



# ADVANCED MANUFACTURING

## Advanced Manufacturing Certification

Transform raw material into precision components through both manual, machine, and computer oriented operations.

Students gain valuable experience in a manufacturing shop environment with curriculum that focuses on the design and production of customer projects. The advanced manufacturing program will help students learn a variety of skills used in the industry, including the following:

- Measurement and blueprint reading for manufacturing production
- Machine shop safety
- Digitally Design 3 Dimensional objects using adobe and solidworks
- Operation of general machine tools such as latne, mills, saws, and lathes
- Operate metal or plastic forming equipment such as CNC machines, Laser Engravers, and 3D printers

### Suggested educational levels:

- English literacy (reading, writing, speaking, and listening)
- Understanding of basic algebra

### Suggested physical abilities:

- Capable of lifting 30 pounds
- Capable of sustained activity for 5 hours at a time

### Class Hours:

- Morning: 7:50am - 10:40am Mon.- Fri.
- Afternoon: 12:05pm - 2:55pm Mon.- Fri.
- Evening: 5:30pm - 10:00pm Mon.-Thu.
- Program is 4 semesters in length, with start dates in Fall.

## Tuition and Credit Hour Calculation

### Semester 1

\$1,690.00 (Tuition)  
 + \$180.00 (Credit Hour Fee)  
\$1,870.00

### Semester 2

\$1,560.00 (Tuition)  
 + \$170.00 (Credit Hour Fee)  
\$1,730.00

### Semester 3

\$1,560.00 (Tuition)  
 + \$170.00 (Credit Hour Fee)  
\$1,730.00

### Semester 4

\$1,560.00 (Tuition)  
 + \$170.00 (Credit Hour Fee)  
\$1,730.00

*Based on Colorado Resident In-State Tuition*

## Estimated Program Costs (to be paid at Picken's payment office)

### Tuition and Credit Hour Fees:

**Semester 1:** \$1,870.00  
**Semester 2:** \$1,730.00  
**Semester 3:** \$1,730.00  
**Semester 4:** \$1,730.00

### Required On Campus Costs:

**Program Charges:** \$500.00 (each semester)  
**Student ID:** \$10.00 (each year)  
**CTSO Charge:** \$20.00 (each year)  
**Safety Glasses:** \$5.00 (+ tax)  
**Books:** \$234.00 (+ tax)

### Estimated Total:

**Advanced Manufacturing Certificate:** \$9,359.00 (+tax)

## Additional Relevant Costs (estimated)

### Required Off Campus Costs:

**Shop Shirt:** \$30.00 (+tax)

### Optional Costs:

**Books:** \$350.00  
**SkillsUSA Workforce Ready Assessment:** \$20.00

**Credits:**  
49

**Length:**  
2 years

**Cost:**  
\$9,359



Cost and information revised **November 2022**  
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# ADVANCED MANUFACTURING

## Courses required for this certificate:

### MAC 1001 Introduction to Machine Shop

Covers safety procedures, use of bench tools, layout tools, power saws, drill presses, precision measurement tools, and various hand tools related to the machine shop. Also included are sharpening drill bits and general purpose turning tools for the lathe and determining speeds and feeds for both the lathe and the milling machine.

### MAC 1002 Print Reading for Machinists

Students read blueprints and interpret symbols, notes dimensions and tolerances.

### MAC 1010 Introduction to Engine Lathe

Introduces basic lathe applications which will consist of identifying lathe components and controls, understanding turning safety, calculating speeds and feeds, using various tools and tool holders, identifying basic tool geometry, and the use of common lathe spindle tooling. Students will perform basic lathe operations, which will consist of facing, center-drilling, chuck turning, turning between centers, boring, grooving, tapers, knurling, and single point threading. Students will be required to produce specified parts to a tolerance of +/- .004 in. and perform competencies set by manufacturing standards.

### MAC 1011 Intermediate Engine Lathe

Teaches students to prepare single point external and internal unified screw threads to a Class 3 fit, generate angles with the compound rest within one degree, ream holes concentric within .001 inches, determine cutting speeds, and perform facing and turning operations.

