ENGINEERING
Civil Drafting and Design Degree: AS
Program code: SAC.ENRCE.AS

Program Control Number: 04212

This program prepares students for employment as a CIVIL ENGINEERING DRAFTER or DESIGNER, or in the 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 CAD software commonly used in industry (AutoCAD, Civil 3D, REVIT) and have knowledge of current industry 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 engineers and architects, so students pursuing these areas are also encouraged to take this coursework as well. Many of these job skills courses may not be available at the university, and others may be transferrable to the university.

Students may also wish to 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:	25-26
ENGR 100A	Introduction to Engineering	3	
–OR–			
ENGR 100B	Introduction to Architecture/Civil Engineering/Construction (AEC)	2	
ENGR 122	Engineering Drawing	3	
–OR–			
ENGR 125	Engineering Graphics	3	
ENGR 142	Civil Drafting	4	
ENGR 183	AutoCAD I	4	
ENGR 184	AutoCAD II	4	
ENGR 185	Civil 3D	4	
ENGR 154	Revit	4	
		Total:	25-26

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 Architecture/Civil Engineering/Construction (AEC)	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 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 engineering majors. 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.

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, 142, 118, and 119.
3. Electrical engineering majors – ENGR 131, 133, 250, and 250L; 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 coursework in drafting, design, and CAD, and a drafting degree or certificate. Engineering technician employment may require coursework in engineering technology, and a degree or certificate in this area.

Students must take coursework from the block of courses below labeled "engineering or engineering-related courses". The courses selected should be based on major:

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

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

For electrical engineering majors: ENGR 250, 250L, 183; 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

Required Core 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 Basic Solid Modeling	3
ENGR 130A	CATIA Beginning Solid Modeling	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 281	Properties of Engineering Materials	3
CMPR 120	Introduction to Programming	3
CMPR 121	Programming Concepts	3

Science and math courses:		**Units:** 21
MATH 180	Single Variable Calculus I	4
–OR–		
MATH 180H	Honors 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.

	Total:	30-32

Engineering Computer Aided Drafting and Design Degree: AS
Program Code: SAC.ENRCA.AS
Program Control Number: 08720

This program prepares students for employment as a COMPUTER-AIDED DESIGN (CAD) DRAFTER in either the MECHANICAL or CIVIL areas. The program focuses strongly on CAD software skills and has two options: (1) MECHANICAL or (2) CIVIL. Each option focuses on the industry-standard CAD software for its respective area. The mechanical option focuses on Solidworks and CATIA. The civil option focuses on AutoCAD, Civil 3D, and REVIT. Students may also wish to take: Engr 105, 106 (for mechanical), or 118, 119 (for civil).

Learning Outcome(s):
1. Use CAD software to produce models and technical drawings that conform to industry standards
2. Use CAD software for the respective field

The associate degree also requires completion general education coursework 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 Architecture/Civil Engineering/Construction (AEC)	2
ENGR 122	Engineering Drawing	3
–OR–		
ENGR 125	Engineering Graphics	3
Select the mechanical or civil option		**Units:** 18-20
Mechanical option		
ENGR 103	Solidworks Basic Solid Modeling	3
ENGR 104	Solidworks Intermediate Solid Modeling	3
ENGR 105	Solidworks Advanced Solid Modeling	3
ENGR 130A	CATIA Beginning Solid Modeling	3
ENGR 130B	CATIA Intermediate Solid Modeling	3
ENGR 124	Advanced Mechanical Drafting and Design	3
Civil option		
ENGR 183	AutoCAD I	4
ENGR 184	AutoCAD II	4
ENGR 185	Civil 3D	4
ENGR 142	Civil Drafting	4
ENGR 154	Revit	4
		Total: 23-26

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.

Students may also wish to take ENGR 133 (basic mechatronics), ENGR 105 (advanced Solidworks), ENGR 106 (Solidworks drawings), and MATH 160 (trigonometry).

Learning Outcome(s):
1. Transform 3-dimensional bodies into 2-dimensional drawing views
2. Produce models and technical drawings that conform to industry standards
3. Use a variety of mechanical engineering CAD software

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

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 Basic Solid Modeling	3
ENGR 104	Solidworks Intermediate Solid Modeling	3
ENGR 130A	CATIA Beginning Solid Modeling	3
ENGR 130B	CATIA Intermediate Solid Modeling	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, industrial, or manufacturing. The program specializes in training 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: modern fabrication techniques (3D printing or FDM, stereolithography SLA, laser cutting/engraving, machining and G-code, CNC processes), control systems (using micro-controllers like Arduino; PID control), using various sensors, and control of various motors and actuators (servo, DC, brushless DC, stepper, and pneumatics).

Employment is mainly in private manufacturing industries such as the mechanical, industrial, biomedical, or aerospace 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.

Students may also wish to take CMPR 120 (programming) and WELD 108 (welding).

