

Western Technical College

## 10606113 Sketching & Auto CAD (Computer Aided Design) - Mechanical Design

### Course Outcome Summary

#### Course Information

<b>Description</b>	Students will learn the basics of design intent of a product/process through sketching and other technical communication skills. The course will develop the student's skill in readying engineering drawings including detail, assembly, welding, piping and electrical. Sketching instruction will be enhanced by disassembling, measuring and drawing the parts that make up an assembly. Students are simultaneously introduced to the concepts, commands and techniques used to create two-dimensional drawings using AutoCAD software. Development and improvement of skills through efficient use of the software is emphasized. The AutoCAD topics include draw and modify commands, display and inquiry commands, layering, annotating and symbol creation methods. Paper/model space, view ports and layouts are used for plotting. Development and improvement of skills through efficient use of the software is emphasized.
<b>Career Cluster</b>	Science, Technology, Engineering and Mathematics
<b>Instructional Level</b>	Associate Degree Courses
<b>Total Credits</b>	4

#### Textbooks

*Engineering Graphics Essentials with AutoCAD 2019*. Copyright 2019. Plantenberg, Kirstie. Publisher: Schroff Development Corporation. **ISBN-13:** 978-1-63057-191-7. Required.

#### Learner Supplies

Scientific calculator (recommend T1-36x Solar). **Vendor:** Campus Shop. Required.

#### Success Abilities

1. **Apply mathematical concepts.**
2. **Demonstrate ability to think critically.**
3. **Use effective communication skills.**

#### 4. Use technology effectively.

### Course Competencies

#### 1. Develop basic sketching skills for a mechanical drawing.

##### Assessment Strategies

- 1.1. through contribution to a classroom activity.
- 1.2. in written assignments.
- 1.3. in drawing assignments.
- 1.4. using a given set of blueprints, class notes and/or the class text.
- 1.5. by successfully completing a quiz or exam.
- 1.6. in the classroom or lab setting.

##### Learning Objectives

- 1.a. Define and use full, half, quarter english scales, metric scales, architectural scales, and engineering scales.
- 1.b. Identify and produce basic line types.
- 1.c. Use proper lettering techniques.
- 1.d. Draw basic geometric shapes utilizing geometric construction techniques.
- 1.e. Use proper symbology on a sketch.
- 1.f. Develop proper sketching techniques to convey neatness, knowledge, and an orderly disciplined mind.
- 1.g. Identify an orthographic drawing.
- 1.h. Develop an understanding of orthographic projection principles.
- 1.i. Apply orthographic projection principles in the creation of an engineering sketch.
- 1.j. Identify an isometric drawing.
- 1.k. Describe the purpose and function of an isometric drawing.
- 1.l. Develop the ability to produce an isometric sketch.
- 1.m. Identify a section view drawing.
- 1.n. Describe the purpose and function of a section view drawing.
- 1.o. Develop the ability to produce a section view drawing.
- 1.p. Identify an auxiliary view drawing.
- 1.q. Describe the purpose and function of an auxiliary view drawing.
- 1.r. Develop the ability to produce an auxiliary view drawing.
- 1.s. Apply basic dimensions to a sketch.
- 1.t. Add and dimension features (holes, counterbores, countersinks) on a sketch.
- 1.u. Demonstrate knowledge of various dimensioning practices ( datum, point to point, etc.).
- 1.v. Identify datum or reference points, lines or surfaces given datum or common point dimensions.
- 1.w. Define and differentiate types of limits or tolerances applied to dimensions.
- 1.x. Define and differentiate types of fits and allowances applied to dimensioned parts.

#### 2. Evaluate various types of mechanical drawing symbology.

##### Assessment Strategies

- 2.1. in written assignments.
- 2.2. in drawing assignments.
- 2.3. using a given set of blueprints, class notes and/or the class text.
- 2.4. in the classroom or lab setting.
- 2.5. by successfully completing a quiz or exam.

##### Learning Objectives

- 2.a. Identify the basic surface finish symbols.
- 2.b. Define the term datum and identify datum surfaces on engineering drawings.
- 2.c. Identify geometric dimension and tolerancing symbols.
- 2.d. Identify welding symbols.

#### 3. Explore the process whereby a technician begins analyzing a design problem. (Time Permitting)

### **Assessment Strategies**

- 3.1. through contribution to a classroom activity.
- 3.2. in written assignments.

