

Engineering technology

ENGINEERING TECHNOLOGY - ENGTC

Open, Dean

Workforce Development and Engineering Technologies
Administration Building, Room 121

Possible career opportunities

Career options in engineering technology include civil engineering technicians, surveying and mapping technicians (cartography), architectural and civil drafters, and mechanical engineering technicians. Engineering technicians may work as computer-aided design drafters, engineering aides, land surveyors, field assistants, planning technicians and technical sales people.

Program-level student learning outcomes

Program learning outcomes are subject to change. The most current list of program learning outcomes for each program is published on the DVC website at www.dvc.edu/slo.

Associate in science degree

Civil design drafting technology

Students completing the program will be able to...

- A. use technical drafting principles to develop technical drawings.
- B. interpret construction blueprints.
- C. use geometric construction and descriptive geometry to solve geometric problems.
- D. create 2-dimensional and 3-dimensional computer aided drawings (CAD).
- E. interpret global positioning data.
- F. measure land forms using ground surveying equipment.
- G. apply trigonometry to math problems.
- H. apply the basic laws of physics to everyday situations.

The associate in science degree in civil design drafting technology provides students with the technical and analytical skills needed for employment in the field of civil engineering drafting. Through both academic and laboratory study students gain the practical skills needed for entry into the job market. For example, civil drafters may work on plans for major construction projects such as dams, roads, bridges, and sewage systems; or prepare, interpret and revise topographic and/or relief maps using computer-aided-drafting (CAD).

To earn the degree, students must complete each course used to meet a major requirement with a "C" grade or higher and complete general education requirements as listed in the catalog. Students who wish to transfer should consult with program faculty and college counselors to ensure that the requirements for transfer to appropriate institutions are met. Certain courses may satisfy both major and general education requirements; however, the units are only counted once.

<i>major requirements:</i>		<i>units</i>
CONST-114	Blueprint Reading.....	3
ENGIN-121	Engineering Drawing/Descriptive Geometry.....	3
PHYS-110	Elementary Physics.....	3

<i>plus at least 3 units from:</i>		
ENGTC-111	Mathematics for Technicians.....	3
MATH-121	Plane Trigonometry.....	3
MATH-191	Pre-Calculus.....	5

<i>plus at least 3 units from:</i>		
ARCHI-119	Introduction to Technical Drawing.....	3
ENGTC-119	Introduction to Technical Drawing.....	3

<i>plus at least 3 units from:</i>		
ARCHI-126	Computer Aided Design and Drafting - AutoCAD.....	3
ENGTC-126	Computer Aided Design and Drafting - AutoCAD.....	3

<i>plus at least 3 units from:</i>		
ARCHI-226	Computer Aided Drafting Design, Advanced Concepts - AutoCAD.....	3
ENGTC-226	Computer Aided Drafting Design, Advanced Concepts - AutoCAD.....	3

<i>plus at least 3 units from:</i>		
GEOG-124	Thinking and Communicating Geospatially.....	3
GEOG-129	Field Data Acquisition and Management.....	3

<i>plus at least 6 units from:</i>		
CONST-116	Plane Surveying.....	4
ENGIN-140	Plane Surveying.....	4
ENGTC-123	Principles of Civil Drafting.....	3
GEOG-125	Introduction to Geographic Information Systems (GIS).....	3
GEOG-126	Advanced Geographic Information Systems ...	3
GEOG-160	Introduction to Remote Sensing.....	4
GEOG-162	Map Design and Visualization.....	3

total minimum required units 30

**Associate in science degree
Manufacturing and mechanical engineering
technology**

Students completing the program will be able to...

- A. read the drawing for an object and visualize the geometry.
- B. choose the correct manufacturing method for the object.
- C. manufacture an object from a given drawing using machine tools.
- D. use algebra, spreadsheets and measurement data to produce QC statistics.
- E. verify that products meet the design criteria.
- F. design and prototype mechanical parts under the supervision of engineers.
- G. use computer integrated manufacturing (CIM) and computer numerical control (CNC) software for automation of manufacturing.

