DIABLO VALLEY COLLEGE   CATALOG 2022-2023
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Engineering technology

ENGINEERING TECHNOLOGY - ENGTC

Despina Prapavessi, Dean
Mathematics and Engineering Division
Mathematics Building, Room 267

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.

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.

major requirements:		units
CONST-114	Print 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 units for the major	**30**

Associate in science degree
Machining for 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 associate of science degree in machining for mechanical engineering technology is offered to prepare students with the required aptitude and skills to enter the workforce as entry-level machinists, tool and die makers, or mold makers. Students will be prepared for careers that are highly in demand for aerospace, medical, electronic, high tech, and automotive and transport industries. Graduates of this program will be well equipped to continue their career advancement as engineers, product developers, prototype/model builders, production machinist, or electro-mechanical maintenance and repair specialists.

Students completing this program will develop familiarity with lathes, mills, drill presses, and precision measuring. They will also be introduced to the concepts of computer numerical control (CNC) machines and 3D (additive) manufacturing processes, geometric dimension and tolerance (GD&T), and modern technical drawing (CAD) techniques.

The DVC machining for 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.

major requirements:		*units*
ENGTC-119	Introduction to Technical Drawing	3
ENGTC-126	Computer Aided Design and Drafting-AutoCAD	3
ENGTC-129	Product Design I Using Solidworks	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

plus at least 3 units from:		
ENGTC-111	Mathematics for Technicians	3
MATH-119	Beginning and Intermediate Algebra	4
MATH-121	Plane Trigonometry	3
MATH-191	Pre-Calculus	5
MATH-192	Analytic Geometry and Calculus I	5
	total minimum units for the major	**25**

Associate in science degree
mTECH - Industrial maintenance machinist/mechanic

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 mechanics, maintenance specialists or technicians, and machinery maintenance workers in industries including chemical, refinery, and public works. These jobs involve repairing, installing, adjusting, or maintaining industrial production and processing machinery or refinery and pipeline distribution systems. The labor market for these high-wage occupations in the Bay Area is strong.

Graduates of this program will gain skills and knowledge in areas that include machining, industrial hydraulics and pneumatics, shop and field maintenance, basic electricity, technical drawing, basic drafting, and applied mathematics. 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.

major requirements:		*units*
CONST-110	Occupational Safety	2
ELECT-110	Survey of Electricity	2
ENGTC-119	Introduction to Technical Drawing	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 0-5 units from:

ENGTC-111	Mathematics for Technicians	3
MATH-119	Beginning and Intermediate Algebra	4
MATH-121	Plane Trigonometry	3
MATH-191	Pre-Calculus	5
MATH-192	Analytic Geometry and Calculus I	5
	total minimum units for the major	**19**

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:		*units*
CONST-114	Print 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.

required courses:		*units*
CONST-114	Print Reading	3
ENGTC-111	Mathematics for Technicians	3
MATH-121*	Plane Trigonometry	3

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:
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
Design for manufacturing (D4m)

Students completing this program will be able to...

A. analyze markets, marketing strategy, the marketing environment, and the marketing mix variables of product, price, promotion, and distribution.

B. work within a team of diverse industry professionals to establish and meet design criteria.

C. develop detailed technical drawings of a product.

D. determine the most efficient and responsible manufacturing method for products.

E. manufacture an object from a given drawing using machine tools.

F. prototype an object from a given technical drawing or three-dimensional CAD model.

G. design and prototype mechanical parts under the supervision of engineers.

H. use computer integrated manufacturing (CIM) and computer numerical control (CNC) software for automation of manufacturing.

Diablo Valley College's (DVC) industrial design program addresses the workforce needs of the design and manufacturing sector with the design for manufacturing (D4m) certificate of achievement. The program courses provide current digital fabrication skills, while providing a foundation of traditional manufacturing. Students will also learn the design process and rapid prototyping techniques required by the field of industrial design as well as business marketing skills.