### **Learning Objectives**

- 3.a. Identify primary factors the designer must consider in the design process which are significant to the product , process or system.
- 3.b. Identify the steps involved in the design process.
- 3.c. Discuss problem solving techniques and models used in various scientific applications.
- 3.d. Acquaint self with current trends in engineering and manufacturing (CE, CIM, CAD/CAM, reverse engineering etc.)

## **4. Utilize vendor catalogs, the internet, textbooks, etc to determine specifications and information for purchased parts.**

### **Assessment Strategies**

- 4.1. in written assignments.
- 4.2. in drawing assignments.
- 4.3. using a given set of blueprints, class notes and/or the class text.
- 4.4. in the classroom or lab setting.
- 4.5. by successfully completing a quiz or exam.

### **Learning Objectives**

- 4.a. Locate standard parts in vendor catalogs, internet or other sources
- 4.b. Identify critical dimensions and specifications inherent to the part
- 4.c. Use information to aid in the completion of engineering drawings

## **5. Interpret piping drawings and symbology. (Time Permitting)**

### **Assessment Strategies**

- 5.1. in a drawing assignment.
- 5.2. using a given set of blueprints, class notes and/or the class text.
- 5.3. in the classroom or lab setting.
- 5.4. by successfully completing an quiz or exam.

### **Learning Objectives**

- 5.a. Identify single line, double line and orthographic piping drawings.
- 5.b. Identify single line, double line and orthographic piping symbology.

## **6. Interpret electrical drawings and symbology.**

### **Assessment Strategies**

- 6.1. in a drawing assignment.
- 6.2. using a given set of blueprints, class notes and/or the class text.
- 6.3. in the classroom or lab setting.
- 6.4. by successfully completing a quiz or exam.

### **Learning Objectives**

- 6.a. Identify the four main types of electronic and electrical drawings.
- 6.b. Identify reference designator letters, numerical values of common electrical components.
- 6.c. Identify elements of an electrical schematic drawing.
- 6.d. Identify graphic symbols used for common electrical components.
- 6.e. Identify elements of wiring or connection drawings.
- 6.f. List and describe the four basic types of printed circuit boards.
- 6.g. Identify logic function symbols.

## **7. Dissect a mechanical assembly and reassemble.**

### **Assessment Strategies**

- 7.1. through contribution to a classroom activity.
- 7.2. in the classroom or lab setting.

### **Learning Objectives**

- 7.a. Describe the function of the assembly.
- 7.b. Question the design factors and process involved in the development of the assembly.

- 7.c. Disassemble the part using common hand tools.
- 7.d. Reassemble the part upon completion of analysis.

**8. Measure component parts of the assembly.**

**Assessment Strategies**

- 8.1. through contribution to a classroom activity.
- 8.2. in the classroom or lab setting.

**Learning Objectives**

- 8.a. Identify various measuring instruments (scale, micrometer, caliper).
- 8.b. Use measuring instruments to read dimensions of the components parts.

**9. Sketch the component parts in the assembly.**

**Assessment Strategies**

- 9.1. using a given set of blueprints, class notes and/or the class text.
- 9.2. in the classroom or lab setting.
- 9.3. by creating a portfolio of the work you have completed in this course for the integrated project.

**Learning Objectives**

- 9.a. Explain the views and/or type of drawing which best illustrates the components which make up the assembly.
- 9.b. Draw necessary views to fully describe the components which make up the assembly.
- 9.c. Add dimensions and annotation to the drawings adhering to industry standards.

**10. Acquaint self with the current release of software.**

**Assessment Strategies**

- 10.1. in drawing assignments.
- 10.2. using a given set of blueprints, class notes and/or the class text.
- 10.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.
- 10.4. by successfully completing a quiz or exam.

**Learning Objectives**

- 10.a. Describe the screen layout and user interface.
- 10.b. Interact with the screen using menu structure, toolbars, dialogue boxes, tool pallettes, windows and keyboard.
- 10.c. Select and follow appropriate commands to perform specific tasks.
- 10.d. Assess information from the info center and help menu.
- 10.e. Use commands to begin, edit, save and file drawings correctly.

**11. Create 2D part geometry using basic applications of AutoCAD.**

**Assessment Strategies**

- 11.1. in drawing assignments.
- 11.2. using a given set of blueprints, class notes and/or the class text.
- 11.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.
- 11.4. by successfully completing a quiz or exam.

