بسم الله الرحمن الرحيم
Engineering Drawing

Textbook: Engineering Drawing

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Engineering Drawing Language communicates an idea or design using **Lines** to represent the **surfaces**, **edges** and **contours** of objects.
Engineering Drawing Applications (Importance)

- Mechanical Engineering
  Detailed drawing of a part that needs to be machined.
- Electrical Engineering
  A circuit schematic.
- Civil Engineering
  Plans for a bridge.

**Drawing Types:** A drawing can be done using freehand, instruments or computer methods.
Freehand Drawing

The lines are sketched without using instruments other than pencils and erasers.

Example
Drawing Instruments

Instruments are used to draw straight lines, circles, and curves concisely and accurately. Thus, the drawings are usually made to scale.

Example
Computer Drawing

The drawings are usually made by commercial software such as AutoCAD, solid works etc.

Example
# Standard Codes

<table>
<thead>
<tr>
<th>Country</th>
<th>Code</th>
<th>Full Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>USA</td>
<td>ANSI</td>
<td>American National Standard Institute</td>
</tr>
<tr>
<td>Japan</td>
<td>JIS</td>
<td>Japanese Industrial Standard</td>
</tr>
<tr>
<td>UK</td>
<td>BS</td>
<td>British Standard</td>
</tr>
<tr>
<td>Australia</td>
<td>AS</td>
<td>Australian Standard</td>
</tr>
<tr>
<td>Germany</td>
<td>DIN</td>
<td>Deutsches Institut für Normung</td>
</tr>
</tbody>
</table>

ISO: International Standards Organization
Drawing Tools

T-Square 🔄 Straight line 🔄 Triangles
Draw a Horizontal Line

1. Press the T-square head against the left edge of the table.

2. Smooth the blade to the right.
Draw a Horizontal Line

3. Lean the pencil at an angle about 60° with the paper in the direction of the line.

4. Draw the line from left to right while rotating the pencil slowly.
**Draw a Vertical Line**

1. Set T-square as before. Place any triangle on T-square edge.

2. Slide your left hand to hold both T-square and triangle in position.
Draw a Vertical Line

3. Lean the pencil to the triangle.

4. Draw the line upward while rotating the pencil slowly.
Draw a Line at 45° with Horizontal

1. Place 45° triangle on the T-square edge and press them firmly against the paper.

2. Draw the line in the direction as shown below.
**Draw a line at Angle 30° and 60°**

1. Place 30°-60° triangle on the T-square edge and press them firmly against the paper.

2. Draw the line in the direction as shown below.
Draw the lines at 15° increments

0 deg.
15 deg. = \(-30 + 45\) deg
30 deg.
45 deg. \{ Already demonstrated. \}
60 deg.
75 deg. = 30 + 45 deg
90 deg. \{ Already demonstrated. \}
Draw the Line Passing Through Two Given Points

1. Place the pencil tip at one of the points.
2. Place the triangle against the pencil tip.
3. Swing the triangle around the pencil tip until its edge align with the second point.
4. Draw a line.
Preparation the Compass

1. Sharpen the lead with a sandpaper.

2. Adjust the **needle** and the **lead** so that the tip of the needle extends slightly more than the lead.
Using the Compass

1. Locate the center of the circle by two intersecting lines.

2. Adjust the distance between needle and lead to a distance equal to radius of the circle.

3. Set the needle point at center.
Using the Compass

4. **Start circle.** Apply enough pressure to the needle, holding compass handle between thumb and index fingers.

5. **Complete circle.** Revolve handle **clockwise**.

Don't Use Circle Template
Drawing Tools

Adhesive Tape

Pencils

HB for thick line (0.7 mm or 0.5 mm)
2H for thin line &
3H or 4H for guiding lines
Drawing Tools

Pencil Eraser

French Curves

Erasing Shield
Drawing Tools

PROTRACTOR

Scale (ruler)
Drawing Tools

Note: Don’t use any template of:
- Circles.
- Ellipses.
- Letters.
Trimmed paper of a size A0 ~ A4.

Standard sheet size (JIS)

<table>
<thead>
<tr>
<th>Size</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4</td>
<td>210 x 297 mm</td>
</tr>
<tr>
<td>A3</td>
<td>297 x 420 mm</td>
</tr>
<tr>
<td>A2</td>
<td>420 x 594 mm</td>
</tr>
<tr>
<td>A1</td>
<td>594 x 841 mm</td>
</tr>
<tr>
<td>A0</td>
<td>841 x 1189 mm</td>
</tr>
</tbody>
</table>

(Dimensions in millimeters)
Scale is the ratio of the linear dimension of an element of an object shown in the drawing to the real linear dimension of the same element of the object.
Drawing Scales

Designation of a scale consists of the word “SCALE” followed by the indication of its ratio, as follow:

- SCALE 1:1 for full size
- SCALE X:1 for **enlargement** scales (X > 1)
- SCALE 1:X for **reduction** scales (X > 1)

Dimension numbers shown in the drawing are correspond to “true size” of the object and they are independent of the scale used in creating that drawing.

**Note:** Take scale as given to you, otherwise you must choose a suitable scale.
Orientation of Drawing Sheet

<table>
<thead>
<tr>
<th>Sheet size</th>
<th>c (min)</th>
<th>d (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A4</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>A3</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>A2</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>A1</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>A0</td>
<td>20</td>
<td>25</td>
</tr>
</tbody>
</table>

All Dimensions in mm
1. Place the paper close to the table’s left edge.

2. Move the paper until its lower edge place about the top edge of T-square.
3. Align the top edge of the paper with T-square blade.