### MAC 1020 Introduction to Milling Machine

Teaches students to identify the major parts of the vertical mill, align a vise, use an indicator, edge finder, and boring head, determine speeds and feeds perform simple indexing, mill flat, square surfaces and slots, drill, bore, and tap holes, and work within a plus or minus .002 inch tolerance. MAC 120 Introduction to Milling Machine 3 credits/67.5 clock hours Teaches students to identify the major parts of the vertical mill, align a vise, use an indicator, edge finder, and boring head, determine speeds and feeds perform simple indexing, mill flat, square surfaces and slots, drill, bore, and tap holes, and work within a plus or minus .002 inch tolerance.

### MAC 1021 Intermediate Milling Machine

Prepares students to determine hole locations by coordinates and degrees, use a rotary table, use a jig bore to drill holes by the coordinate method, and work within plus or minus .001 inch tolerance.

### MAC 1045 Production Manufacturing

Familiarizes the student to concepts related to manufacturing environments. Topics will consist of, but not be limited to Material Identification, Shop Floor Management, Just-In Time Manufacturing, Kan-Ban Systems, Statistical Quality Control, Total Quality Management. Various lectures and demonstrations of these processes will be delivered. Students may be required to research, explore, and report on particular manufacturing processes or topics.

### MAC 2001 Introduction to CNC Turning Operations

Covers computer numerical control (CNC) lathe operations, control functions, the letter address system, the program format, and machine setup. G & M codes, control functions, the letter address system, and math issues related to CNC are included. This class is NOT offered on an open-entry, open-exit basis.

### MAC 2002 CNC Turning Operations II

Prepares students to write basic computer numerical control (CNC) lathe part programs. G and M codes, math related to CNC, setups, speeds and feeds, straight turning, spherical turning, threading, chamfering, tapering, drilling, tapping, boring, and grooving will be covered. Cutter compensations, sub-programming techniques, repetitive cycles, and both absolute and incremental will be incorporated into programs. Students will also proof and edit the programs to make them valid. This class is NOT offered on an open-entry, open-exit basis.

### MAC 2005 Introduction to CNC Milling Operations

Provides transitional information between conventional machining applications and the typical applications found in Computer Numerical Control Machining. Topics may consist of Numerical Control Systems, The Cartesian Coordinate System, High Efficiency Tooling Applications, Objectives of Numerical Control, Calculating Speed and Feed Rates, Defining and Calculating Tool Motion, Fixturing Requirements, Basic Program Structure, Programming Codes, and Basic Conversational Programming. Operations of NC machines will be required.

### MAC 2021 Surface Grinder Setups and Operations

Teaches students how to identify major parts and accessories of the surface grinder and grind flat, vertical, and angular surfaces to a tolerance of .0002 position and size.

### MAC 2040 CAD/CAM 2D

Provides the student with the essential concepts and techniques that are required to successfully create part geometry, generate tool path, verify tool path models, and post process the NC codes. The student will be exposed to a 2-axis machining, 3-axis machining wire frame and surface modeling, lathe programming, and DNC systems. Programming projects and models will be demonstrated in the CNC manufacturing lab.

### MAC 2041 CAD/CAM 2D Lab

Requires students to produce a variety of lab exercises on robotic machinery in conjunction with MAG 240. Aspects of toolpaths for contour, drill and pocket will be covered. Chaining geometry, setting parameters, and managing cutter compensations will be addressed in both multi-tool programs and remachining operations. Coursework will primarily focus on 2D geometry projects.

### MAC 2052 Practical Metallurgy

Offers a study of metallurgical terms and definitions in an effort to understand both the behavior of metals and their service to industry. Characteristics during heating, cooling, shaping, forming, and the stresses related to their mechanical properties are covered. The theory behind the alloys, heat treatment processes, and the impact they have on strength, toughness, hardness, elasticity, ductility, malleability, wear resistance and fatigue resistances is investigated.

### MAC 2075 Special Topics: Machine Shop Math

Covers material designed for career technical or general studies students who need to study particular mathematical topics. Topics may include measurement, algebra, geometry, trigonometry, graphs, and/or finance. These are presented on an introductory level and the emphasis is on applications.

### MAC 2078 Machining Workshop

Provides students with an experiential learning opportunity.

## ADVANCED MANUFACTURING CERTIFICATE

**Certificate Total:** Clock Hours: 1102.5 Credit Hours: 49

**Certificate Length:** 4 semesters