**Learning Objectives**

- 11.a. Set up a drawing with the proper units, drafting settings, limits, etc. to achieve desired results.
- 11.b. Locate points utilizing various methods including coordinate entry, direct distance, screen cursor, etc.
- 11.c. Manipulate basic drawing operations to create desired shapes.
- 11.d. Use drawing aids and tools to create precision drawings (OBJECT SNAP).
- 11.e. Use the software tools to speed up point specification (DYNAMIC INPUT).
- 11.f. Use the software tools to locate points relative to other points in a drawing (TRACKING).
- 11.g. Apply both geometric and dimensional Parametric Constraints to a drawing.

**12. Modify 2D part geometry using basic applications of AutoCAD.**

**Assessment Strategies**

- 12.1. in drawing assignments.
- 12.2. using a given set of blueprints, class notes and/or the class text.
- 12.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.
- 12.4. by successfully completing a quiz or exam.

### **Learning Objectives**

- 12.a. Activate object selection modes to select entities for editing.
- 12.b. Operate the modify and edit commands to create and change drawings.
- 12.c. Utilize automatic editing features available in the software (GRIPS).

## **13. Use layers to organize drawings.**

### **Assessment Strategies**

- 13.1. in drawing assignments.
- 13.2. using a given set of blueprints, class notes and/or the class text.
- 13.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.
- 13.4. by successfully completing a quiz or exam.

### **Learning Objectives**

- 13.a. Create, modify, copy, delete layers utilizing the appropriate dialogue boxes.
- 13.b. Utilize layers, linetypes, color and lineweights in a drawing.
- 13.c. Manipulate display and plots by turning layers on/off, freeze/thaw, locking, etc.
- 13.d. Change the properties of an entity.

## **14. Utilize different drawing displays to view drawings.**

### **Assessment Strategies**

- 14.1. in drawing assignments.
- 14.2. using a given set of blueprints, class notes and/or the class text.
- 14.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.
- 14.4. by successfully completing a quiz or exam.

### **Learning Objectives**

- 14.a. Utilize the Zoom options to effectively view the drawing.
- 14.b. Use the Pan command for movement about your drawing.
- 14.c. Explore viewports, 3D vpoints and orbit features.

## **15. Use inquiry commands to obtain information about the drawing.**

### **Assessment Strategies**

- 15.1. in drawing assignments.
- 15.2. using a given set of blueprints, class notes and/or the class text.
- 15.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.
- 15.4. by successfully completing a quiz or exam.

### **Learning Objectives**

- 15.a. Calculate the area and perimeter of an object.
- 15.b. Use the ADD and SUBTRACT options in the AREA command.
- 15.c. Measure the distance between points.
- 15.d. Identify the location of a point.
- 15.e. Utilize appropriate commands to obtain information about an entity or drawing file.

## **16. Add annotation to an engineering drawing.**

### **Assessment Strategies**

- 16.1. in drawing assignments.
- 16.2. using a given set of blueprints, class notes and/or the class text.
- 16.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.
- 16.4. by successfully completing a quiz or exam.

### **Learning Objectives**

- 16.a. Add text to a drawing.
- 16.b. Change text using appropriate commands and/or dialogue boxes.
- 16.c. Create, modify, copy and delete text styles in a drawing.
- 16.d. Utilize the ANNOTATIVE options to achieve proper text sizes in viewports.
- 16.e. Use the table creation command.

## **17. Utilize proper commands to perform dimensioning.**

### **Assessment Strategies**

- 17.1. in drawing assignments.
- 17.2. using a given set of blueprints, class notes and/or the class text.
- 17.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.
- 17.4. by successfully completing a quiz or exam.

**Learning Objectives**

- 17.a. Interpret and use ANSI Y14.5 drafting standards and symbology on all drawing assignments.
- 17.b. Add numerical values to drawings utilizing the dimensioning commands.
- 17.c. Use the BASELINE and CONTINUE dimensioning options where applicable.
- 17.d. Utilize the MULTILEADER command to place local notes on a drawing.
- 17.e. Adhere to ANSI standards and use ANNOTATIVE dimensioning for proper text size and style.
- 17.f. Use the proper character codes to display symbols with dimensioning text. (MULTILINE TEXT OPTION)
- 17.g. Explore the quick dimension option.
- 17.h. Edit dimension placement using GRIPS and appropriate commands.
- 17.i. Edit dimension text and appearance on a drawing using the properties window and other appropriate commands.
- 17.j. Create, modify and copy dimension styles.