Graduates of the design for manufacturing (D4m) program may be employed in jobs that include production occupations, engineering occupations, assemblers and fabricators, engineering technicians, computer-controlled machine operators, rapid prototyping for product design, and within research and development (R&D) fields. Students will gain the skills necessary to create 3D CAD models, program computer numerical control (CNC) manufacturing equipment, and operate traditional machinery such as lathes, mills, drill presses, and precision measuring devices. Students completing this program will also be candidates for a broad range of manufacturing and corporate jobs requiring a combination of technical knowledge and the skills needed to collaborate between marketing, design, engineering, and manufacturing.

The design for manufacturing (D4m) certificate of achievement program shares coursework with both the machining and mechanical engineering technology and industrial design certificate programs. To earn the certificate of achievement, students must complete each of the courses required for the major with a "C" grade or higher.

required courses: *units*
ENGTC-119 Introduction to Technical Drawing.................... 3
ENGTC-128 Fusion 360 for Design and Prototyping............ 3
ENGTC-165 Machining and Manufacturing I 3
ENGTC-168 Introduction to Computer Numerical Control .. 3
ENGTC-268 CNC Programming and Machining.................... 3
IDSGN-120 Introduction to Industrial and Product Design 3
IDSGN-121 Industrial and Product Design Foundations ... 3
IDSGN-137 Digital Fabrication and Prototyping 3

plus at least 2 units from:
IDSGN-105 Assembly and Fabrication Workshop..................... 2
IDSGN-107 Furniture Design Studio.. 2

plus at least 3 units from:
BUSMK-256 Marketing... 3
ENGTC-129 Product Design I Using SolidWorks........................ 3

plus at least 3 units from:
IDSGN-220 Soft Goods Product Design Studio 4
IDSGN-221 Transportation Design Studio 4

total minimum required units	**32**

Certificate of achievement – Industrial automation and robotics

Students completing this program will be able to...

A. program robots to perform or simulate industrial applications.

B. identify, measure, and analyze series, parallel, and series-parallel circuits mathematically and experimentally.

C. measure, analyze, and troubleshoot equipment problems.

D. program the programmable logic controllers to control output devices based on sensor inputs

E. solve series, parallel, and series-parallel AC circuits for voltage, current, impedance, and phase angle.

F. describe the quality assurance procedure that might be used to verify the part is conforming to specification.

G. demonstrate competence in principles and operation of basic hydraulic systems; use flow meters and pressure gauges to measure valves and make adjustments.

H. diagnose and troubleshoot mechanical systems.

I. use currently available basic personal protective equipment and be able to select appropriate equipment for a given environment.

This program prepares students for jobs in the robotic industry related to the diagnostics, repair, maintenance, and integration of complex equipment. Robotic jobs can be found within the fields of research and development (R&D), manufacturing, industrial production, distribution logistics, and the biomedical and medical industries. Disciplines of study include, programmable logic controllers (PLC), motors and controllers, direct and alternate current circuits, hydraulic and pneumatic systems, and industrial robotic applications.

Today's advanced manufacturing industries, distribution centers, and medical research facilities are increasingly dependent on robotic systems to provide highly accurate and uninterrupted throughput. With this inherent dependence on highly complex equipment, specialized robotic technicians are highly sought after and are increasingly employed within these facilities. DVC's industrial automation and robotics graduates will provide highly qualified robotic technicians who can problem solve for a variety of technical diagnostic areas.

DVC's students will utilize state of the art equipment needed to integrate robotic equipment into advanced production and specialty systems. Courses will introduce the basic operations of robotic equipment and autonomous systems, with an emphasis on hydraulics and pneumatics, electronics, and programmable logic controllers (PLC). Students will also learn how to practice safety within high-tech facilities as they troubleshoot and repair electromechanical systems and components. An emphasis on quality control standards and production system efficiencies is inclusive.

