EF 101 Analysis & Skills
Module 1.2

Engineering Graphics - Introduction and Sketching Basics

Learning Objectives
(from Handbook and website)

Engineers tend to be very visually oriented and thus they like to communicate information and ideas in a visual manner. Just as equations and data are easier to communicate using graphs and charts, engineering designs are more easily communicated through sketches, drawing and pictures. In order to be effective in their communications, engineers have developed a "language" of graphics. As with any language, graphics has its own vocabulary, syntax, and grammar. As part of their formal education, engineers must learn the structure of the graphics language as well as its appropriate use and limitations.

Learning Objectives
(continued)

As part of the Engineering Fundamentals program, you will learn the basic structure of this graphics language. You will learn how to represent and interpret ideas based upon hand sketches and drawings of objects. Utilizing a Computer Aided Design (CAD) program called AutoCAD Mechanical Desktop, you will learn how to create computer models of these objects and how to create detailed working drawings based on these models. Finally, you will practice and utilize graphical communication skills by utilizing the graphics tools during completion of team projects.

Learning Objectives
(continued)

At the completion of EF101, students will:

• Be able to create oblique and isometric sketches of objects, represent normal, inclined, and oblique surfaces and features, create orthographic multi-view sketches of objects, and visualize object shapes and features based on two-dimensional representations.
• Understand basic drawing conventions and dimensioning techniques. Be able to create and interpret engineering drawings utilizing multi-view projections, dimensions, tolerances, notes, auxiliary views, detail views, and section views as appropriate.
• Be able to create computer models, using AutoCAD Mechanical Desktop, which completely and accurately represent objects.
Learning Objectives (continued)

- Learn generic concepts utilized in CAD such as coordinate systems, sketch planes, feature-based modeling, profiles, constraints, and assembly techniques.
- Be able to create and modify complex objects by using extrude, revolve, sweep, fillet, chamfer, hole, work point, work axis, and work plane features.
- Be able to create an associated working drawing from a computer model which includes orthographic views, isometric views, auxiliary views, detail views, section views, center lines, hidden lines, notes, and title block information.
- Be able to use CAD tools to produce drawings and images for inclusion in project reports.

Learning Objectives (continued)

- Be able to assemble multiple objects by defining geometric relationships such as mate, flush, and angle assembly constraints.
- Be able to establish parametric relationships between object dimensions and constraints.
- Become familiar with standard drawing practices and procedures.
- Be introduced to additional dimensioning and tolerancing concepts.
- Integrate all skills by completing the comprehensive documentation of a final project.

Examples of EF Projects

Assembly Example
Mechanical Design

Analysis

Process Design

Electrical Design
Piping Design

Site Layout

Documentation

Engineering “Language”
Engineering Communications

• Engineers communicate with words and pictures. BOTH are important.
• WORDS: reports, memos, presentations
• GRAPHICS: sketches, detail drawings, computer models, graphs, charts, rendered images (pictures).

Why and What?

• Why do we use sketching?
  To make a quick, graphic representation of an idea that can be easily communicated.
• How do we represent objects so that others will understand all essential features?
  Use a graphics “language”. It has its own rules and conventions so everybody can communicate.

How?

• How do we represent a real object (3D) on paper (2D)?
  The graphics language has conventions for different types of 2D “views.”
• How do we develop the skill to read representations made by other people?
  Understand the “language” and practice using it.

Assigned Reading – Chapter 1

• What does CAD stand for?
• According to the book, what are the three steps of the design process?
• What is an exploded view? Isometric view? Orthographic projection? Pictorial perspective?
• What is descriptive geometry?
Without Graphics

Make an ice scraper:
Generally in the shape of a 140x80x10 mm rectangular prism. One end is beveled from zero thickness to the maximum thickness in a length of 40mm to form a sharp edge. The opposite end is semicircular. A 20 mm diameter hole is positioned so the center of the hole is 40 mm from the semicircular end and 40 mm from either side of the scraper.

Sketch Types

Coordinate system!
• 3D Cartesian coordinate system.
• Three orthogonal axis (x,y,z)
• Right hand rule determines relationship between x, y, z.
• We can place and orient the coordinate system as desired - some are better than others.

With Graphics
Mechanical Desktop Viewing

Keypad 8 - isometric view

Desktop View toolbar
(rotate, shade, pan, zoom)

View->Display->Desktop Browser
Model and Drawing Tabs

In-class Practice

• Sketch an isometric view of an L shaped block on engineering paper.
  – Paper orientation
  – Scale
  – Placement on paper
  – Object orientation
  – Bounding box
  – Coordinate system

In-class Practice

• Sketch top, front, and right side views of a L shaped block on engineering paper.
  – Scale
  – Placement on paper
  – Which is front view
  – View spacing
  – View alignment
  – Coordinate system