ADVM 0067 - CNC MACHINING LEVEL 2

Catalog Description

Formerly known as WELD 67
Prerequisite: Completion of ADVM 66 with grade of "C" or better
Hours: 90 (36 lecture, 54 laboratory)
Description: Applications using multi-axis CNC machining. Developing complicated part geometry with Computer Aided Design (CAD), importing files, planning machine operations, and developing machine codes by Computer-Aided Machining (CAM) with multi-axis focus. Includes simulation modeling used to proof the assigned laboratory exercises and set-up for 3+2 and 4th and 5th axis operation of CNC machining centers. (not transferable)

Course Student Learning Outcomes

- CSLO #1: Demonstrate safety standards with 4th and 5th axis equipment for both a learning lab environment and worksite environment including workholding safety.
- CSLO #2: Explain and apply the use of following terms: work holding, trunnion table, incremental coordinates, Optical comparator, intuitive programming, dynamic work offsets, additional axis A & B along with X-Y-Z, and quadrant.
- CSLO #3: Demonstrate CAM assigned project(s) through program development to create G and T code to manufacture assigned multi-axis parts.

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:
1. Identify safe work expectations when using CNC equipment
2. Outline CAM process to create finished part
3. Determine work development process
4. Explain work holding
5. Identify industry machining coordinate systems
6. Explore tolerances and metro-logy standards
7. Compare process when different material are specified
Laboratory:
1. Apply shop safe practices
2. Prepare CAD process for creating CAM application render assigned project;
3. Develop program operation - dry run and modeling using computer assisted programming;
4. Demonstrate CNC machining center set-up and operation using created design
5. Compare and practice applications of metro-logy
6. Analyze and compare CAD specifications with completed part geometry and provide logical recommendations for corrections

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 take a multiple-choice and fill-in examination on G-code. Standard Grading. Example; List the G-Codes for the four common hole operations.
- Projects
  - Example: Successfully demonstrate the ability to process and plan a project through the lab until completion. Using CAM application, proofing code in simulation, perform machining from raw stock to completed part, meeting specifications assigned in the course.
- Skill Demonstrations
  - Example: Demonstrate competency in CAM design and manufacturing by successfully creating programming code that proofs out with no mistakes in simulation.

Repeatable

No

Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. Laboratory demonstration of workholding procedures to verify safe machining of multi-axis parts. Students are expected to experience and perform workholding steps with the various types of workholding systems.

Lecture:

1. Instructor presents lecture on metro-logy uses and applications. Students are expected to utilize Q.C. methods and techniques of verifying parts accuracy with the parts produced in lab assignments.

Distance Learning

1. Following a brief introduction video and reading assignment of 3+2 Axis Machining. Students will complete an online quiz utilizing

multiple choice and essay questions. Students will be expected to know when 3+2 Axis machining has an advantage over standard 3-axis machining and when 3-axis machining has an advantage over 3+2 axis machining.

Typical Out of Class Assignments Reading Assignments

1. Read material on workholding vises used in multi part applications, multi operations and of types of workholding - non-marking vs. marking used in 4th and 5th axis applications. Be prepared to outline each type. 2. Read material on methods of addressing multi-axis machinery, vertical mill with indexer or rotary table or trunnion. Report on the advantages of add on devices such as rotary table or trunnion vs. Universal Mill and how embedded 5 axis machines compare to add on approaches.

Writing, Problem Solving or Performance

1. Diagram tooth style vs dovetail holding and compare sequence of manufacturing process of dovetail versus bite holding systems. Give examples of where each application has best use. 2. Identify the positive and negative aspects of each type of multi-axis CNC machines.

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

1. Apply a subprogram in application of assigned student part to be made. 2. Identify spindle speed and cutter feed rate for different materials.

Required Materials

- CNC Machining Fundamentals and Applications
  - Author: Richard A. Gizelbach
  - Publisher: Goodheart-Wilcox
  - Publication Date: 2009
  - Text Edition: 1st
  - Classic Textbook?:
  - OER Link:
  - OER:
- Machining and CNC Technology
  - Author: Michael Fitzpatrick
  - Publisher: McGraw-Hill
  - Publication Date: 2019
  - Text Edition: 4th
  - Classic Textbook?:
  - OER Link:
  - OER:
- Programming of CNC Machines
  - Author: Ken Evans
  - Publisher: Industrial Press
  - Publication Date: 2016
  - Text Edition: 4th
  - Classic Textbook?:
  - OER Link:
  - OER:

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