Engineering technology

The associate of science degree in manufacturing and mechanical engineering technology is offered to prepare students with the required skills to enter the workforce as manufacturing technicians. The program emphasizes traditional and modern machining techniques along with additional concepts in technical drawing and geometric dimensioning and tolerancing.

Students completing this program will learn the skills to become a manufacturing technician working with traditional machinery such as lathes, mills, saws and drill presses as well as precision measuring devices. Students will also gain skills in the use of modern 3-D printing and Computer Numerical Control (CNC) equipment for computer controlled manufacturing. Graduates of the program may work as quality control technicians, pursue jobs in research and development, rapid prototyping and fabrication, and be able to design mechanical parts working in consultation with engineers.

The DVC manufacturing and mechanical engineering technology major is not intended for transfer. Option 1 (DVC General Education) is advised for students who do not intend to transfer. Students who intend to transfer to a four-year baccalaureate program should consult with a counselor regarding specific major preparation requirements at the transfer institution of their choice. Students who intend to transfer are advised to select General Education Option 2 (IGETC) or Option 3 (CSU GE).

Students must complete each of the courses required for the major with a "C" grade or higher. Students may not take a pass/no pass option for major courses. Certain courses may satisfy both major and general education requirements; however, the units are only counted once.

<i>major requirements:</i>	<i>units</i>
ENGTC-119 Introduction to Technical Drawing.....	3
ENGTC-160 Introduction to Industrial and Manufacturing Engineering	3
ENGTC-162 Geometric Dimensioning and Tolerancing	1
ENGTC-165 Machining and Manufacturing I	3
ENGTC-166 Machining and Manufacturing II	3
ENGTC-168 Introduction to Computer Numerical Control...	3
<i>plus at least 3 units from:</i>	
ENGTC-111 Mathematics for Technicians	3
MATH-120 Intermediate Algebra.....	5
MATH-121 Plane Trigonometry	3
MATH-191 Pre-Calculus.....	5
<i>plus at least 6 units from:</i>	
ENGTC -126 Computer Aided Design and Drafting - AutoCAD	3
ENGTC -129 Product Design I Using Solidworks	3
ENGTC -226 Computer Aided Design and Drafting, Advanced Concepts - AutoCAD	3
total minimum required units	25

**Associate in science degree
Industrial maintenance machinist/mechanic (mTECH)**

Students completing the program will be able to...

- A. discuss the role of the industrial maintenance machinist/mechanic in shop and field maintenance safety.
- B. interpret blueprints and technical drawings for parts manufacturing and maintenance repair operations
- C. grind high speed steel tool bits for general purpose turning and threading.
- D. cut multiple lead and acme threads on a lathe.
- E. use the vertical milling machine to drill holes, index, bore hole to a specified diameter and depth, mill surfaces and edges, and use an indicator to reference work.
- F. replace a single mechanical seal in a centrifugal pump.
- G. align a pump shaft to a motor to a specified tolerance.

This program prepares students for jobs in the manufacturing industry including industrial machinery mechanic and machinery maintenance worker. These jobs involve repairing, installing, adjusting, or maintaining industrial production and processing machinery or refinery and pipeline distribution systems. The labor market for this high-technology, high-wage occupations in Contra Costa, Alameda, and Solano counties is expected to be strong.

Courses include machining, industrial hydraulics and pneumatics, shop and field maintenance, welding, basic electricity, blueprint drawing and reading, basic drafting, mathematics, computer software, and technical reading and writing. Major courses are offered sequentially over a period of three terms. This program is offered as a collaborative program with Los Medanos College in Pittsburg and Laney College in Oakland. Students may complete courses at any of the colleges in order to meet requirements. Some required courses are only offered at Laney College, Los Medanos College or DVC. Students are advised to meet with a counselor or program advisor to develop an educational plan that meets their needs.

