Learning Objectives:

By the end of this lecture, students should be able to:

- 1. Understand the importance and application of scaling in technical drawings.
- 2. Differentiate between various projection methods (orthographic, axonometric).
- 3. Illustrate basic perspective drawing principles.
- 4. Apply appropriate scaling and projection techniques in engineering drawings.

I. Introduction to Engineering Drawings

- Engineering drawings are the universal language of engineers.
- Used to communicate ideas, fabrication specs, site layouts, etc.
- Need for clarity, accuracy, and consistency.

II. Scaling in Engineering Drawings

A. What is Scale?

- Scale is the **ratio** between the size of the drawing and the actual size.
- Used when objects are too large or too small to be drawn full-size.

B. Types of Scale

Scale Type	Description	Example
Full Scale	1:1 – Actual size	Small objects
Reduction Scale	1:n – Drawing is smaller	Buildings, roads
Enlargement Scale	n:1 – Drawing is larger	Machine parts, micro parts

C. Common Scales in Civil Engineering

- 1:100, 1:200 for site plans
- 1:50 for floor plans
- 1:20 or 1:10 for detailed sections

The ratio of the dimension of the object shown on the drawing to its actual size is called the Representative Fraction (RF).

$$RF = \frac{Drawing size of an object}{Its actual size}$$
 (in same units)

For example, if an actual length of 3 metres of an object is represented by a line of 15mm length on the drawing

$$RF = \frac{15mm}{3m} = \frac{15mm}{(3 \times 1000)mm} = \frac{1}{200} \text{ or } 1:200$$

If the desired scale is not available in the set of scales it may be constructed and then used.

Metric Measurements

10 millimetres (mm) = 1 centimetre(cm)

10 centimetres (cm) = 1 decimetre(dm)

10 decimetre (dm) = 1 metre(m)

10 metres (m) = 1 decametre (dam)

10 decametre (dam) = 1 hectometre (hm)

10 hectometres (hm) = 1 kilometre (km)

1 hectare = $10,000 \text{ m}^2$

III. Projections in Engineering Drawing (60 minutes)

A. Purpose of Projection

• Transferring 3D objects onto 2D surfaces (paper or screen).

B. Types of Projection

- 1. Orthographic Projection (most used in engineering)
 - Multiple 2D views (front, top, side) at right angles.
 - Standard arrangement:
 - Front view → Elevation

- Top view → Plan
- Side view → Profile

2. Axonometric Projection

- Shows object in 3D without distortion:
- o Types:
 - Isometric (all angles 120°)
 - Dimetric
 - Trimetric
- o Isometric is most commonly used in engineering.

3. Oblique Projection

- o Front face is in true shape; depth recedes at an angle (often 45°).
- o Less accurate for measurement but useful for visualization.

C. First Angle vs Third Angle Projection

Feature First Angle Third Angle
View placement Europe and Asia USA and Canada

Front View position Top view below front view Top view above front view

IV. Perspective Drawing (45 minutes)

A. What is Perspective Drawing?

- Shows objects as they appear to the eye.
- More **realistic**, used in conceptual stages, architecture, and presentations.

B. Types of Perspective

1. One-point perspective

- o One vanishing point on the horizon line.
- Useful for rooms, straight roads.

2. Two-point perspective

- o Two vanishing points.
- Used for showing corners, buildings.

3. Three-point perspective

- o Adds a vertical vanishing point.
- Used for skyscrapers or looking up/down tall objects.

C. Key Elements

- Vanishing Point: Where parallel lines converge.
- Horizon Line: Eye level of the observer.
- Ground Line: Base level where object rests.