

ENGINEERING

Civil Drafting and Design Degree: AS

Program Code: SAC.ENRCE.AS

Program Control Number: 04212

This program prepares students for employment as a DRAFTER or DESIGNER in the CIVIL ENGINEERING, architecture, or construction fields. Civil drafters create detailed technical drawings of buildings, structures, and various construction projects designed by architects and civil engineers. Civil drafters must be proficient in industry-standard CAD software (AutoCAD, Civil 3D, REVIT) and have knowledge of industry-standard drafting practices. Employment is available in private industry and at local and county government agencies.

The skills learned in this program are also essential job skills for civil engineers and architects, so transfer students are encouraged to take this coursework as well. Some of the courses in the program may articulate to university engineering or engineering technology programs. It should be noted that many university engineering programs may not have these job skills courses as part of their regular curriculum.

If more units are needed to complete the associate degree (~60 units), it is suggested students also take: ENGR 118, 119 (surveying).

Learning Outcome(s):

1. Select and develop engineering careers
2. Read and produce civil engineering drawings that meet industry standards
3. Use a variety of CAD software standard for the civil engineering field

The associates degree also requires completion of general education coursework per Plans A, B, or C of the college catalog

Required Core Courses:

Units: 23-24

ENGR 100A Introduction to Engineering	3
OR	
ENGR 100B Introduction to Civil Engineering	2
ENGR 012 Civil/Architectural Blueprint Reading	2
ENGR 122 Engineering Drawing	3
OR	
ENGR 125 Engineering Graphics	3
ENGR 183 AutoCAD I	4
ENGR 184 AutoCAD II	4
ENGR 185 Civil 3D	4
ENGR 154 Revit and Civil Drafting	4

Total: 23-24

Civil Engineering Technology Degree: AS

Program Code: SAC.ENRCT.AS

Program Control Number: 04202

This program prepares students for employment as a CIVIL ENGINEERING TECHNICIAN. Civil engineering technicians help civil engineers to plan, design, and build various infrastructure projects (e.g., highways, bridges, utilities, etc.) as well as commercial, industrial, residential, and land development projects. Civil engineering technicians work in offices and at jobsites, assisting engineers and surveyors. Activities include reviewing blueprints, preparing maps and proposals, testing, and data collection/reporting. Employment is available in private industry and at local and county government agencies.

The skills learned in this program are also essential job skills for civil engineers and architects, so transfer students are encouraged to take this coursework as well. Some of the courses in the program may articulate to university engineering or engineering technology programs. Note that many university engineering programs may not have these job skills courses as part of their regular curriculum.

Learning Outcome(s):

1. Select and develop engineering careers
2. Use CAD software to produce models and technical drawings that conform to industry standards
3. Use common land surveying instruments

The associates degree also requires completion of general education coursework per Plans A, B, or C of the college catalog.

Required Core Courses:

Units: 31-32

ENGR 100A Introduction to Engineering	3
OR	
ENGR 100B Introduction to Civil Engineering	2
ENGR 122 Engineering Drawing	3
OR	
ENGR 125 Engineering Graphics	3
ENGR 183 AutoCAD I	4
ENGR 184 AutoCAD II	4
ENGR 185 Civil 3D	4
ENGR 118 Surveying	3
ENGR 119 Advanced Plane Surveying	3
GEOL 101 Introduction to Geology	3
GEOL 101L Introduction to Geology Laboratory	1
MATH 162 Trigonometry	4

Total: 31-32

Engineering CAD Drafting Degree: AS

Program Code: SAC.ENRCA.AS

Program Control Number: 08720

This program prepares students for employment as a MECHANICAL or CIVIL ENGINEERING COMPUTER-AIDED DESIGN (CAD) DRAFTER, and has a strong focus on teaching industry-standard CAD software in the respective areas. Students select one of two options: (1) MECHANICAL, which focuses on Solidworks and CATIA, or (2) CIVIL, which focuses on AutoCAD, Civil 3D, and REVIT.