The DVC mTECH major is not intended for transfer. Option 1 (DVC General Education) is advised for students who do not intend to transfer. Students who intend to transfer to a four-year baccalaureate program should consult with a counselor regarding specific major preparation requirements at the transfer institution of their choice. Students who intend to transfer are advised to select General Education Option 2 (IGETC) or Option 3 (CSU GE).

Students must complete each of the courses required for the major with a "C" grade or higher. Students may not take a pass/no pass option for major courses. Certain courses may satisfy both major and general education requirements; however, the units are only counted once.

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any updates to this document can be found in the addendum at www.dvc.edu/communication/catalog

<i>major requirements:</i>	<i>units</i>
COMSC-101 Computer Literacy.....	4
CONST-110 Occupational Safety.....	2
ELECT-110 Survey of Electricity	2
ENGTC-119 Introduction to Technical Drawing.....	3
ENGTC-126 Computer Aided Design and Drafting - AutoCAD.....	3
ENGTC-165 Machining and Manufacturing I.....	3
ENGTC-166 Machining and Manufacturing II.....	3
ENGTC-175 Hydraulic and Pneumatic Systems and Components.....	3
ENGTC-176 Mechanical Systems and Components.....	3

plus at least 0-3 units from:

ENGTC-111 Mathematics for Technicians.....	3
MATH-120 Intermediate Algebra.....	5
MATH-121 Plane Trigonometry	3
MATH-191 Pre-Calculus.....	5
MATH-192 Analytic Geometry and Calculus I.....	5

plus at least 6 units in one of the following specializations:

fabrication

ENGTC-168 Introduction to Computer Numerical Control.....	3
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plus at least 3 units from:

WELD-10* Basic Arc Welding Theory.....	3
WELD-205** Introduction to Welding.....	3

electro-mechanical

ELECT-120 Direct Current Circuits	4
ELECT-121 Alternating Current Circuits	4
ELECT-130 Motors and Motor Controllers.....	4
ELECT-220 Circuit Diagnosis and Analysis: Troubleshooting.....	2
ELECT-230 Electro-Mechanical Equipment	2
ELECT-271 Programmable Logic Controllers.....	4
total minimum required units	32

*Los Medanos College

**Laney College

Certificate of achievement Civil design drafting technology

Students completing the program will be able to...

- A. use technical drafting principles to develop technical drawings.
- B. interpret construction blueprints.
- C. use geometric construction and descriptive geometry to solve geometric problems.
- D. create 2-dimensional and 3-dimensional computer aided drawings (CAD).
- E. interpret global positioning data.
- F. measure land forms using ground surveying equipment.
- G. apply trigonometry to math problems.
- H. apply the basic laws of physics to everyday situations.

This certificate program prepares students for an entry level job as a civil drafter. Drafters work under the supervision of civil or structural engineers, architects, and/or surveyors as support staff in jobs requiring them to prepare, interpret, and revise technical drawings, or gather and categorize field data. Engineering technicians work as support staff in field, laboratory and/or office environments.

To earn a certificate of achievement, students must complete each of the required courses with a "C" grade or higher. Some courses are not offered every term so please consult with the program director for assistance in scheduling classes.

required courses:

	<i>units</i>
CONST-114 Blueprint Reading.....	3
ENGIN-121* Engineering Drawing /Descriptive Geometry.....	3
PHYS-110 Elementary Physics.....	3

plus at least 3 units from:

ENGTC-111 Mathematics for Technicians.....	3
MATH-121 Plane Trigonometry	3
MATH-191 Pre-Calculus.....	5

plus at least 3 units from:

ARCHI-119 Introduction to Technical Drawing.....	3
ENGTC-119 Introduction to Technical Drawing.....	3

plus at least 3 units from:

ARCHI-126 Computer Aided Design and Drafting - AutoCAD.....	3
ENGTC-126 Computer Aided Design and Drafting - AutoCAD.....	3

plus at least 3 units from:

ARCHI-226 Computer Aided Drafting Design, Advanced Concepts - AutoCAD	3
ENGTC-226 Computer Aided Drafting Design, Advanced Concepts - AutoCAD	3

plus at least 3 units from:

GEOG-124 Thinking and Communicating Geospatially.....	3
GEOG-129 Field Data Acquisition and Management	3

plus at least 6 units from:

CONST-116* Plane Surveying.....	4
ENGIN-140* Plane Surveying.....	4
ENGTC-123 Principles of Civil Drafting.....	3
GEOG-125 Introduction to Geographic Information Systems (GIS).....	3
GEOG-126 Advanced Geographic Information Systems ...	3
GEOG-160 Introduction to Remote Sensing.....	4
GEOG-162 Map Design and Visualization.....	3

total minimum required units 30

*Certain courses required for this certificate have recommended or prerequisite coursework that could add additional units.

Certificate of achievement

Civil drafting, CAD

Students completing the program will be able to...

- A. apply civil drafting principles to interpret and develop civil engineering maps.
- B. interpret construction blueprints.
- C. create 2-dimensional and 3-dimensional computer aided drawings (CAD).
- D. interpret global positioning data.
- E. measure land forms using ground surveying equipment.
- F. use general computer software such as Microsoft Word and Excel.
- G. apply trigonometry to math problems.

This certificate program prepares students for further study or an entry-level training position in jobs requiring them to prepare and revise technical drawings used in civil engineering and surveying.

To earn a certificate of achievement, students must complete each of the required courses with a "C" grade or higher. Some courses are not offered every term so please consult with the program director for assistance in scheduling classes.

<i>required courses:</i>		<i>units</i>
CONST-114	Blueprint Reading	3
ENGTC-111	Mathematics for Technicians.....	3
MATH-121*	Plane Trigonometry	3

<i>plus at least 3 units from:</i>		
ARCHI-119	Introduction to Technical Drawing.....	3
ENGTC-119	Introduction to Technical Drawing.....	3

<i>plus at least 3 units from:</i>		
ARCHI-126	Computer Aided Design and Drafting - AutoCAD.....	3
ENGTC-126	Computer Aided Design and Drafting - AutoCAD.....	3

<i>plus at least 3 units from:</i>		
ARCHI-226	Computer Aided Drafting Design, Advanced Concepts - AutoCAD.....	3
ENGTC-226	Computer Aided Drafting Design, Advanced Concepts - AutoCAD.....	3

<i>plus at least 3 units from:</i>		
GEOG 124	Thinking and Communicating Geospatially.....	3
GEOG-129	Field Data Acquisition and Management	3

<i>plus at least 6 units from:</i>		
ARCHI-135	Digital Tools for Design	3
ARCHI-136	Digital Tools for Architecture	3
CONST-116*	Plane Surveying.....	4
ENGIN-140*	Plane Surveying.....	4
ENGTC-123	Principles of Civil Drafting.....	3
GEOG-125	Introduction to Geographic Information Systems (GIS).....	3
GEOG-126	Advanced Geographic Information Systems ...	3
GEOG-160	Introduction to Remote Sensing.....	3
GEOG-162	Map Design and Visualization.....	3

total minimum required units 27

*Certain courses required for this certificate have recommended or prerequisite coursework that could add additional units.

**Certificate of achievement
Manufacturing and mechanical engineering technology**

Students completing the program will be able to...

- A. read the drawing for an object and visualize the geometry.
- B. choose the correct manufacturing method for the object.
- C. manufacture an object from a given drawing using machine tools.
- D. use algebra, spreadsheets and measurement data to produce QC statistics.
- E. verify that products meet the design criteria.
- F. design and prototype mechanical parts under the supervision of engineers.
- G. use computer integrated manufacturing (CIM) and computer numerical control (CNC) software for automation of manufacturing.

The certificate of achievement in manufacturing and mechanical engineering technology is offered to prepare students with the required skills to enter the workforce as manufacturing technicians. The program emphasizes traditional and modern machining techniques along with additional concepts in technical drawing and geometric dimensioning and tolerancing.

