

EASTERN ARIZONA COLLEGE
Advanced Manufacturing Methods

Course Design
2015-2016

Course Information

Division Industrial Technology Education
Course Number AMT 220
Title Advanced Manufacturing Methods
Credits 4
Developed by Brian Coppola
Lecture/Lab Ratio 2 Lecture/4 Lab

Transfer Status

ASU	NAU	UA
Pending Evaluation	Pending Evaluation	Non-transferable

Activity Course No
CIP Code 48.0503
Assessment Mode Portfolio
Semester Taught Spring
GE Category None
Separate Lab No
Awareness Course No
Intensive Writing Course No

Prerequisites

AMT 110 or instructor approval

Educational Value

Advanced manufacturing technology majors will utilize advanced machine shop skills to produce first-run parts using a traveler or production plan.

Description

This course will focus on using manual tools, mill, lathe, surface grinder, and CNC (Computer Numerical Control) machines to produce first-run prototype parts from an industry standard drawing. Students will develop a process plan to establish the step-by-step process for part production. Students will use this process plan to ensure each part produced meets tolerances allowed as noted on CAD/CAM drawing. The course also explores the work opportunities related to the emerging careers in the Advanced Manufacturing field.

Supplies

Safety glasses

Competencies and Performance Standards

1. Locate and analyze job listings.

Learning objectives

What you will learn as you master the competency:

- a. Understand and acquaint self with manufacturing careers and entrepreneurial opportunities.
- b. Identify duties, job qualifications, and required soft skills and technical skills necessary for success in Advanced Manufacturing field.
- c. Demonstrate the ability to prepare one's self for work in a specific manufacturing field.

Performance Standards

Competence will be demonstrated:

- o in oral discussion and written assignments

Criteria – Performance will be satisfactory when:

- o learner understands and knows what is required to fulfill a chosen manufacturing position
- o learner is successful in identifying duties, job qualifications for three different areas in manufacturing

2. Demonstrate the use of all tools and advanced manufacturing equipment in accordance to operational manual and shop procedures.

Learning objectives

What you will learn as you master the competency:

- a. Identify the causes of accidents in a machine shop environment.
- b. List the safety equipment required in shop operation.
- c. List the safety rules for each machine tool and hand tool.
- d. Identify the conditions in a shop that could be considered hazardous.

Performance Standards

Competence will be demonstrated:

- o by completing the assigned projects
- o by choosing the correct tools for each task and using them correctly

Criteria - Performance will be satisfactory when:

- o learner practices recognized safety procedures and uses the prescribed safety equipment at all times
- o learner demonstrates an ability and willingness to follow designated procedures

3. Measure complex part callouts and dimensions using precision inspection tools.

Learning objectives

What you will learn as you master the competency:

- a. Demonstrate the correct use of an optical comparator, precision height gage, Rockwell hardness tester, and bore gage.
- b. Demonstrate the correct use of an inside micrometer, internal relief gage, sign bar, and double protractor.
- c. Use correctly blade micrometer, OD & ID & depth micrometers, pitch gage, finish comparator, indicator, and thread gage.

- d. Validate parts meet each precision callout shown on the project's print.

Competence will be demonstrated:

- o by completing homework assignments
- o by completing classroom exercises
- o by completing a quality inspection process on parts(s) produced

Criteria - Performance will be satisfactory when:

- o learner records actual part dimensions in assigned projects

4. Develop a process plan/traveler and drawing detailing the step-by-step process for fabrication of a multi-dimensional part using multiple advance manufacturing machines/equipment (CNC mill & lathe, 3D printer, laser, plasma cutter, router and CAD/CAM software).

Learning objectives

What you will learn as you master the competency:

- a. Identify and understand purposes for critical print callouts and datum.
- b. Develop a list of fixtures, holding methods, and part clamping techniques.
- c. Write a process plan/traveler and revise as needed to ensure the part is made properly.
- d. List cautions a machine operator needs to be aware of during the part manufacturing process (oil, tool type, inspection process, material issues, etc.).

