

## Intermediate Engineering Graphics

### 1<sup>st</sup> Week Lecture Notes

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## Topic: Sketching and Mechanical Drafting ABC

### 1<sup>st</sup> Subject: Tools, Lettering and Drawing Scales:

#### 1. Use of tools:

(1) Use **HB or F drawing pencil or a #2 writing pencil, light-blue lined quadrillo pad (1/4")**, and a **soft pencil eraser for all sketching assignments in these courses.**

(2) **Traditional drafting uses the following tools:** drawing board/table, drawing sheet, T-square, tape, erasing shield, dusting brush, pencil sharpener/pointer/sand paper, triangles (30°-60°-90°, and 45°-45°-90° combos), compass/dividers, protractor, French curves, templates (come with circles, ellipse, symbols, letters, etc), drafting machine (combo of T-square, scales, triangles and protractor).

(3) **Types of pencils used in drafting:** 4B, 3B, 2B, B (soft, for perspective drawings and shading); HB, F (for freehand sketching); 3H, 4H, 5H, 6H (hard, for construction lines); and mechanical pencils with leads of different diameters.

(4) **Types of Scales: Architect's scale:** comes with 3/32, 3/16, 1/8, 1/4, 3/8, 3/4, 1/2, 1 scales, 1 1/2, 3. Scales read either from left to right or from right to left. Commonly used scale for building is 1/4" = 1'. Marks on the other side of 0 mark designate smaller units. Used for architectural as well as general purposes.

**Mechanical engineer's scale** (comes with 1/8, 1/4, 1/2", and full size scale),

**Civil engineer's scale** (comes with inches divided into decimal parts: 10, 20, 30, 40, 50, and 60).

**Metric scale:** usually 150-300mm long. Scales: 1:2, 1:5, 1:10, 2:1, 5:1.

#### 2. Lettering Tips:

**Single-stroke Gothic** is the most common form used on drawings. Use the same style on the same drawings, NOT different styles (such as vertical and inclined) on the same drawing.

**For right-handed people**, form letters from left to right and from top to bottom. **For left-handed people**, form letters from right to left and from bottom to top (See "Blue Book p7-8).

### 2<sup>nd</sup> Subject: Types and Usage of Lines

**Visible line.** Thick, solid. Used to draw the outline of an object.

**Hidden line.** Thin, dashed. Used to show surfaces not normally seen.

**Dimension line.** Thin. Used to show extent of dimension with the dimension size written within or above the line.

**Extension line.** Thin. Extend out from the object; and used with dimension lines.

**Leader.** Thin. Points out the part to which a dimension or note refers.

**Center line.** Thin, long dashes separated by a short dash. Used to show center of an object.

**Cutting-plane line.** Thick. May be either long dashes or long dashes separated by two short dashes. Used to show an imaginary cut section through an object.

**Section line.** Thin, solid and drawn at an angle (normally 45 degree). Used to show cut surfaces in section view.

**Break line.** Thick for short breaks; thin for long breaks, solid. Used to show that part of an object has been removed.

**Phantom line.** Thin, long dashes separated by two short dashes. Used to show alternate position of a part.

### 3<sup>rd</sup> Subject: Systems of Measurement and Paper Sizes

**1. Systems of measurement or units used in drafting:** There are currently two systems of measurement units widely used in the world:

- (1) **Metric system** first adopted by France and based on the meter with other decimalized units (kilometer, millimeter, etc); The metric system is also called SI or International System, and is gradually coming into use in the United States, especially by many multinational corporations in the chemical, electronic and mechanical industries;
- (2) **The US Customary or British Imperial system** developed by England which includes inches, yards, feet, etc.

**Metric measurement is decimalized, or based on division by multiples of tens):**

1 km = 1,000m, 1m = 10 decimeter, 1 decimeter = 100cm, 1cm = 10mm

**Basic SI Metric Measurement System:** Kilogram (mass or weight), Kelvin (temperature), meter (length), mole (amount of substance), ampere (electrical current), candela (brightness of light), second (time). To help memorize these units, I use their abbreviation to come up with an acronym: **“KKMMacs”** (pronounced like Kaykay-am-max).