If more units are needed to complete the associates degree (~ 60 units), it is suggested students

also select from the following list: For mechanical drafting (ENGR 114, 105, 106), for civil drafting (118, 119).

Learning Outcome(s):

1. Use CAD software to produce industry-standard models
2. Use CAD software to produce industry-standard technical drawings

The associate degree also requires completion of general education coursework (~ 30 units) per Plans A, B, or C of the college catalog.

Required Core Courses:

Units: 5-6

ENGR 100A Introduction to Engineering	3
OR	
ENGR 100B Introduction to Civil Engineering	2
ENGR 122 Engineering Drawing	3
OR	
ENGR 125 Engineering Graphics	3

Select the Mechanical or Civil Option

Units: 18

Mechanical Option

ENGR 103 Solidworks Beginning Solid Modeling	3
ENGR 104 Solidworks Intermediate Solid Modeling	3
ENGR 105 Solidworks Advanced Solid Modeling	3
ENGR 130A CATIA I	3
ENGR 130B CATIA II	3
ENGR 124 Advanced Mechanical Drafting and Design	3

Civil Option

ENGR 012 Civil/Architectural Blueprint Reading	2
ENGR 183 AutoCAD I	4
ENGR 184 AutoCAD II	4
ENGR 185 Civil 3D	4
ENGR 154 Revit and Civil Drafting	4

Total: 23-24

Engineering Degree: AS

Program Code: SAC.ENGR.AS

Program Control Number: 04201

This associate degree curriculum provides a basic program of engineering coursework for students planning to transfer to a university engineering program. The program includes common lower- division engineering courses and also the foundational science and mathematics coursework required for most university engineering programs. While the program reflects a typical lower division university engineering curriculum, it may not fully satisfy lower-division requirements at all engineering university programs. Thus, students should communicate with their desired university to determine the required coursework to transfer with upper-division status. Transfer students are also advised to take job skills courses to improve their employability (see paragraph below).

Students must take coursework for the specified number of units from the block of courses below labeled "engineering or engineering-related courses". Students should select the courses based on major:

For mechanical engineering majors: ENGR 235, 240, 250, 250L, 280, 281, 125, 103 (or 130A)

For civil engineering majors: ENGR 235, 240, 280, 281, 125, 183;

For electrical engineering majors: ENGR 250, 250L, 183; CMPR 120, 121

The program may also provide the necessary background for employment as a drafter, designer, or engineering technician. However, in these cases, students are advised to also pursue associate degrees or certificates in the appropriate career education areas to improve their employability.

For instance, drafter employment may require a degree or certificate in drafting or CAD technology. Engineering technician employment may require a degree or certificate in engineering technology.

Suggested job skill courses depend on major:

1.) Mechanical engineering majors – ENGR 131, 132, 133, 134, 135, 103, 104, 105, 130A, 130B, 125, 124, 114, and 158.

2.) Civil engineering majors – ENGR 183, 184, 185, 154, 118, and 119.

3.) Electrical engineering majors – ENGR 131, 133, 250, and 250L; CMPR 120, 121.

Learning Outcome(s):

1. Select and prepare for engineering careers
2. Demonstrate aptitude in foundational math and science topics
3. Solve engineering problems of common lower division engineering courses

Engineering and engineering-related courses

(take at least 9 units):

Units: 9-11

ENGR 100A Introduction to Engineering	3
ENGR 125 Engineering Graphics	3
ENGR 103 Solidworks Beginning Solid Modeling	3
ENGR 130A CATIA I	3
ENGR 183 AutoCAD I	4
ENGR 235 Statics	3
ENGR 240 Dynamics	3
ENGR 250 Electric Circuits	3
ENGR 250L Electric Circuits Laboratory	1
ENGR 280 Strength of Materials	3
ENGR 281 Properties of Engineering Materials	3
CMPR 120 Introduction to Programming	3
CMPR 121 Programming Concepts	3

Science and math courses:

MATH 180	Single Variable Calculus I	4
MATH 185	Single Variable Calculus II	4
PHYS 217	Engineering Physics I	4
PHYS 227	Engineering Physics II	4
OR		
PHYS 237	Engineering Physics III	4
CHEM 219	General Chemistry	5
OR		
CHEM 219H	Honors General Chemistry	5

The associate degree also requires completion of general education coursework per Plans A, B, or C of the college catalog (~ 30 units).

