# ADVM 0064 - COMPUTER-AIDED 2D DESIGN

## Catalog Description

Formerly known as WELD 64
Hours: 90 (36 lecture, 54 laboratory)
Description: Study of Computer Numerically Controlled (CNC) cutting systems in the 2D world using industry standard hardware and development software. Topics include design principles, copyright, selection of materials, billing of materials and job estimating, basic G and M code commands, use of consumables, cut quality evaluation, and trouble-shooting techniques. (not transferable)

## Course Student Learning Outcomes

- CSLO #1: Demonstrate safety and process in a learning and work site environment of Plasma Arc Cutting in personal protection standpoint and safety as related to equipment process.
- CSLO #2: Define terms related to this course: abrasive, units of pressure, x - y - z planes, dross, cut quality, nesting, linked images, copyright.
- CSLO #3: Produce design files to cut line files, and demonstrate performance delivered from producing an assigned student project.

## Effective Term

Fall 2022

## Course Type

Credit - Degree-applicable

## Contact Hours

90

## Outside of Class Hours

72

## Total Student Learning Hours

162

## Course Objectives

Lecture Objectives:
1. Overview of Computer Numerically Controlled material cutting and shaping methods and identification of CNC cutting equipment.
2. Identify and describe the purposes of software tools used to create design.
3. Demonstrate the differences between raster and vector images.
4. Explain the difference between positive and negative cut designs.
5. Explore basic principles to create cutting patterns using shape and text tools.
6. Import and convert raster images for use in developing cut patterns.
7. Analyze objective and audience for cut design and choose appropriate font.
8. Describe the factors that determine sign readability.
9. Examine copyright rules related to original artwork.
10. Develop a notebook documenting design process of cut designs.
11. Compare robotic metal-cutting systems and methods.
12. Outline and study how plasma torches, water jet or lasers cut metal.
13. Identify and describe the purpose of the components of the CNC system and torch.
14. Analyze all consumable parts and assess viability of safety using each part.
15. Articulate the ways that torch settings and cut path settings affect cut quality.
16. Develop trouble-shooting methodology to utilize when correcting cutting errors.
17. Identify dangers of cutting certain types of metal using Plasma Arc or Laser.
Laboratory Objectives:
1. Employ safe working methods and construct safe working environmental conditions.
2. Use vector-based software to create cut patterns.
3. Plan and modify text and images to hold together the part after cutting is complete.
4. Modify vector files to create tool cutting-line files.
5. Modify tool cutting-line files to create G code files for CNC.
6. Observe test cut process and evaluate cut quality; determine changes needed to improve cut quality.
7. Monitor plasma, water jet, or laser operation and warning lights.
8. Use computer file management and consistent file-naming conversions to manage each different file format for each project assigned.
9. Research and apply online resources for troubleshooting techniques specific to Plasma torches, and other cutting processes utilizing CNC.
10. Evaluate and __critique__ finished cut pieces for cut quality and structural integrity.
11. Monitor and correct torch errors during cutting operation.
12. Monitor and adjust cut speed of travel during cutting operation.
13. Operate computer, electronics, and mechanical systems during cutting sessions.
14. Utilize good nesting practices in layout of material.

## General Education Information

- Approved College Associate Degree GE Applicability
- CSU GE Applicability (Recommended-requires CSU approval)
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)

## Articulation Information

## Methods of Evaluation

- Objective Examinations
  - Example: Students will complete an online test on personal protective equipment needed for plasma cutting and safe use of electricity and metal handling used in robotic plasma cutting. Standard Grading
- Projects
  - Example: Students will create a course binder that includes project information completed throughout the semester to include: sketches, rough drafts, and final printouts. Additional project materials such as copyright permissions, costing estimates, cutline checklists, cut process forms, and self-evaluations will increase the student's grade on the assignment.
- Skill Demonstrations

- Example: Students will demonstrate the ability to use vector-based software to create cut patterns. Grading based on industry standard.

## Repeatable

No

## Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. With instructor demonstration and oversight, students will observe, evaluate and modify machine settings to improve cut quality, then safely cut original designs in sheet metal.

Lecture:

1. Following lecture and presentation, instructor will divide students into groups to participate in collaborative lab group exercises using image and font software tools to create vector-based images. Instructor will then lead a class discussion designed to analyze and critique the results of finished lab project. (Lecture Objective 2)
2. Following class lecture and video presentation, students will participate in a discussion designed to identify and describe components in the CN system.

Distance Learning

1. Following a brief introduction video and reading assignment on plasma torches, water jets, and lasers, students will compare and contrast what cutting process they would use for cutting 1-inch-thick mild steel with tolerances plus or minus .065". Students must consider accuracy requirements, set-up costs, running costs, operator costs, equipment limitations, proximity of equipment, edge finish, and clean-up costs. Students shall share on the discussion board both with students and the instructor, why they would select a certain cutting process for the required job.

## Typical Out of Class Assignments Reading Assignments

1. Read online training materials from Hypertherm Plasma Torch website and be prepared to discuss in class. 2. Read chapter on choosing font styles for image design. Prepare a chart depicting the various styles.

## Writing, Problem Solving or Performance

1. View, analyze, and discuss the purpose of copyright and describe the three methods of appropriately using copyrighted material in original art as described in the videos Copyright: Forever Less One Day and Copyright Basics. 2. Use CorelDraw to draw shapes and use shape editing methods to create a shelf bracket, export and convert the image file to Torchmate-CAD, and use the robotic plasma torch to cut the project. Self-evaluate finished cut in writing based on kerf verticality, dross amount and ease of removal, and design effectiveness.

## Other (Term projects, research papers, portfolios, etc.)

Create and manage project portfolio of all project processes, design sketches, and resulting evaluations.

## Required Materials

- Welding Principles and Practices
  - Author: Edward R. Bohnart
  - Publisher: McGraw-Hill
  - Publication Date: 2018
  - Text Edition: 5th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Non-Designer's Design Book, The
  - Author: Robin Williams
  - Publisher: Peachpit Press
  - Publication Date: 2012
  - Text Edition: 3rd
  - Classic Textbook?:
  - OER Link:
  - OER:
- Introduction to Robotics: Mechanic and Control
  - Author: John J. Craig
  - Publisher: Pearson Education
  - Publication Date: 2008
  - Text Edition: 3rd
  - Classic Textbook?:
  - OER Link:
  - OER:
- The CNC Cookbook
  - Author: E. Hess
  - Publisher: Scited
  - Publication Date: 2009
  - Text Edition: 1.0.1
  - Classic Textbook?:
  - OER Link:
  - OER:

## Other materials and-or supplies required of students that contribute to the cost of the course.

Thumb drive