

# ADVANCED MANUFACTURING

## Contact Information

### Division

Business, Technology and Public Service

### Dean

Jill Alcorn

### Associate Dean

Vance Klinke

### Division Office

B 3, Rocklin Campus

Gain hands-on skills to design, build and manufacture in the Computer Numeric Control (CNC) machining courses held in our state-of-the-art machining center. This program is affiliated with Gene Haas Foundation of Haas Automation, the largest CNC machine tool builder in the western world.

Learn the latest technologies and get exposure to the entire spectrum of manufacturing. Delve into computer modeling and creation. Design for technology applications on our brand-new Haas machines.

## Advanced Manufacturing Advisory Committee

- AB Tools Inc., Lincoln, CA
- BackFlow Direct-Watts Water, Rancho Cordova, CA
- Folsom High School, Folsom, CA
- GBC Materials
- Golden Sierra Job Training Agency, Roseville, CA
- InSight Manufacturing Services, Rancho Cordova, CA
- John F Kennedy High School, Sacramento, CA
- Kratos Unmanned Aerial System
- Microform Precision LLC, Sacramento, CA
- Nevada Union High School, Grass Valley, CA
- Oasis Precision, Rocklin, CA

## Degrees/Certificates

### Associate Degree

- Advanced Manufacturing (p. 1)
- Advanced Manufacturing - Drafting Mechanical/Civil (p. 1)
- **Certificate of Achievement**
- Advanced Manufacturing (p. 2)
- Advanced Manufacturing - Drafting Mechanical/Civil (p. 2)
- **Skills Certificate**
- Drafting Essentials (p. 2)
- Foundations of Modern Machining (p. 3)
- Mechanical Drafting Specialist (p. 3)

## Advanced Manufacturing

### AS Degree

The Sierra College Advanced Manufacturing Program prepares students for C.N.C. machining and is also ideal for students who need to upgrade prior machine shop training to comply with the current needs of industry.

For the degree, students must fulfill the following major requirements with grades of "C" or better, complete a minimum of 60 degree-applicable semester units (12 of which must be completed at Sierra College) with a grade point average of at least 2.0 and complete one of the following three general education patterns:

- Sierra College Associate Degree Requirements (<http://catalog.sierracollege.edu/student-resources/general-education/associate-degree-requirements/>);
- California General Education Transfer Curriculum (Cal-GETC) (<http://catalog.sierracollege.edu/student-resources/general-education/california-general-education-transfer-curriculum-cal-getc/>)

### Required Courses:

Code	Title	Units
ADVM 0001	Computer Aided Design for Mechanical Design and Drafting I	3
ADVM 0003D	Design for Additive Manufacturing - 3D Printing	3
ADVM 0062	Introduction to Computer Aided Design and Computer Aided Manufacturing	3
ADVM 0063	CNC Cutting and Fabrication Level I	2
ADVM 0064	Computer-Aided 2D Design	3
ADVM 0066	CNC Milling Level 1	2
ADVM 0067	CNC Milling Level 2	2
ADVM 0068	CNC Milling with 4th and 5th Axis	2
WELD 0001A	Introduction to Welding and Fabrication	2
<b>Select 4-7 units from the following:</b>		<b>4-7</b>
MECH 0004	Fundamentals of Mechatronics	
ADVM 0002	Computer Aided Design for Mechanical Design and Drafting II	
ADVM 0012	Geometric Dimensioning and Tolerancing	
WELD 0002A	Gas Metal Arc Welding of Mild Carbon Steel on Sheet and Plate	
WELD 0003B	Gas Tungsten Arc Welding of Mild Carbon and Stainless Steel on Sheet and Plate	
<b>Total Units</b>		<b>26-29</b>

## Advanced Manufacturing - Drafting Mechanical Civil

(formerly Drafting and Engineering Support—Mechanical/Civil)

### AA or AS Degree

Successful completion of the curriculum in Advanced Manufacturing—Drafting Mechanical/Civil prepares students for entry-level positions as document support technicians in the fields of mechanical and civil engineering. For the degree, students must fulfill the following major requirements with grades of "C" or better, complete a minimum of 60 degree-applicable semester units (12 of which must be completed at Sierra College) with a grade point average of at least 2.0 and complete one of the following three general education patterns:

- Sierra College Associate Degree Requirements (<http://catalog.sierracollege.edu/student-resources/general-education/associate-degree-requirements/>);

- California General Education Transfer Curriculum (Cal-GETC) (<http://catalog.sierracollege.edu/student-resources/general-education/california-general-education-transfer-curriculum-cal-getc/>)

**Required Courses**

Code	Title	Units
ADVM 0001	Computer Aided Design for Mechanical Design and Drafting I	3
ADVM 0002	Computer Aided Design for Mechanical Design and Drafting II	3
ADVM 0011	Advanced Computer Aided Design Modeling	3
ADVM 0012	Geometric Dimensioning and Tolerancing	3
ADVM 0062	Introduction to Computer Aided Design and Computer Aided Manufacturing	3
ADVM 0063	CNC Cutting and Fabrication Level I	2
ADVM 0066	CNC Milling Level 1	2
ADVM 0067	CNC Milling Level 2	2
ADVM 0095	Internship in Advanced Manufacturing	0.5-4
<b>Total Units</b>		<b>21.5-25</b>

**Optional Recommended Electives:**

Code	Title	Units
ADVM 0003D	Design for Additive Manufacturing - 3D Printing	
BI 0015	Managing the Computer-Aided Design (CAD) Environment	
ENGR 0180	Engineering Surveying	
WELD 0005A	Manual Metal Arc Welding of Mild Carbon Steel Fillet Welds	

**Advanced Manufacturing****Certificate of Achievement**

The Advanced Manufacturing certificate of achievement provides a comprehensive understanding of the skills necessary for success in the Advanced Manufacturing industry. This program is designed to enable the student to enter industry with problem-solving skills in design, production, planning, materials handling, quality control, inspection and programming with computer-aided controls. The student, upon the successful completion of the program, will have job-entry skill and career advancement opportunities.

A certificate is designed to provide career technical skills; it is not equivalent to an associate degree.

**Required Courses:**

Code	Title	Units
ADVM 0062	Introduction to Computer Aided Design and Computer Aided Manufacturing	3
ADVM 0063	CNC Cutting and Fabrication Level I	2
ADVM 0064	Computer-Aided 2D Design	3
ADVM 0066	CNC Milling Level 1	2
ADVM 0067	CNC Milling Level 2	2
ADVM 0068	CNC Milling with 4th and 5th Axis	2
<b>Total Units</b>		<b>14</b>

**Advanced Manufacturing - Drafting Mechanical Civil**

(formerly Drafting and Engineering Support—Mechanical/Civil)

**Certificate of Achievement**

Successful completion of the curriculum in Advanced Manufacturing —Drafting Mechanical/Civil prepares students for entry-level positions as document support technicians in the fields of mechanical and civil engineering. A certificate is designed to provide career technical skills; it is not equivalent to an associate degree.

**Required Courses:**

Code	Title	Units
ADVM 0001	Computer Aided Design for Mechanical Design and Drafting I	3
ADVM 0002	Computer Aided Design for Mechanical Design and Drafting II	3
ADVM 0011	Advanced Computer Aided Design Modeling	3
ADVM 0012	Geometric Dimensioning and Tolerancing	3
ADVM 0062	Introduction to Computer Aided Design and Computer Aided Manufacturing	2.5
ADVM 0063	CNC Cutting and Fabrication Level I	2
ADVM 0066	CNC Milling Level 1	3
ADVM 0067	CNC Milling Level 2	3
ADVM 0095	Internship in Advanced Manufacturing	0.5-4
<b>Total Units</b>		<b>23-26.5</b>

**Optional Recommended Electives:**

Code	Title	Units
ADVM 0003D	Design for Additive Manufacturing - 3D Printing	
BI 0015	Managing the Computer-Aided Design (CAD) Environment	
ENGR 0180	Engineering Surveying	
WELD 0005A	Manual Metal Arc Welding of Mild Carbon Steel Fillet Welds	

**Drafting Essentials****Skills Certificate**

Designed to give students the basic drafting support knowledge and abilities required to enter the workforce at an entry level. Focuses on skills relative to the fields of architecture and mechanical computer-aided drafting (CAD). Appropriate for students seeking retraining. A skills certificate is designed to provide career technical skills; it is not equivalent to an associate degree.