Total: 30-32**Mechanical Drafting and Design Degree: AS****Program Code: SAC.ENRDD.AS****Program Control Number: 04203**

This program prepares students for employment as a MECHANICAL ENGINEERING DRAFTER or DESIGNER. Mechanical drafters use MCAD (mechanical computer-aided drafting/design) software to create solid models and then detailed technical drawings of machinery or mechanical devices produced by engineers. Mechanical drafters must be proficient in parametric MCAD software and have knowledge of current industry drafting practices. Designers are typically drafters with additional industry experience and training. Designers take generic designs from engineers and add detail to them (e.g., material and fastener selection) using MCAD. Employment is primarily in the private industries such as aerospace, biomedical, industrial, and other manufacturing industries.

The skills learned in this program are also essential job skills for ENGINEERS, so transfer students are also encouraged to take this coursework. It should be noted that many of these job skills courses may not be available at the university, and others may be transferable to the university.

If more units are needed to complete the associate degree (~ 60 units), it is suggested students also select from the following list: ENGR 105 (advanced Solidworks), ENGR 106 (Solidworks drawings), ENGR 133 (basic mechatronics), and MATH 160 (trigonometry).

Learning Outcome(s):

1. Apply the rules of orthographic projection to create multiview drawings
2. Produce models and technical and working drawings that conform to industry standards
3. Effectively use Solidworks and CATIA software to produce models and drawings

The associate degree also requires completion of general education coursework per Plans A, B, or C of the college catalog.(~ 30 units)

Required Core Courses:**Units: 27.5**

ENGR 100A	Introduction to Engineering	3
ENGR 122	Engineering Drawing	3
OR		
ENGR 125	Engineering Graphics	3
ENGR 124	Advanced Mechanical Drafting and Design	3
ENGR 103	Solidworks Beginning Solid Modeling	3
ENGR 104	Solidworks Intermediate Solid Modeling	3
ENGR 130A	CATIA I	3
ENGR 130B	CATIA II	3
ENGR 114	Geometric Dimensioning and Tolerancing	3
ENGR 158	Basic Machining Concepts and Operations	3
ENGR 131	Introduction to Mechatronics	0.5

Total: 27.5**Mechatronics Degree: AS****Program Code: SAC.ENEMT.AS****Program Control Number: 08711**

This program prepares students for employment as a MECHANICAL ENGINEERING TECHNICIAN or as an engineering technician in the related areas of electro-mechanical, aerospace, biomedical, industrial, or manufacturing. The program specializes in the design, fabrication, and testing of mechatronics systems – mechanical systems controlled with electronics or computer technology. The program emphasizes hands-on learning and covers: robotics, PLC (programmable logic controllers), modern fabrication techniques (FDM 3D printing, SLA stereolithography, laser cutting/ engraving, machining, G-code, CNC), control systems (using micro-controllers like Arduino; PID control, sensors, motors and actuators), testing and measurement, and basic circuits,

Employment is mainly in private manufacturing industries such as the mechanical, aerospace, bio-medical, or industrial areas.

The skills learned in this program are also essential job skills for ENGINEERS, so transfer students are also encouraged to take this coursework. It should be noted that many of these job skills courses may not be available at the university, and others may be transferable to the university.

If more units are needed to complete the associate degree (~ 60 units), it is suggested students also select from the following list: CMPR 120 (C programming), CMPR 121 (C programming), ENGR 250L (circuits lab), ENGR 104 (Solidworks II), WELD 101 (intro welding).

Learning Outcome(s):

1. Design, fabricate, and operate mechatronics systems
2. Use and program micro-controllers to obtain sensor data and to control various actuators
3. Fabricate parts using various rapid prototyping equipment

The associate degree also requires completion of general education coursework (~30 units) per Plans A, B, or C of the college catalog.