Graduates of this program will gain skills and knowledge in areas that include industrial hydraulics and pneumatics, electricity and electronics, machine repair, shop and field maintenance, and operational robotic programing.

To earn a certificate of achievement, students must complete each of the required courses with a "C" grade or higher.

required courses:		*units*
ELECT-120	Direct Current Circuits	4
ELECT-130	Motors and Motor Controllers	4
ELECT-271	Programmable Logic Controllers	4
ELTRN-121	Alternating Current Circuits	4
ENGTC-160	Introduction to Industrial and Manufacturing Engineering	3
ENGTC-175	Hydraulic and Pneumatic Systems and Components	3
ENGTC-176	Mechanical Systems and Components	3
ENGTC-180	Applications for Industrial Robotics	3
ELTRN-107	Introduction to Robotics	2
plus at least 2 units from:		
CONST-110	Occupational Safety	2
ENGTC-165	Machining and Manufacturing I	3

total minimum required units	**32**

Certificate of achievement Machining for 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 machining for mechanical engineering technology is offered to prepare students with the required aptitude and skills to enter the workforce as entry-level machinists, tool and die makers, or mold makers. Students will be prepared for careers that are highly in demand for aerospace, medical, electronic, high tech, and automotive and transport industries. Graduates of this program will be well equipped to continue their career advancement as engineers, product developers, prototype/model builders, production machinist, or electro-mechanical maintenance and repair specialists.

Students completing this program will develop familiarity with lathes, mills, drill presses, and precision measuring. They will also be introduced to the concepts of computer numerical control (CNC) machines and 3D (additive) manufacturing processes, geometric dimension and tolerance (GD&T), and modern technical drawing (CAD) techniques.

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

required courses:		units
ENGTC-119	Introduction to Technical Drawing	3
ENGTC-126	Computer Aided Design and Drafting-AutoCAD	3
ENGTC-129	Product Design I Using Solidworks	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

plus at least 3 units from:

ENGTC-111	Mathematics for Technicians	3
MATH-119	Beginning and Intermediate Algebra	4
MATH-121	Plane Trigonometry	3
MATH-191	Pre-Calculus	5
MATH-192	Analytic Geometry and Calculus I	5
	total minimum required units	**25**

Certificate of achievement
mTECH - Industrial maintenance machinist/mechanic

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 mechanics, maintenance specialists or technicians, and machinery maintenance workers in industries including chemical, refinery, and public works. These jobs involve repairing, installing, adjusting, or maintaining industrial production and processing machinery or refinery and pipeline distribution systems. The labor market for these high-wage occupations in the Bay Area is strong.

Graduates of this program will gain skills and knowledge in areas that include machining, industrial hydraulics and pneumatics, shop and field maintenance, basic electricity, technical drawing, basic drafting, and applied mathematics. 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. Students may not take a pass/no pass option for certificate courses.

required courses:		units
CONST-110	Occupational Safety	2
ELECT-110	Survey of Electricity	2
ENGTC-119	Introduction to Technical Drawing	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 0-5 units from:

ENGTC-111	Mathematics for Technicians	3
MATH-119	Beginning and Intermediate Algebra	4
MATH-121	Plane Trigonometry	3
MATH-191	Pre-Calculus	5
MATH-192	Analytic Geometry and Calculus I	5
	total minimum required units	**19**

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.

required courses:		units
complete 3 units from:		
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 Print 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...

A. develop technical drawings with detailed dimensions us-ing hand drafting line work and lettering.

B. create 2-dimensional computer aided design (CAD) draw-ings and 3-dimensional computer models.

C. safely operate hand and power tools.

D. use measuring devices to calculate and verify tolerances for metal, wood, and plastics parts.

E. apply prototyping techniques for engineering, product design, and manufacturing.

The certificate of accomplishment in pre-engineering tech-nology provides students with the foundation of skills required to pursue a degree or certificate in mTECH (indus-trial 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 draft-ing 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 numeri-cal control (CNC) machining and manufacturing.