Students completing this program will learn the skills to become a manufacturing technician working with traditional machinery such as lathes, mills, saws and drill presses as well as precision measuring devices. Students will also gain skills in the use of modern 3-D printing and Computer Numerical Control (CNC) equipment for computer controlled manufacturing. Graduates of the program may work as quality control technicians, pursue jobs in research and development, rapid prototyping and fabrication, and be able to design mechanical parts working in consultation with engineers.

Students must complete each of the courses required for the major with a "C" grade or higher. Students may not take a pass/no pass option for required courses.

<i>required courses:</i>		<i>units</i>
ENGTC-119	Introduction to Technical Drawing.....	3
ENGTC-160	Introduction to Industrial and Manufacturing Engineering.....	3
ENGTC-162	Geometric Dimensioning and Tolerancing	1
ENGTC-165	Machining and Manufacturing I.....	3
ENGTC-166	Machining and Manufacturing II	3
ENGTC-168	Introduction to Computer Numerical Control..	3

<i>plus at least 3 units from:</i>		
ENGTC-111*	Mathematics for Technicians.....	3
MATH-120	Intermediate Algebra.....	5
MATH-121	Plane Trigonometry	3
MATH-191	Pre-Calculus.....	5

<i>plus at least 6 units from:</i>		
ENGTC -126	Computer Aided Design and Drafting, AutoCAD.....	3
ENGTC -129	Product Design I Using Solidworks	3
ENGTC -226	Computer Aided Design and Drafting, Advanced Concepts AutoCAD	3

total minimum required units 25

*ENGTC 111 satisfies DVC GE math requirement

**Certificate of achievement
Industrial maintenance machinist/mechanic
(mTECH)**

Students completing the program will be able to...

- A. discuss the role of the industrial maintenance machinist/mechanic in shop and field maintenance safety.
- B. interpret blueprints and technical drawings for parts manufacturing and maintenance repair operations
- C. grind high speed steel tool bits for general purpose turning and threading.
- D. cut multiple lead and acme threads on a lathe.
- E. use the vertical milling machine to drill holes, index, bore hole to a specified diameter and depth, mill surfaces and edges, and use an indicator to reference work.
- F. replace a single mechanical seal in a centrifugal pump.
- G. align a pump shaft to a motor to a specified tolerance.

This program prepares students for jobs in the manufacturing industry including industrial machinery mechanic and machinery maintenance worker. These jobs involve repairing, installing, adjusting, or maintaining industrial production and processing machinery or refinery and pipeline distribution systems. The labor market for this high-technology, high-wage occupations in Contra Costa Alameda and Solano counties is expected to be strong.

Courses include machining, industrial hydraulics and pneumatics, shop and field maintenance, welding, basic electricity, blueprint drawing and reading, basic drafting, mathematics, computer software, and technical reading and writing. Required courses are offered sequentially over a period of three terms. This program is offered as a collaborative program with Los Medanos College in Pittsburg and Laney College in Oakland. Students may complete courses at any of the colleges in order to meet requirements. Some required courses are only offered at Laney College, Los Medanos College or DVC. Students are advised to meet with a counselor or program advisor to develop an educational plan that meets their needs.

Students must complete each course used to meet a program requirement with a "C" grade or higher.

<i>required courses:</i>	<i>units</i>
COMSC-101 Computer Literacy	4
CONST-110 Occupational Safety	2
ELECT-110 Survey of Electricity	2
ENGTC-119 Introduction to Technical Drawing.....	3
ENGTC-126 Computer Aided Design and Drafting - AutoCAD	3
ENGL-098 Introduction to College Writing.....	3
ENGTC-165 Machining and Manufacturing I.....	3
ENGTC-166 Machining and Manufacturing II.....	3
ENGTC-175 Hydraulic and Pneumatic Systems and Components	3
ENGTC-176 Mechanical Systems and Components	3

plus at least 0-3 units from:

ENGTC-111 Mathematics for Technicians.....	3
MATH-120 Intermediate Algebra.....	5
MATH-121 Plane Trigonometry	3
MATH-191 Pre-Calculus.....	5
MATH-192 Analytic Geometry and Calculus I	5

plus at least 6 units in one of the following specializations:

fabrication	
ENGTC-168 Introduction to Computer Numerical Control.....	3

plus at least 3 units from:

WELD-10* Basic Arc Welding Theory	3
WELD-205** Introduction to Welding	3

electro-mechanical	
ELECT-120 Direct Current Circuits	4
ELECT-121 Alternating Current Circuits	4
ELECT-130 Motors and Motor Controllers	4
ELECT-220 Circuit Diagnosis and Analysis: Troubleshooting	2
ELECT-230 Electro-Mechanical Equipment	2
ELECT-271 Programmable Logic Controllers	4
total minimum required units	35

*Los Medanos College

**Laney College

**Certificate of accomplishment
Computer aided drafting and digital media
for architecture, industrial design and
engineering**

Students completing the program will be able to...

- A. create 2-dimensional and 3-dimensional computer aided drawings (CAD).
- B. interpret construction blueprints and architectural plans.
- C. calculate data collected from land surveying).
- D. interpret simple technical drawings.
- E. construct 3-Dimensional models using parametric software.

Drafters make drawings and plans to specify dimensions, materials and processes used in the making of a final product. These drawings are guidelines for the workers who will actually build or make whatever is being produced. Drafters also make drawings from blueprints, engineering sketches, photos and other sources which show how parts and other objects work, their relation to one another, and how they will be put together. Drafters create drawings and plans to specify dimensions, materials and processes for the finished product. Such drawings and plans provide guidance to those working to complete the finished product. Drafters also render drawings from blueprints, sketches, photos and other sources which show the interplay of components and their relationships to one another, and to provide guidance for final assembly.

To earn a certificate of accomplishment, students must complete each of the required courses with a "C" grade or higher. Some courses are not offered every term. Consult with the program director for assistance in scheduling classes.

<i>required courses:</i>	<i>units</i>
<i>complete 3 units from:</i>	
ARCHI-126 Computer Aided Design and Drafting - AutoCAD.....	3
ENGTC-126 Computer Aided Design and Drafting - AutoCAD.....	3

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plus at least 3 units from:

ARCHI-226	Computer Aided Drafting Design, Advanced Concepts - AutoCAD	3
ENGTC-226	Computer Aided Drafting Design, Advanced Concepts - AutoCAD	3

plus at least 3 units from:

ARCHI-119	Introduction to Technical Drawing	3
ARCHI-120	Introduction to Architecture and Environmental Design	3
CONST-114	Blueprint Reading	3
ENGTC-119	Introduction to Technical Drawing	3

plus at least 3 units from:

ARCHI-135	Digital Tools for Design	3
ARCHI-136	Digital Tools for Architecture	3
ARTDM-160	3D Modeling and Animation I	3
ENGTC-129	Product Design I Using SolidWorks	3
GEOG-125	Introduction to Geographic Information Systems (GIS)	3
IDSGN-120	Introduction to Industrial and Product Design	3
total minimum required units		12

Certificate of accomplishment Pre-engineering technology

Students completing the program will be able to...

- develop technical drawings with detailed dimensions using hand drafting line work and lettering.
- create 2-dimensional computer aided design (CAD) drawings and 3-dimensional computer models.
- safely operate hand and power tools.
- use measuring devices to calculate and verify tolerances for metal, wood, and plastics parts.
- apply prototyping techniques for engineering, product design, and manufacturing.

The certificate of accomplishment in pre-engineering technology provides students with the foundation of skills required to pursue a degree or certificate in mTECH (industrial machine maintenance), manufacturing, industrial design, or electro-mechanical. The courses provide students with skills in technical drawing, computer aided design (CAD), and traditional shop tools.