Required Core Courses:**Units: 23.5**

ENGR 100A	Introduction to Engineering	3
ENGR 122	Engineering Drawing	3
OR		
ENGR 125	Engineering Graphics	3
ENGR 103	Solidworks Beginning Solid Modeling	3
OR		
ENGR 130A	CATIA I	3
ENGR 132	Introduction to Robotics	2.5
ENGR 133	Basic Mechatronics	3
ENGR 134	Intermediate Mechatronics	3
ENGR 135	Advanced Mechatronics	3
ENGR 158	Basic Machining Concepts and Operations	3

Total: 23.5

Civil Drafting and Design: Certificate of Achievement

(Transcripted)

Program Code: SAC.ENRCE.CA

Program Control Number: 21775

This program prepares students for employment as a DRAFTER or DESIGNER in the CIVIL ENGINEERING, architecture, or construction fields. Civil drafters create detailed technical drawings of buildings, structures, and various construction projects designed by architects and civil engineers. Civil drafters must be proficient in industry-standard CAD software (AutoCAD, Civil 3D, REVIT) and have knowledge of industry-standard drafting practices. Employment is available in private industry and at local and county government agencies.

The skills learned in this program are also essential job skills for civil engineers and architects, so transfer students are encouraged to take this coursework as well. Some of the courses in the program may articulate to university engineering or engineering technology programs. It should be noted that many university engineering programs may not have these job skills courses as part of their regular curriculum.

Learning Outcome(s):

1. Select and develop engineering careers
2. Read and produce industry-standard civil engineering drawings
3. Use a variety of CAD software standard for the civil engineering field

Required Core Courses:

Units: 23-24

ENGR 100A Introduction to Engineering	3
OR	
ENGR 100B Introduction to Civil Engineering	2
ENGR 012 Civil/Architectural Blueprint Reading	2
ENGR 122 Engineering Drawing	3
OR	
ENGR 125 Engineering Graphics	3
ENGR 183 AutoCAD I	4
ENGR 184 AutoCAD II	4
ENGR 185 Civil 3D	4
ENGR 154 Revit and Civil Drafting	4

Total: 23-24

Civil Engineering Technology: Certificate of Achievement (Transcripted)

Program Code: SAC.ENRCT.CA

Program Control Number: 21766

This program prepares students for employment as a CIVIL ENGINEERING TECHNICIAN. Civil engineering technicians help civil engineers to plan, design, and build various infrastructure projects (e.g., highways, bridges, utilities, etc.) as well as commercial, industrial, residential, and land development projects. Civil engineering technicians work in offices and at jobsites, assisting engineers and surveyors. Activities include reviewing blueprints, preparing maps and proposals, testing, and data collection/reporting. Employment is available in private industry and at local and county government agencies.

The skills learned in this program are also essential job skills for civil engineers and architects, so transfer students are encouraged to take this coursework as well. Some of the courses in the program may articulate to university engineering or engineering technology programs. Note that many university engineering programs may not have these job skills courses as part of their regular curriculum.

Learning Outcome(s):

1. Select and develop engineering careers
2. Use civil CAD software to do basic drafting and design
3. Use common land surveying instruments

Required Core Courses:

Units: 31-32

ENGR 100A Introduction to Engineering	3
OR	
ENGR 100B Introduction to Civil Engineering	2
ENGR 122 Engineering Drawing	3
OR	
ENGR 125 Engineering Graphics	3
ENGR 183 AutoCAD I	4
ENGR 184 AutoCAD II	4
ENGR 185 Civil 3D	4
ENGR 118 Surveying	3
ENGR 119 Advanced Plane Surveying	3
GEOL 101 Introduction to Geology	3
GEOL 101L Introduction to Geology Laboratory	1
MATH 162 Trigonometry	4

Total: 31-32

Engineering CAD Drafting: Certificate of Achievement (Transcripted)

Program Code: SAC.ENRCA.CA

Program Control Number: 21773

This program prepares students for employment as a MECHANICAL or CIVIL ENGINEERING COMPUTER-AIDED DESIGN (CAD) DRAFTER, and has a strong focus on teaching industry-standard CAD software in the respective areas. Students select one of two options: (1) MECHANICAL, which focuses on Solidworks and CATIA, or (2) CIVIL, which focuses on AutoCAD, Civil 3D, and REVIT.