To earn a certificate of accomplishment, students must com-plete 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: *units*
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**

Certificate of accomplishment
Rapid prototyping and 3D printing
Students completing the program will be able to...

A. prototype and fabricate a variety of components in vari-ous materials.

B. model components and parts in a 3D modeling and manufacturing software package.

C. develop detailed technical drawings of a product.

D. determine the most efficient and responsible manufactur-ing method for the product.

E. prototype an object from a given technical drawing or three-dimensional CAD model.

F. design and prototype mechanical parts under the super-vision of engineers.

G. use computer integrated manufacturing (CIM) and com-puter numerical control (CNC) software for automation of manufacturing.

The certificate of accomplishment provides foundation skills for 3D printing and operating computer numerical control (CNC) devices that are required for fabrication and prototyping. The Rapid Prototyping and 3D Printing courses provide students with the experience in the latest 3D CAD modeling and CAM programming software and hardware.

Students use Rapid Prototyping and 3D Printing techniques inherent to the field of industrial design and advanced manufacturing. Students completing this program will also be candidates for a broad range of jobs that require a combination of technical knowledge and the skills needed to collaborate between marketing, design, engineering, and manufacturing.

The Rapid Prototyping and 3D Printing certificate of accomplishment is not intended for transfer, rather, it has been developed to increase skills for employment and as a segue into DVC's D4m (Design for Manufacturing) certificate of achievement.

To earn a certificate of accomplishment, students must complete each course used to meet a certificate requirement with a "C" grade or higher.

two units from:
IDSGN-105 Assembly and Fabrication Workshop............... 2
IDSGN-107 Furniture Design Studio 2

plus at least 3 units from:
ENGTC-128 Fusion 360 Modeling and Prototyping 3
ENGTC-129 Introduction to SolidWorks 3

plus at least 3 units from:

ENGTC-168	Introduction to Computer Numerical Control	3
IDSGN-137	Digital Fabrication and Prototyping	3
	total minimum required units	**8**

Certificate of accomplishment
Robotics

Students completing the program will be able to...

A. program robots to perform or simulate industrial applications.

B. identify, measure, and analyze series, parallel, and series-parallel circuits mathematically and experimentally.

C. diagnose and troubleshoot mechanical systems.

D. demonstrate competence in principles and operation of basic hydraulic systems; use flow meters and pressure gauges to measure valves and make adjustments.

This certificate of accomplishment prepares students with foundational skills related to jobs in the robotic industry that include operating, diagnostics, and repair. Robotics jobs can be found within the fields of research and development (R&D), advanced manufacturing, industrial production, distribution logistics, and the biomedical industries. Disciplines of study may include programming, motors and controllers, direct current circuits, hydraulic and pneumatic systems, mechanical systems and components, and applications for industrial robotics. The labor market for these high-wage occupations in the Bay Area is strong.

Today's advanced manufacturing industries, distribution centers, and medical research facilities are increasingly dependent on robotic systems to provide highly accurate and uninterrupted throughput. With the dependence on highly complex equipment, specialized robotic operators and technicians are required within these facilities. This certificate of accomplishment will prepare graduates to problem solve for a variety of technical applications with an emphasis on industrial machinery, electronics, and programming. Students will also learn how to practice safety within high-tech facilities.

To earn a certificate of accomplishment, students must complete each course used to meet a certificate requirement with a "C" grade or higher.

two units from:

ELTRN-107	Introduction to Robotics	3
ENGTC-180	Applications for Industrial Robotics	3

plus at least 2 units from:

ELECT-110	Survey of Electricity	2
ELECT-120	Direct Current Circuits	4

plus at least 3 units from:

ENGTC-175	Hydraulic and Pneumatic Systems and Components	3
ENGTC-176	Mechanical Systems and Components	3
	total minimum required units	**7**