**Required Courses:**

Code	Title	Units
ADVM 0001	Computer Aided Design for Mechanical Design and Drafting I	3
ADVM 0002	Computer Aided Design for Mechanical Design and Drafting II	3
BI 0010	Architectural Drawing I	3

BI 0011	Architectural Drawing II	3
<b>Total Units</b>		<b>12</b>

## Foundations of Modern Machining

### Skills Certificate

Designed to give students modern manufacturing skills, knowledge, and abilities required to enter the workforce. Also intended for entrepreneurs seeking the fundamental skills to get started in modern manufacturing.

A certificate is designed to provide career technical skills; it is not equivalent to an associate degree.

#### Required Courses:

Code	Title	Units
ADVM 0062	Introduction to Computer Aided Design and Computer Aided Manufacturing	3
ADVM 0066	CNC Milling Level 1	2
ADVM 0067	CNC Milling Level 2	2
<b>Total Units</b>		<b>7</b>

## Mechanical Drafting Specialist

### Skills Certificate

Designed to give students the advanced drafting support knowledge and abilities required to enter the workforce at the specialist level. Focuses on skills relative to specialized mechanical documentation such as is used in aerospace and automotive drafting. Appropriate for students seeking retraining. Will help successful candidates prepare to sit for the professional ASME (American Society of Mechanical Engineers) Y14.5 Geometric Dimensioning and Tolerancing certification exam. This is a specialty skills certificate designed to provide career technical skills; it is not equivalent to an associate degree.

#### Required Courses:

Code	Title	Units
ADVM 0001	Computer Aided Design for Mechanical Design and Drafting I	3
ADVM 0002	Computer Aided Design for Mechanical Design and Drafting II	3
ADVM 0003D	Design for Additive Manufacturing - 3D Printing	3
ADVM 0011	Advanced Computer Aided Design Modeling	3
ADVM 0012	Geometric Dimensioning and Tolerancing	3
<b>Total Units</b>		<b>15</b>

## Courses

Understanding course descriptions (<http://catalog.sierracollege.edu/student-resources/course-information/understanding-course-descriptions/>)

### ADVM 0001. Technical Drafting I

Units: 3

Formerly known as DES 1

Hours: 90 (36 lecture; 54 laboratory which may be scheduled TBA)  
Fundamental use of design equipment to create both two dimensional technical sketches and two and three dimensional computer generated (CAD) working drawings that are used for product definition. Introduction to product and process definition as specified by engineering design disciplines. This course teaches introductory 3D AutoCAD skills.

Designed for students with no previous experience in engineering design/drafting. (CSU)

### ADVM 0002. Technical Drafting II

Units: 3

Formerly known as DES 2

Prerequisite: Completion of ADVM 1 with grade of "C" or better or equivalent as determined by instructor

Hours: 90 (36 lecture; 54 laboratory which may be scheduled TBA)  
Intermediate concepts of engineering design including sections, auxiliaries, threads, fasteners, and dimensional tolerancing. Basic concepts of Geometric Dimensioning and Tolerancing. Design for manufacturability and assembly explored to include material selection and properties of materials. This course teaches intermediate/advanced 3D AutoCAD skills. Designed for students who have attained a fundamental knowledge of the processes and practices of engineering design/drafting. (CSU)

### ADVM 0003D. Design for Additive Manufacturing - 3D Printing

Units: 3

Formerly known as DES 3D

Hours: 90 (36 lecture, 54 laboratory)

Design for the additive manufacturing industry (3D printing). An in-depth look at the product design process and how it is used to create complex geometric models to satisfy defined requirements. An exploration of additive manufacturing's (or 3D printing's) impact on conventional manufacturing. Designed for students who are planning to pursue a career in Advanced Manufacturing. (not transferable)

### ADVM 0011. Three-Dimensional Modeling

Units: 3

Formerly known as DES 11

Prerequisite: Completion of ADVM 2 or ADVM 3D or MECH 44 or ENGR 151 or ADVM 66 with grade of "C" or better; or equivalent as determined by instructor

Hours: 90 (36 lecture; 54 laboratory which may be scheduled TBA)  
Processes employed in developing design solutions using a feature based parametric solid modeler. Includes 3D part and assembly modeling, and the development of 2-dimensional part, assemblies, welding and sheet metal drawings per ASME standards. SolidWorks is the solid modeler used. (CSU, UC)