Learning Outcome(s):

1. Use CAD software to produce industry-standard models
2. Use CAD software to produce industry-standard technical drawings

Required Core Courses:

Units: 5-6

ENGR 100A Introduction to Engineering	3
OR	
ENGR 100B Introduction to Civil Engineering	2
ENGR 122 Engineering Drawing	3
OR	
ENGR 125 Engineering Graphics	3

Select the Mechanical Option or the Civil Option

Units: 18

Mechanical Option

ENGR 103 Solidworks Beginning Solid Modeling	3
ENGR 104 Solidworks Intermediate Solid Modeling	3
ENGR 105 Solidworks Advanced Solid Modeling	3
ENGR 130A CATIA I	3
ENGR 130B CATIA II	3
ENGR 124 Advanced Mechanical Drafting and Design	3

Civil Option

ENGR 012 Civil/Architectural Blueprint Reading	2
ENGR 183 AutoCAD I	4
ENGR 184 AutoCAD II	4
ENGR 185 Civil 3D	4
ENGR 154 Revit and Civil Drafting	4

Total: 23-24

Mechanical Drafting and Design: Certificate of Achievement (Transcripted)**Program Code: SAC.ENRDD.CA****Program Control Number: 21774**

This program prepares students for employment as a MECHANICAL ENGINEERING DRAFTER or DESIGNER. Mechanical drafters use MCAD (mechanical computer-aided drafting/design) software to create solid models and then detailed technical drawings of machinery or mechanical devices produced by engineers. Mechanical drafters must be proficient in parametric MCAD software and have knowledge of current industry drafting practices. Designers are typically drafters with additional industry experience and training. Designers take generic designs from engineers and add detail to them (e.g., material and fastener selection) using MCAD. Employment is primarily in the private industries such as aerospace, biomedical, industrial, and other manufacturing industries.

The skills learned in this program are also essential job skills for ENGINEERS, so transfer students are also encouraged to take this coursework. It should be noted that many of these job skills courses may not be available at the university, and others may be transferable to the university.

If more units are needed to complete the associate degree (~ 60 units), it is suggested students also select from the following list: ENGR 105 (advanced Solidworks), ENGR 106 (Solidworks drawings), ENGR 133 (basic mechatronics), and MATH 160 (trigonometry).

Learning Outcome(s):

1. Apply the rules of orthographic projection to create multiview drawings
2. Produce models and technical and working drawings that conform to industry standards
3. Effectively use Solidworks and CATIA software to produce models and drawings

Required Core Courses:

ENGR 100A Introduction to Engineering	3
ENGR 122 Engineering Drawing	3
OR	
ENGR 125 Engineering Graphics	3
ENGR 124 Advanced Mechanical Drafting and Design	3
ENGR 103 Solidworks Beginning Solid Modeling	3
ENGR 104 Solidworks Intermediate Solid Modeling	3
ENGR 130A CATIA I	3
ENGR 130B CATIA II	3
ENGR 114 Geometric Dimensioning and Tolerancing	3
ENGR 158 Basic Machining Concepts and Operations	3
ENGR 131 Introduction to Mechatronics	0.5

Units: 27.5**Total: 27.5****Mechatronics: Certificate of Achievement** (Transcripted)**Program Code: SAC.ENMT.CA****Program Control Number: 21776**

This program prepares students for employment as a MECHANICAL ENGINEERING TECHNICIAN or as an engineering technician in the related areas of electro-mechanical, aerospace, biomedical, industrial, or manufacturing. The program specializes in the design, fabrication, and testing of mechatronics systems – mechanical systems controlled with electronics or computer technology. The program emphasizes hands-on learning and covers: robotics, PLC (programmable logic controllers), modern fabrication techniques (FDM 3D printing, SLA stereolithography, laser cutting/ engraving, machining, G-code, CNC), control systems (using micro-controllers like Arduino; PID control, sensors, motors and actuators), testing and measurement, and basic circuits,

Employment is mainly in private manufacturing industries such as the mechanical, aerospace, bio-medical, or industrial areas.