Students create detailed product specifications and gain knowledge required to safely operate shop tools. Concepts in technical drawing, computer-aided design, and hand drafting will be inclusive. In addition, students use a variety of measuring devices and safely operate traditional machinery including drills, saws and mechanical tools. Completion of the foundation courses and prepare students to transition into technical design, rapid prototyping, computer numerical control (CNC) machining and manufacturing.

To earn a certificate of accomplishment, students must complete each course used to meet a certificate requirement with a "C" grade or higher and maintain an overall GPA of 2.5 or higher in the coursework required for the certificate.

required courses:

	<i>units</i>	
ENGTC-119	Introduction to Technical Drawing	3
ENGTC-126	Computer Aided Design and Drafting-AutoCAD	3
IDSGN-105	Assembly and Fabrication Workshop	2
total minimum required units		8

ENGTC-111 Mathematics for Technicians

3 units LR

- 54 hours lecture per term
- Prerequisite: MATH-090 or MATH-090E or MATH-090SP or equivalent
- Formerly ENGIN-111

This course is a study of mathematical topics used for technical applications in the workplace. Topics include algebraic operations, factoring, fractional equations, quadratic equations, rational, square root, exponential, absolute value and logarithms. Calculation of surface areas and volumes of objects, polynomials and systems of equations is covered. CSU

ENGTC-119 Introduction to Technical Drawing

3 units SC

- 36 hours lecture/72 hours laboratory per term
- Note: Same as ARCHI-119. For students with no previous drafting experience. Credit by examination option available.
- Formerly ENGIN-119

This course presents an introduction to technical drawing. Topics include technical lettering and line work, geometric constructions, sketching and shape description, orthographic projection, dimensioning, section views, and auxiliary views. Students will gain experience using computers to produce technical drawings, utilizing 3D modeling and orthographic computer aided design (CAD) drafting. An introduction to computer numerical control (CNC) prototyping and 3D printing is also covered. CSU

ENGTC-123 Principles of Civil Drafting

3 units LR

- 36 hours lecture/72 hours laboratory per term
- Recommended: ENGTC-111 (may be taken concurrently), ENGTC-119 and ENGTC-126 or equivalents
- Formerly ENGIN-123

Introduction to civil drafting as it relates to topographic maps and charts. Course covers reading, interpreting and constructing a variety of maps used for civil engineering such as surveyor maps, plat and plot maps, and aerial maps. Students will use both manual and computer methods for drafting of maps. CSU

ENGTC-126 Computer Aided Design and Drafting - AutoCAD

3 units SC

- 36 hours lecture/72 hours laboratory per term
- Recommended: ENGTC-119 or ARCHI-119 or equivalent
- Note: Same as ARCHI-126. Students may petition to repeat this course when software or hardware is changed. Only the first course completed will be applied toward a degree or certificate requirement. Units for both courses will apply towards the 60 units required for the degree. Credit by examination option available.
- Formerly ENGIN-126

This introductory course covers the fundamentals of AutoCAD, a computer design drafting program, applied to the creation of technical drawings. Hands-on training utilizing a comprehensive overview of the software package and its applications to engineering drafting is stressed. CSU, UC (credit limits may apply to UC - see counselor)

ENGTC-129 Product Design I Using SolidWorks

3 units SC

- 36 hours lecture/72 hours laboratory per term
- Recommended: ARCHI-119 or ENGTC-119 or equivalent
- Note: Students may petition to repeat this course when software or hardware is changed. Only the first course completed will be applied toward a degree or certificate requirement. Units for both courses will apply towards the 60 units required for the degree. Credit by examination option available.
- Formerly ENGIN-129

This course will introduce students to product design using SolidWorks. Students will learn the functions of SolidWorks and how to apply these functions within the product design process. CSU

ENGTC-160 Introduction to Industrial and Manufacturing Engineering

3 units LR

- 54 hours lecture per term
- Recommended: ENGTC-111 or equivalent
- Formerly ENGIN-160