### ADVM 0012. Geometric Dimensioning and Tolerancing

Units: 3

Formerly known as DES 12

Prerequisite: Completion of ADVM 2 or ADVM 11 or ADVM 66 or ENGR 151 with grade of "C" or better or equivalent as determined by instructor  
Hours: 54 lecture

Expands upon basic knowledge of dimensioning mechanical drawings by adding form and feature controls in order to clearly define parts. Review of basic dimensioning and tolerancing. Topics, as defined in ASME Standards, include geometric tolerancing symbols and terms, rules of geometric dimensioning and tolerancing, datums, material condition symbols, tolerances of form and profile, tolerances of orientation and runout, location tolerances and virtual condition. (CSU)

**ADVM 0028. Independent Study***Units: 1-3*

Designed for students interested in furthering their knowledge at an independent study level in an area where no specific curriculum offering is currently available. Independent study might include, but is not limited to, research papers, special subject area projects, and research projects. See Independent Study page in catalog. (CSU, UC-with unit limitation)

**ADVM 0062. Introduction to Computer Aided Design and Computer Aided Manufacturing***Units: 3*

Hours: 90 (36 lecture, 54 laboratory)

Introduction to Computer Aided Design (CAD) parametric modeling and Computer Aided Manufacturing (CAM) using CAD/CAM software. Covers practical on-the-job parametric modeling skills needed for precision machining. Students will learn skills needed to read and understand detailed drawings, create 3D CAD model files, develop a process plan for machining parts, and create CNC tool paths for manufacturing processes. (not transferable)

**ADVM 0063. Design and 2-D Manufacturing of 3-D Objects***Units: 2*

Hours: 72 (18 lecture, 54 laboratory)

Students will learn the basic working principles of water jet cutting, laser cutting, laser engraving, plasma cutting, CNC and manual press brake machinery. Class projects will be modeled using computer software and then cut, engraved, or formed using the appropriate manufacturing process for the job. (not transferable)

**ADVM 0064. Computer-Aided 2D Design***Units: 3*

Formerly known as WELD 64

Hours: 90 (36 lecture, 54 laboratory)

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)

**ADVM 0066. CNC Milling Level 1***Units: 3*

Formerly known as WELD 66

Hours: 90 (36 lecture, 54 laboratory)

Intermediate course making billet aluminum parts from start to finish using HAAS CNC milling machines. Students will learn how to set up and operate HAAS CNC vertical machining centers. After the parts have been machined, students will use common industry measuring and inspection techniques to insure their parts are in tolerance. (not transferable)

**ADVM 0067. CNC Milling Level 2***Units: 3*

Formerly known as WELD 67

Prerequisite: Completion of ADVM 62 and ADVM 66 with grade of "C" or better

Hours: 90 (36 lecture, 54 laboratory)

Applications using three-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). Includes simulation modeling used to proof the assigned laboratory exercises and set-up for 3 axis operation of CNC machining centers. (not transferable)

**ADVM 0068. Advanced Mill 4th and 5th Axis***Units: 3*

Prerequisite: Completion of ADVM 67 with grade of "C" or better

Hours: 90 (36 lecture, 54 laboratory)

Advanced CNC machining 4th and 5th axis Mill work. Developing complicated part geometry with Computer Aided Design (CAD), Post process CAM tool path development, planning machine operations, and developing machine codes and techniques for cost effectiveness. CNC Lathe operations. (CSU)

**ADVM 0095. Internship in Advanced Manufacturing***Units: 0.5-4*

Designed for advanced students to work in an area related to their educational or occupational goal. Provides new on-the-job technical training under the direction of a worksite supervisor, allowing students to expand knowledge and skills in the chosen field. Mandatory orientation session and faculty approval to determine eligibility. One unit of credit is equal to 54 hours of work. Students may earn up to a total of 16 units in internship courses (any course numbered 95 and PDEV 94). (CSU-with unit limitation)

## Program Student Learning Outcomes (PSLOs)

- Create and analyze basic CAD drawing files for use in mechanical systems
- Evaluate an industrial process based on principles of Computer Integrated Manufacturing
- Identify necessary tools and describe tool offsets and part offsets for machining designed parts
- Design programming using CAM and basic G code to machine parts on a CNC turning center and CNC milling center that meet the part specification
- Describe and evaluate Geometric Dimensioning and tolerancing of parts from design