ADVM 0005A - CNC MILLING MACHINE OPERATION

Catalog Description

Hours: 72 (18 lecture, 54 laboratory)
Description: Introduction to Computer Numerical Controlled (CNC) Milling Machine operation. This course provides the basic knowledge necessary for a CNC milling machine operator and prepares the student for industry certification. It introduces basic CNC machine operation, proper machine safety, and fundamental machining processes. Students learn the basics of indexing, loading parts, part quality inspection, tool nomenclature, and safely operating milling machines while running pre-validated programs. This course prepares students for entry-level employment and certification as a CNC Milling Machine Operator. (not transferable)

Course Student Learning Outcomes

- CSLO #1: Demonstrate the safe operation of a Computer Numerical Controlled (CNC) Vertical Milling Center
- CSLO #2: Execute and monitor Computer Numerical Controlled (CNC) machining cycles to prove programs and machine setups
- CSLO #3: Validate parts conform to the tolerances specified on technical drawings using precision measurement instruments

Effective Term

Fall 2026

Course Type

Credit - Degree-applicable

Contact Hours

72

Outside of Class Hours

36

Total Student Learning Hours

108

Course Objectives

Lecture Objectives

1. Describe the elements of CNC machining and automation
2. Describe operator responsibilities
3. Describe shop policies and Personal Protective Equipment (PPE) requirements.
4. Describe safety principles
5. Recall Safe shutdown and cleanup practices
6. Explain the function of the control modes: MEM, MDI, JOG, EDIT, HANDLE
7. Discuss the risks of improper clamping and part ejection
8. Calculate solutions for basic math problems using fractions, decimals, tolerances, and unit conversion
9. Identify milling cutting tools and their applications
10. Discuss cutter replacement procedures
11. Identify common workpiece materials
12. Interpret title blocks, views, and tolerances on technical drawings
13. Identify the five basic measurement tools used in precision machine shops: calipers, micrometers, steel rules, height gages, dial indicators
14. Document part measurements
15. Recall operator-level daily and weekly maintenance

Lab Objectives

1. Identify raw stock and staging methods
2. Demonstrate correct material handling and part clamping
3. Discuss job documentation (router, traveler, and inspection sheet)
4. Identify major CNC Vertical Mill VMC components and safety features
5. Perform power-up and power-down procedures
6. Execute jog and handwheel operations safely
7. Demonstrate proper housekeeping and equipment shutdown
8. Navigate control menus and screens
9. Load and view a sample program in Memory mode
10. Use jog and handle controls in non-cutting operations
11. Demonstrate feed hold, cycle start, and reset functions
12. Demonstrate safe procedures for loading/unloading parts
13. Verify that the part is held securely and that the clearance is visually clear.
14. Demonstrate the ability to pause the program to verify the current cutter position in relation to the current block coordinate is correct.
15. Run programs to verify programs and set up
16. Identify and respond appropriately to alarms
17. Demonstrate correct operator monitoring during a production cycle
18. Apply math calculations to dimensional checks
19. Identify tool types used in lab projects
20. Identify material types
21. Evaluate sample parts and record results on inspection sheets
22. Compare measured values to blueprint specifications
23. Demonstrate proper tool handling and accuracy techniques
24. Identify tool wear
25. Demonstrate a full maintenance inspection

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

- Not Transferable

Methods of Evaluation

- Objective Examinations
  - Example: Students will take a multiple-choice test on each major topic area. Standard Grading. Example Question: Which of the following five basic measurement tools used in precision machining is the most precise: A) Steel Rule, B) Dial Caliper, C) Micrometer, D) Height Gage, E) Dial Test Indicator
- Projects
  - Example: The instructor-assigned student projects are evaluated against industry standards using performance rubrics. Example: Comparison of a technical drawing to a finished project part
- Skill Demonstrations
  - Example: The instructor will use student skill demonstrations to evaluate student performance against industry standards as an entry-level CNC operator. Example: Student will demonstrate selecting the correct mode to manually move the mill table in the X axis.

Repeatable

No

Methods of Instruction

- Laboratory
- Lecture/Discussion
- Distance Learning

Lab:

1. Instructor demonstrates how to execute jog and handwheel operations safely, followed by the students' safety showing how to perform safe jog and handwheel operations.

Lecture:

1. Instructor presents a lecture on the risks of improper clamping and part ejection. Students are expected to describe and discuss the risks of improper clamping and part ejection.

Distance Learning

1. Following a brief introduction video and reading assignment on the function of the control modes: MEM, MDI, JOG, EDIT, HANDLE. Students will complete an online quiz utilizing multiple-choice and essay questions. Students will be expected to know the function of the control modes: MEM, MDI, JOG, EDIT, HANDLE.

Typical Out of Class Assignments
Reading Assignments

1. Students read the safety section from the machine manual and will be prepared to discuss in class. 2. Students are required to read a technical specification and apply it to an activity worksheet.

Writing, Problem Solving or Performance

1. Students will complete an assigned project that meets the criteria and specifications outlined. Example: Machined a part and measured to determine if the features conform to the +- .01 inch tolerance defined in the tolerance block on the drawing. 2. The student will evaluate the size of a feature with a measurement tool and calculate the amount the cutter must be compensated to remachine a non-conforming feature to the specified size.

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

- Machining and CNC Technology
  - Author: Michael Fitzpatrick
  - Publisher: McGraw-Hill
  - Publication Date: 2024
  - Text Edition:
  - Classic Textbook?: No
  - OER Link:
  - OER:

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