Performance Standards

Competence will be demonstrated:

- o when completing a homework assignments
- o when completing shop assignments (project plan)
- o when properly completing first run projects
- o when learning can demonstrate set-up and machine processes using industry print

Criteria - Performance will be satisfactory when:

- o learner identifies the elements of a cutting operation
- o learner explains the physical movements that take place in separating

5. Recognize material volatility and materialization characteristics to identify necessary precautions needed during part fabrication process.

Learning objectives

What you will learn as you master the competency:

- a. List concerns and caution needed while fabrication and cutting product material.
- b. Identify the effects of heat during manufacturing of project.
- c. Describe the purpose of quenching, annealing, case hardening, tempering, and stress relieving.
- d. Identify the hardness characteristics of each par's material accurately.
- e. Identify the volatility of material and caution needed when heat is applied to material used for each part prior to production.

Performance Standards

Competence will be demonstrated:

- o in listing all concerns related to material heating and material stress that could occur

- during the fabrication process
- in using hardness testing equipment in the shop
- in a quiz to link material properties with available Fab Lab material

Criteria - Performance will be satisfactory when:

- learner chooses proper materials for project
- learner demonstrates correct procedures for handling material during fabrication process

6. Demonstrate an ability to properly use a variety of cutters and machine tool holders to produce complex and multi-dimensional shapes using both manual and CNC machines.

Learning objectives

What you will learn as you master the competency:

- a. Perform threading operations using lathe and mill.
- b. Demonstrate using preformed lathe and mill high speed steel and carbide tools/cutters to cut metal.
- c. Demonstrate using technician formed boring and turning tools to make cut, boring head and facing head.
- d. Demonstrate using quick change tool holders with boring tooling, reamers, drills, and lathe & mill cutters.
- e. Demonstrate the use of edge finder, wiggler, and center drill.
- f. Demonstrate how to perform 3-axis operations on CNC machines.

Performance Standards

Competence will demonstrated:

- by using the machine tools in the EAC machine shop correctly during all fabrication processes

Criteria- Performance will be satisfactory when:

- learner accurately produces approved project using manual and CNC equipment

7. Demonstrate various machining techniques and set-ups to produce a multi-dimensional part using CNC machining center, laser, and 3D printer.

Learning objectives

What you will learn as you master the competency:

- a. Demonstrate the set-up and operation on various advance manufacturing equipment.
- b. Demonstrate how to properly mount parts with fixtures and accessories.
- c. Perform linear radial and angled cuts to form unique dimensions using 2 and 3 axis operations on CNC machines.
- d. Utilize proper support and clamping methods to hold project correctly and safety while machining.
- e. Utilize a follower rest to machine acme threads in a long shaft.
- f. Utilize tooling to form produce proper part radius and fillets.

Performance Standards

Competence will be demonstrated:

- in setting up and operating equipment to produce project per process plan

Criteria - Performance will be satisfactory when:

- learner identifies all of the tools and accessories used
- learner operates all machine and equipment per manufacture guidelines and safely
- learner produces accurate cuts on approved projects

Types of Instruction

Classroom and lab- presentation/demonstrations/collaboration/observations

Grading Information

Grading Rationale

40% of final grade is chapter tests & quizzes (all quizzes = one test score)

50% of final grade is project grades and lab activity timecard

10% of final grade is final exam

Grading Scale

A	90%-100%
B	80%-89%
C	70%-79%
D	60%-69%
F	Below 60 %

- This tool was created in order to fulfill the requirements of the TAACCCT 4 grant. AZ Ramp Up products by Eastern Arizona College are licensed under a Creative Commons Attribution 4.0 International License. This workforce product was funded by a grant awarded by the U.S. Department of Labor’s Employment and Training Administration. The product was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The U.S. Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership.