**18. Create symbols for multiple use in an engineering drawing.**

**Assessment Strategies**

- 18.1. in drawing assignments.
- 18.2. using a given set of blueprints, class notes and/or the class text.
- 18.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.
- 18.4. by successfully completing a quiz or exam.

**Learning Objectives**

- 18.a. Utilize the BLOCK command to create and save symbols.
- 18.b. Insert symbols and libraries into a drawing.
- 18.c. Modify a symbol and update the current block definition to reflect changes.
- 18.d. Copy symbols from one drawing file to another using the appropriate dialogue box.
- 18.e. Use tool pallettes effectively including, creating, renaming, deleting them and setting up the desired properties.
- 18.f. Set up tool pallettes with symbology used in the drawing.

**19. Add section patterns to an engineering drawing.**

**Assessment Strategies**

- 19.1. in drawing assignments.
- 19.2. using a given set of blueprints, class notes and/or the class text.
- 19.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.
- 19.4. by successfully completing a quiz or exam.

**Learning Objectives**

- 19.a. Acquaint self with the hatch patterns available in the software.
- 19.b. Add hatch patterns to selected area utilizing the pick point or select object methods.
- 19.c. Set the proper scale factor for hatch patterns.

**20. Utilize layouts and viewports for plotting.**

**Assessment Strategies**

- 20.1. in drawing assignments.
- 20.2. using a given set of blueprints, class notes and/or the class text.
- 20.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.
- 20.4. by successfully completing a quiz or exam.

**Learning Objectives**

- 20.a. Set up layouts using titleblocks and viewports.
- 20.b. Differentiate between paper/model space.
- 20.c. Apply appropriate scale and visibility to the viewport.
- 20.d. Use dimension styles and proper techniques to dimension and annotate a drawing in paper/model space.
- 20.e. Produce hard copy plots with multiple viewports at various scale factors.

**21. Operate output devices.**

**Assessment Strategies**

- 21.1. in drawing assignments.
- 21.2. using a given set of blueprints, class notes and/or the class text.
- 21.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.

**Learning Objectives**

- 21.a. Set the proper parameters in the print dialogue box to obtain proper results.
- 21.b. Set up and operate the printer/ plotter.
- 21.c. Print scaled, hard copies of drawing assignments.

**22. Create 2D working drawings utilizing sketching and AutoCAD skills and techniques.**

**Assessment Strategies**

- 22.1. in drawing assignments.
- 22.2. using a given set of blueprints, class notes and/or the class text.
- 22.3. in the lab setting utilizing the computer and most recent release of AutoCAD software.
- 22.4. by successfully completing a quiz or exam.

**Learning Objectives**

- 22.a. Examine and use the terminology related to working drawings, i.e. detail drawings and assembly drawings. etc.
- 22.b. Create an assembly drawing from part files.
- 22.c. Describe the function of an item list or bill of material (BOM) in an assembly drawing.
- 22.d. Explain when and where exploded assembly drawings are used.
- 22.e. Utilize CAD commands and sketching techniques to produce the necessary views to describe the part to be manufactured.
- 22.f. Utilize CAD commands and sketching techniques to add the dimensions and specifications required to manufacture the part.
- 22.g. Utilize CAD commands and sketching techniques to produce a bill of material list.
- 22.h. Apply visible or hidden attributes to blocks. (Time Permitting)
- 22.i. Edit attributes defined for existing blocks. (Time Permitting)

**23. Accept responsibility for attending class and completing all learning activities.**

**Assessment Strategies**

- 23.1. Attending lecture and lab with no unexcused absences.
- 23.2. Obtain missed information and assignments from other students and/or instructor.
- 23.3. Read missed technical information.
- 23.4. Make up excused lab time.

**Learning Objectives**

- 23.a. Develop good work habits.
- 23.b. Fulfill job expectations and requirements.

**24. Cooperate and establish a good working relationship with the instructor and other students in the class.**

**Assessment Strategies**

- 24.1. By presenting ideas to others in group.
- 24.2. By completing assigned tasks within group.

**Learning Objectives**

- 24.a. Help group members understand and complete assigned tasks.
- 24.b. Identify roles and responsibilities of individual group members.
- 24.c. Respect the ideas and opinions of others.