, washer, etc.).
6. Draw orthographic views (front, top, side) of the object.
7. Draw isometric view of the same object.
8. Darken the final sketch and erase unnecessary lines.



7) Conclusion:

Freehand sketches of basic shapes and engineering components were drawn successfully with proper proportion and clarity.