ENGTC-111 Mathematics for Technicians
3 units   LR
- *DVC GE: IC*
- *54 hours lecture per term*
- *Prerequisite: Placement into MATH-121 or higher or MATH-085 or MATH-085SP or beginning algebra or equivalent*

This course is a study of mathematical topics used for technical applications in the workplace. Topics include an introduction to units of measurement, mathematical operations with application to technical problems, algebraic operations and concepts in geometry and trigonometry. An introduction to coordinate spaces and systems and their application to technical problems in the field are also covered. The calculation of surface areas and volumes are presented in context with problems encountered in technical and design fields. 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.*

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, UC (credit limits may apply to UC - see counselor)

ENGTC-123 Principles of Civil Drafting
3 units   LR
- *36 hours lecture/72 hours laboratory per term*
- *Advisory: ENGTC-111 (may be taken concurrently), ENGTC-119 and ENGTC-126 or equivalents*

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*
- *Advisory: 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.*

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

ENGTC-128 Fusion 360 for Design and Prototyping

3 units   SC
- *36 hours lecture/72 hours laboratory per term*
- *Advisory: ENGTC-119 or ARCHI-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.*

This course introduces Autodesk's Fusion 360 software as related to the product design process and rapid prototyping. The course covers a broad range of topics related to the software's features that include: 3D modeling, 2D documentation, rendering, animation, generative design, additive (3D Printing), and subtractive fabrication (CNC milling). Students will use the cloud-based software from step-by-step lessons and project-based instruction. Previous experience with Fusion 360 or 3D CAD modeling software is not required. CSU

ENGTC-129 Product Design I Using SolidWorks

3 units   SC
- *36 hours lecture/72 hours laboratory per term*
- *Advisory: 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.*

This course introduces students to product design using SolidWorks. Students use the functions of SolidWorks and 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*

This course presents the methods and processes involved in the manufacturing of a variety of products in various materials. Topics include an introduction to various materials and their properties, types of machinery used in manufacturing, methods of casting and shaping materials along with other industrial and technical processes. An introductory overview of engineering drawing standards and quality assurance is also covered. CSU, UC

ENGTC-162 Geometric Dimensioning and Tolerancing

1 unit   LR
- *9 hours lecture/27 hours laboratory per term*
- *Advisory: ENGTC-111 or equivalent*

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*
- *Advisory: ENGTC-119 or ARCHI-119 or equivalent*

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, and computer-numerical control (CNC) machines 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*

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*
- *Advisory: ENGIN-120 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.*

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*

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*

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-180 Applications for Industrial Robotics

3 units   SC
- *36 hours lecture/72 hours laboratory per term*
- *Prerequisite: ELTRN-107 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.*

This course introduces applied robotics and automation through the examination of principles of controller hardware, systems interface, and programming structure. Students will practice the skills needed to operate and control robotic devices. Students also develop autonomous systems and robotic operations within industrial applications that include research and development (R&D), advanced manufacturing, distribution logistics, and the biomedical and medical fields. CSU

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

3 units   SC
- *36 hours lecture/72 hours laboratory per term*
- *Advisory: 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.*

This course covers the concepts and applications of constructing digital three-dimensional (3D) models and photo-realistic renderings for presentation using AutoCAD. 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. Other software may be presented. CSU, UC (credit limits may apply to UC - see counselor)

ENGTC-268 CNC Programming and Machining

3 units   SC
- *36 hours lecture/72 hours laboratory per term*
- *Advisory: ENGTC-165 or equivalent and ENGTC-168 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.*

This course will provide students with advanced instruction on how to program and operate Computer Numerical Control (CNC) machines. Students in this class will build upon prior knowledge from foundational manual and CNC machining experience. Learners will prototype and manufacture parts on DVC's CNC mills, CNC lathes, and 5-axis tables. The course includes programing with CAD/CAM software, fixturing materials, operating CNC machines, and creating precision parts. Students within this program can be employed in a variety of manufacturing-related fields such as production machining, engineering, industrial design, prototyping, fabrication, and quality control. CSU