This course presents the methods of manufacturing steel, aluminum, and plastic products from ore mining to finished goods. topics include blueprint reading, quality assurance, types of machinery used in manufacturing, methods of casting, forming, forging, extruding, and sintering of materials. CSU, UC

ENGTC-162 Geometric Dimensioning and Tolerancing

1 unit LR

- 9 hours lecture/27 hours laboratory per term
- Recommended: ENGTC-111 or equivalent
- Formerly ENGIN-162

This course will present the principles of geometric dimensioning and tolerancing (GDT). Topics include GDT symbols, datum planes, material conditions, orientation, location, profile and runout tolerances. Laboratory assignments emphasize measurement using granite tables and pin and height gauges. CSU, UC

ENGTC-165 Machining and Manufacturing I

3 units LR

- 36 hours lecture/72 hours laboratory per term
- Recommended: ENGTC-119 or ARCHI-119 or equivalent
- Formerly ENGIN-165

This course introduces practical and theoretical aspects of machine tool processes. Topics include basic blueprint interpretation, use of hand tools, measuring instruments and gauges, layout, inspection techniques and metals identification. Setup and operation of drill presses, band saw, grinders, lathes, milling machines and related tools will also be covered. CSU

ENGTC-166 Machining and Manufacturing II

3 units LR

- 36 hours lecture/72 hours laboratory per term
- Prerequisite: ENGTC-165 or equivalent
- Formerly ENGIN-166

This course introduces practical and theoretical aspects of advanced machine tool processes, focusing on lathe and vertical milling machine operations. Topics include precision measuring and inspection practices, surface grinding, special work holding devices, and mechanical hardware. An introduction to Geometric Dimensioning and Tolerancing (GDT) and properties of materials associated with machinability, heat treating and hardness testing is provided. CSU

ENGTC-168 Introduction to Computer Numerical Control

3 units SC

- 36 hours lecture/72 hours laboratory per term
- Recommended: ENGIN-120 or equivalent
- Formerly ENGIN-168, ENGIN-172

This course introduces students to Computer Numerical Control (CNC) machining. Students will learn the techniques of developing and programming cutting tool paths and movements using three-dimensional CAD models and working drawings. Instruction will cover the use of Computer Integrated Manufacturing package (CIM) software and visualization of cutting operations. Topics will also include setup and operation of CNC equipment for manufacturing. CSU

ENGTC-175 Hydraulic and Pneumatic Systems and Components

3 units SC

- 18 hours lecture/108 hours laboratory per term
- Formerly ENGIN-175

This course covers the practical and theoretical aspects of hydraulic and pneumatic systems. Topics include concepts, theory and common systems, components and devices. The laboratory emphasizes hands-on exercises in operation, maintenance and mechanical skills. CSU

ENGTC-176 Mechanical Systems and Components

3 units SC

- 18 hours lecture/108 hours laboratory per term
- Formerly ENGIN-176

This course covers mechanical systems with an emphasis on mechanical drives, flexible belt drives, lubrication, bearings, vibration, and rotating equipment. Topics include operation, maintenance and repair of mechanical systems and components used in a variety of industrial occupations. CSU

**ENGTC-226 Computer Aided Drafting Design,
Advanced Concepts - AutoCAD**

3 units SC

- 36 hours lecture/72 hours laboratory per term
- Recommended: ENGTC-126 or ARCHI-126 or equivalent
- Note: Same as ARCHI-226. Students may petition to repeat this course when software or hardware is changed. Only the first course completed will be applied toward a degree or certificate requirement. Units for both courses will apply towards the 60 units required for the degree.
- Formerly ENGIN-226

This course covers the concepts and applications of constructing digital three-dimensional (3D) models and photo-realistic renderings for presentation using AutoCAD, 3D Studio Max and Alias. Advanced techniques for surface, wireframe and solid modeling will be presented. Students will explore lighting, materials mapping and rendering as they apply to architecture, engineering and industrial design. CSU, UC (credit limits may apply to UC - see counselor)