4. Attach the paper’s corners with tape.
Fastening Paper to Drafting Board

5. Move T-square down to smooth the paper.

6. Attach the remaining paper’s corners with tape.
## Basic Line Types

<table>
<thead>
<tr>
<th>Types of Lines</th>
<th>Appearance</th>
<th>Name according to application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous thick line</td>
<td>—</td>
<td>Visible line</td>
</tr>
<tr>
<td>Continuous thin line</td>
<td>—</td>
<td>Dimension line</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extension line</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Leader line</td>
</tr>
<tr>
<td>Dash thick line</td>
<td>— — — — — — —</td>
<td>Hidden line</td>
</tr>
<tr>
<td>Chain thin line</td>
<td>— — — — — —</td>
<td>Center line</td>
</tr>
</tbody>
</table>
Meaning of Lines

**Visible lines** represent features that can be seen in the current view.

**Hidden lines** represent features that **cannot be seen** in the current view.

**Center line** represents symmetry, path of motion, centers of circles, axis of axisymmetrical parts.

**Dimension and Extension lines** indicate the sizes and location of features on a drawing.
Basic Sketching Line Types

Visible Object – Thick
Visible Edges and Outlines

- 0.7mm (HB)
- Thickness: 2-8mm
- Purpose: Visible Edges and Outlines

Hidden – Thin
Hidden detail for like wall thickness and holes..

- 0.3mm (2H)
- Thickness: 1-3mm
- Purpose: Hidden detail

Center - Thin
centre of a circle, cylindrical features, or a line of symmetry.

- 0.3mm (2H)
- Thickness: 15-20mm
- Purpose: Centre of a circle, cylindrical features, or a line of symmetry.
Line Types an Example

1. Visible
2. Hidden
3. Center
Example: Line conventions in engineering drawing

- **Dimension line** (Thin)
- **Extension line** (Thin)
- **Leader line** (Thin)
- **Center line** (Thin)
- **Visible line** (Thick)
- **R8**
- **50**
Centerline Conventions

"+" MARKS CENTER

Extend 5mm

LEAVE GAP WHEN EXTENDING VISIBLE LINE

CROSS VISIBLE LINE WITH LONG DASH
Intersection of Lines

Solid Line Intersections

Dashed Line Intersections

Gap
Hidden Line Conventions

(a) LEAVE GAP – DO NOT EXTEND VISIBLE LINE

(b) DASHES FORM "T" OR "L"

(c) PASS THROUGH GAP OR CUT DASH IN HALF

(d) DASHES MEET AT POINT

(e) STAGGER DASHES WHEN CLOSE TOGETHER
Example: Hidden Line Conventions

- CORRECT
  - A: No space
  - B: Join corners
  - C: Space
  - D: Join
  - E: Join
  - F: Start arc on center line
  - G: Do not intersect solid line
  - H: Do not intersect

- INCORRECT
Lettering
Text on Drawings

Text on engineering drawing is used:

- To communicate monographic information.
- As a substitute for graphic information, in those instances where text can communicate the needed information more clearly and quickly.

Thus, it must be written with

**Legibility**
- shape
- space between letters and words

**Uniformity**
- size
- line thickness
Example: Placement of the text on drawing

- Dimension & Notes
- Title Block
- Notes
Basic Strokes

Examples: Application of basic stroke

“I” letter

“A” letter

“B” letter

Upper-case letters & Numerals

Straight line letters

Curved line letters

Curved line letters & Numerals
**Lettering Standard**

**ANSI Standard**
- Use a text style, either inclined or vertical.
- Use all capital letters.
- Use 3 mm for most text height.

**This course**
- Use only a vertical text style.
- Same.
- Same. For letters in title block it is recommend to use 6 mm text height.
Lettering Rules

- **Vertical style.**
- **Always use capital letters.**
- **Use HB pencil or 0.5 mm mechanical pencil (for visible lines and 4H for guiding lines).**
- **Text height** (h=3~6 mm). (for most texts).
  - Tex Width (d): for h=3 mm → d=2 mm except letters (I, J, L, M, T, W) and number (1).
  - Also for h=6 mm; use the attached sheet.
- **Space between letters of** (h=3 mm) is (1 mm) and for letters of (h=6 mm) is (2 mm).
- **Space between words for** (h=3 mm) is (2 mm) and for (h=6 mm) is (4 mm).
Word Composition

Look at the same word having different spacing between letters.

A) Non-uniform spacing

B) Uniform spacing

Which one is easier to read?
Space between Letters

1. Straight - Straight
2. Straight - Curve
3. Straight - Slant
4. Curve - Curve
Space between Letters

5. Curve - Slant

6. Slant - Slant

7. The letter “L” and “T”
Example: Good and Poor Lettering

**GOOD**

Not uniform in style.

Not uniform in height.

Not uniformly vertical or inclined.

Not uniform in thickness of stroke.

Area between letters not uniform.

Area between words not uniform.

ESTIMATE

EstiMaTe

ESTiMaTE

ESTiMaTE

ESTiMaTE

ESTiMaTE

ESTiMaTE

ESTiMaTE

ESTiMaTE

ESTiMaTE

ABILITY WILL NEVER CATCH UP WITH THE DEMAND FOR IT
Sentence Composition

Leave the suitable space between words with respect to the letters height.

Example

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.
Title Block Drawing
Required H.W./ Next Week

1- Using grid paper, draw letters from A to Z:
- For h=3 mm.
- For h= 6 mm(as in sheet).

2- Using grid paper(scale 1:1), draw title block for (5) times.

Notes:
1- Always bring your text book with you.
2- Write your name on white paper of(100 mm x 50 mm)dimensions.
3- Not allowed to leave your board also not allowed to Metaphor for any instruments.
END