**Basic conversion of units to remember for this class:**

Length:	Area:
1 in = 25.4 mm	1 sq.in = 645.16
1 foot = 304.8mm	sq.mm
1 yard = 0.91m	1 sq.feet = 0.09
1 mile = 1.6km	sq.m
1 mm = 0.04 in	1 sq. yard = 0.84
1m = 1.09 yard	sq.m
1km = 0.62 mile	1 cm <sup>2</sup> = 0.16 sq.in
	1 m <sup>2</sup> = 1.2 sq.yard
	1 km <sup>2</sup> = 0.39
	sq.mile

**2. Metric and customary paper sizes:** each smaller size is obtained by dividing the longer sides of the preceding size by two

Size	US	Metric	Customary	USA Architectural
A0	E	841 x 1189 mm	34 x 44”	36 x 48”
A1	D	594 x 841 mm	22 x 34”	24 x 36”
A2	C	420 x 594 mm	17 x 22”	18 x 24”
A3	B	297 x 420 mm	11 x 17”	12 x 18”
A4	A	210 x 297 mm	8½ x 11”	9 x 12”

**3. Examples for drawing sheet layout:**

- (1) **Customary:** border line ½” from edge of drawing; title block 3/8” vertical space per line
- (2) **Metric:** border line 15mm from top, right and bottom edges of drawing sheet, 25mm from

left edge of drawing sheet; Title block 10mm vertical space per line (See “Blue Book” p95).

Title block can be placed on upper or lower right-hand corner.

## 4<sup>th</sup> Subject: Three Types of Drafting Jobs

### 1. Three types of drafting jobs:

Traditionally, engineer, designer, and architect make rough sketches, descriptions, and calculations of the first drawing of the product. Then the drafters prepares finished, detailed drawings, and figure the strength, quality amount and cost of materials. They are specialized in mechanical, electrical, or architectural fields, most work for private firms, and about one third work for engineering and architectural firms. Classification according to types of work: (1) **Tracer:** copies drawings made by others; (2) **Detailer:** makes detail and assembly drawings; (3) **Checker:** examines final drawings for errors.

Classification according to experience and level of responsibility: **Drafter, Senior drafter, Supervisor. Training needed to become a drafter:** technical institute, junior and community colleges, technical and vocational high schools, universities. Santa Ana College offers many courses tightly-related to market demands (refer to the College Catalog for details). Information on potential employment can be find through the internet, school Job Placement office, local Employment Development Department office, and non-profit civil groups and organizations. Santa Ana College also offers courses that teach how to find a job (talk with a councilor for course information).

## Study Questions

1. What type of pencil is used for perspective drawings and shading?
2. What type of pencil is used for freehand sketching?
3. What type of pencil is used for construction lines?
4. How to read the Architect’s scale? What scales does it come with?
5. What do marks on the other side of 0 mark on the Architect’s scale designate?
6. What scale does a mechanical engineer’s scale come with?
7. What does a civil engineer’s scale divided an inch into?
8. Usually, how long is a metric scale? And what scale does it come with?
9. What are the most common font and style used on drawings?

10. What is the normal way of forming letters for right-handed people, and for left-handed people?

11. What is an easy way to remember the following metric and customary paper sizes?

Size	US	Metric	Customary	USA Architectural
A0	E	841 x 1189 mm	34 x 44"	36 x 48"
A1	D	594 x 841 mm	22 x 34"	24 x 36"
A2	C	420 x 594 mm	17 x 22"	18 x 24"
A3	B	297 x 420 mm	11 x 17"	12 x 18"
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12. What are the two systems of units used in drafting, in what countries are they originally created?

13. How do they work?

14. What are the basic units in the SI Metric Measurement System, and how to remember them in an easy way?

15. Try do remember the basic conversion of units if you can:

Length:	Area:
1 in = 25.4 mm	1 sq.in = 645.16 sq.mm
1 foot = 304.8mm	1 sq.feet = 0.09 sq.m
1 yard = 0.91m	1 sq. yard = 0.84 sq.m
1 mile = 1.6km	1 cm <sup>2</sup> = 0.16 sq.in
1 mm = 0.04 in	1 m <sup>2</sup> = 1.2 sq.yard
1m = 1.09 yard	1 km <sup>2</sup> = 0.39 sq.mile
1km = 0.62 mile	

16. Try to remember these:

1 yard = feet, 1 foot = inches, 1 in = mm, 1 yard = m, 1 mile = km; and  
 1 km = m, 1 m = cm, 1 cm = mm