The skills learned in this program are also essential job skills for ENGINEERS, so transfer students are also encouraged to take this coursework. It should be noted that many of these job skills courses may not be available at the university, and others may be transferable to the university.

If more units are needed to complete the associate degree (~ 60 units), it is suggested students also select from the following list: CMPR 120 (C programming), CMPR 121 (C programming), ENGR 250L (circuits lab), ENGR 104 (Solidworks II), WELD 101 (intro welding).

Learning Outcome(s):

1. Design, fabricate, and operate mechatronics systems
2. Use and program micro-controllers obtain sensor data and to control various actuators
3. Fabricate parts using various rapid prototyping equipment

Required Core Courses:

ENGR 100A Introduction to Engineering	3
ENGR 122 Engineering Drawing	3
OR	
ENGR 125 Engineering Graphics	3
ENGR 103 Solidworks Beginning Solid Modeling	3
OR	
ENGR 130A CATIA I	3
ENGR 132 Introduction to Robotics	2.5
ENGR 133 Basic Mechatronics	3
ENGR 134 Intermediate Mechatronics	3
ENGR 135 Advanced Mechatronics	3
ENGR 158 Basic Machining Concepts and Operations	3

Total: 23.5**AutoCAD 2D Basics: Certificate of Proficiency**

(Untranscripted)

Program Code: SAC.CAD2D.CERT

This program prepares students for entry level DRAFTER positions that require knowledge of AutoCAD, typically in the architectural, civil, construction, and industrial fields. Students will learn to create and edit technical drawings and annotate designs. The program may be completed in less than one year, and it provides a good first step to more advanced drafting technology coursework and programs.

Learning Outcome(s):

1. Effectively use AutoCAD software

Required Core Courses:

ENGR 100A Introduction to Engineering	3
OR	
ENGR 100B Introduction to Architecture/Civil Engineering/ Construction (AEC)	2
ENGR 183 AutoCAD I	4
ENGR 184 AutoCAD II	4

Total: 10-11

Mechanical 3D Solid Modeling CAD: Certificate of Proficiency (Untranscribed)

Program Code: SAC.ENGR3D.CERT

This program prepares students for employment as a MECHANICAL ENGINEERING DRAFTER or DESIGNER. Mechanical drafters use MCAD (mechanical computer-aided drafting/design) software to create solid models and then detailed technical drawings of machinery or mechanical devices designed by engineers. The program focuses on training students on industry-standard MCAD software that is used heavily in the mechanical, aerospace, automotive, industrial, & biomedical engineering fields. Students learn to use the parametric nature of MCAD software to produce changeable models incorporating "design intent" and to produce drawings that conform to industry standards. The skills learned are applicable to drafters, designers, engineering technicians, and engineers in these fields.

Employment is primarily in the private manufacturing industries such as aerospace, biomedical, industrial, and many other manufacturing industries.

The skills learned in this program are also essential job skills for ENGINEERS, so transfer students are also encouraged to take this coursework. It should be noted that many of these job skills courses may not be available at the university, and others may be transferable to the university.

Learning Outcome(s):

1. Apply rules of orthographic projection to create multiview drawings
2. Produce models and technical drawings that conform to industry standards
3. Effectively use Solidworks and CATIA software

Required Core Courses:	Units: 15.5
ENGR 103 Solidworks Basic Solid Modeling	3
ENGR 104 Solidworks Intermediate Solid Modeling	3
ENGR 130A CATIA I	3
ENGR 130B CATIA II	3
ENGR 122 Engineering Drawing	3
OR	
ENGR 125 Engineering Graphics	3
ENGR 131 Introduction to Mechatronics	0.5
	Total: 15.5