Learning Outcome(s):
1. Design and fabricate mechatronics systems
2. Use and program micro-controllers to control various actuators
3. Fabricate parts using various rapid prototyping equipment

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

Required Core Courses:		Units: 24
ENGR 100A	Introduction to Engineering	3
ENGR 122	Engineering Drawing	3
–OR–		
ENGR 125	Engineering Graphics	3
ENGR 103	Solidworks Basic Solid Modeling	3
–OR–		
ENGR 130A	CATIA Beginning Solid Modeling	3
ENGR 131	Introduction to Mechatronics	0.5
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: 24

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 CIVIL ENGINEERING 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 CAD software commonly used in industry (AutoCAD, Civil 3D, REVIT) and have knowledge of current industry 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 civil engineering drawings that meet industry standards
3. Use a variety of CAD software standard for the civil engineering field

Required Core Courses:		Units: 25-26
ENGR 100A	Introduction to Engineering	3
–OR–		
ENGR 100B	Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 122	Engineering Drawing	3
–OR–		
ENGR 125	Engineering Graphics	3
ENGR 142	Civil Drafting	4
ENGR 183	AutoCAD I	4
ENGR 184	AutoCAD II	4
ENGR 185	Civil 3D	4
ENGR 154	Revit	4
		Total: 25-26

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 Architecture/Civil Engineering/Construction (AEC)	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 Computer Aided Drafting and Design:
Certificate of Achievement *(Transcripted)*
Program Code: SAC.ENRCA.CA
Program Control Number: 21773

This program prepares students for employment as a COMPUTER-AIDED DESIGN (CAD) DRAFTER in either the MECHANICAL or CIVIL areas. The program focuses strongly on CAD software skills and has two options: (1) MECHANICAL or (2) CIVIL. Each option focuses on the industry-standard CAD software for its respective area. The mechanical option focuses on Solidworks and CATIA. The civil option focuses on AutoCAD, Civil 3D, and REVIT.

Learning Outcome(s):

1. Use CAD software to produce models and technical drawings that conform to industry standards

2. Use CAD software for the respective field

Required Core Courses:		Units: 5-6
ENGR 100A	Introduction to Engineering	3
–OR–		
ENGR 100B	Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 122	Engineering Drawing	3
–OR–		
ENGR 125	Engineering Graphics	3
Select the mechanical option or the civil option		**Units:** 18-20
Mechanical option		
ENGR 103	Solidworks Basic Solid Modeling	3
ENGR 104	Solidworks Intermediate Solid Modeling	3
ENGR 105	Solidworks Advanced Solid Modeling	3
ENGR 130A	CATIA Beginning Solid Modeling	3
ENGR 130B	CATIA Intermediate Solid Modeling	3
ENGR 124	Advanced Mechanical Drafting and Design	3
Civil option		
ENGR 183	AutoCAD I	4
ENGR 184	AutoCAD II	4
ENGR 185	Civil 3D	4
ENGR 142	Civil Drafting	4
ENGR 154	Revit	4
		Total: 23-26

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.

Students may also wish to take ENGR 133 (basic mechatronics), ENGR 105 (advanced Solidworks), ENGR 106 (Solidworks drawings), and MATH 160 (trigonometry).

Learning Outcome(s):

1. Transform 3-dimensional bodies into 2-dimensional drawing views

2. Produce models and technical drawings that conform to industry standards

3. Use a variety of mechanical engineering CAD software

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 Basic Solid Modeling	3
ENGR 104	Solidworks Intermediate Solid Modeling	3
ENGR 130A	CATIA Beginning Solid Modeling	3
ENGR 130B	CATIA Intermediate Solid Modeling	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: 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, industrial, or manufacturing. The program specializes in training 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: modern fabrication techniques (3D printing or FDM, stereolithography SLA, laser cutting/engraving, machining and G-code, CNC processes), control systems (using micro-controllers like Arduino; PID control), using various sensors, and control of various motors and actuators (servo, DC, brushless DC, stepper, and pneumatics).

Employment is mainly in private manufacturing industries such as the mechanical, industrial, biomedical, or aerospace 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.

Students may also wish to take CMPR 120 (programming) and WELD 108 (welding).

Learning Outcome(s):
1. Design and fabricate mechatronics systems
2. Use and program micro-controllers to control various actuators
3. Fabricate parts using various rapid prototyping equipment

Required Core Courses:		Units: 24
ENGR 100A	Introduction to Engineering	3
ENGR 122	Engineering Drawing	3
–OR–		
ENGR 125	Engineering Graphics	3
ENGR 103	Solidworks Basic Solid Modeling	3
–OR–		
ENGR 130A	CATIA Beginning Solid Modeling	3
ENGR 131	Introduction to Mechatronics	0.5
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: 24

3D CAD Skill Builder: Certificate of Proficiency
(Untranscripted)
Program Code: SAC.3DCAD.CERT

This program is for students who have some amount of prior CAD experience and seek to learn 3D skills. Courses in this program prepare students for work in basic 3D or parametric 3D, or for further study in engineering majors.
Students will complete a series of 3D drawings or projects that indicate competency with 3D software for problem solutions.

Learning Outcome(s):
Upon successful completion of this program, students will be able to:

Students will complete a series of 3D drawings or projects that indicate competency with 3D software for problem solutions.

Required Core Courses:		
ENGR 103	Solidworks Basic Solid Modeling	3
ENGR 154	AEC BIM with Revit	5
ENGR 186	AutoCAD 3-Dimensional Drawing	3
		Total: 11

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:		Units: 10-11
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 *(Untranscripted)*
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 mechanical CAD (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 multi-view 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 Beginning Solid Modeling	3
ENGR 130B	CATIA Intermediate Solid Modeling	3
ENGR 122	Engineering Drawing	3
–OR–		
ENGR 125	Engineering Graphics	3
ENGR 131	Introduction to Mechatronics	0.5
		Total: 15.5