

ENGINEERING

Engineering Degree

Program code: sac.engr.as

The associate degree curriculum in the engineering program is primarily intended to provide a basic program of engineering courses for students planning to transfer to four-year college or university engineering programs.

The student should be aware the Santa Ana College associate degree requirements are less than full university lower-division engineering requirements and that additional coursework is required. See "Engineering Transfer," below.

Completion of the associate degree in engineering can also provide the necessary background for immediate employment as a designer, technician, or engineering assistant. Job opportunities exist in both private industry and city, county, and state agencies.

Students interested in the design or practical phases of the engineering profession should take the engineering sequence 122, 124 and 228. These are transferable college or university level courses, giving students a comprehensive preparation in graphic communication and graphic solution of engineering problems. Students interested in the math and science-oriented engineering fields should take ENGR 125.

Learning Outcome(s):

Students will develop the skills and knowledge necessary to select as well as develop engineering careers; produce engineering drawings that conform to industry standards; create engineering drawings in 2D CAD program; and solve problems of calculus, calculus-based physics, and chemistry.

Major requirements for the associate degree:

Course	Units
ENGR 100A Introduction to Engineering	2
ENGR 122 Engineering Drawing	3
– or –	
ENGR 125 Engineering Graphics	3
ENGR 183 CAD I-Computer Aided Drafting	3
ENGR 235 Statics	3
MATH 180 Analytic Geometry and Calculus I	4
– or –	
MATH 180H Honors Analytic Geometry and Calculus	4
MATH 185 Analytic Geometry and 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	
Total Units	32

Engineering Transfer

Santa Ana College offers a wide variety of lower-division engineering coursework for transfer to any four-year university or college in California.

Although lower-division engineering course requirements are similar at most universities, important differences do occur. These differences depend upon the university and the specific engineering option the student has selected. Engineering students planning to transfer with upper-division standing at a university should contact the Transfer Center for detailed information concerning specific lower-division course requirements for the various engineering options.

Engineering Technology, Manufacturing Technology, and Industrial Technology Transfer

Technology programs are offered by most area universities. They are bachelor degree curriculums usually offered by the school's Engineering Department. Generally, technology degree programs are less rigorous than traditional engineering programs. Typically, they require one or two semesters of mathematics and one semester of physics. Upper division work is more practical application-oriented than traditional engineering programs.

Additional details concerning technology program transfer are available from the counseling and engineering offices.

Engineering Civil Technology Degree

Program code: sac.enrct.as

The associate degree curriculum provides a background for employment in a civil engineering office or for field work in support of and under the direction of a professional engineer or licensed surveyor. Typical employment is in a surveying office recording data, preparing subdivision maps, street and highway proposals, and grading maps. Employment opportunities exist in both private industry and local and county government agencies that employ engineering assistants.

Learning Outcome(s):

Students will be able to identify, analyze, and explain the basic parts of common land surveying instruments and their function by way of a multiple field exercises and cite how accurate surveys can be used to avoid or resolve property legal disputes.

Major requirements for the associate degree:

Course	Units
ENGR 100B Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 118 Surveying	4
ENGR 183 CAD I - Computer Aided Drafting	3
ENGR 184 CAD II - Computer Aided Drafting	3
ENGR 187 3D CAD with Civil 3D	3.5
GEOL 101 Introduction to Geology	3
GEOL 101L Introduction to Geology Laboratory	1
MATH 160 Trigonometry	4
Select ONE of the Following:	Units
ENGR 122 Engineering Drawing	3
ENGR 125 Engineering Graphics	3
Select ONE of the Following:	Units
ENGR 119 Advanced Plane Surveying	4
ENGR 205 Engineering Programming and Problem-Solving	3
Total Units	29.5-30.5

Engineering Civil Technology Certificate (Transcripted)

Program code: sac.enrct.ca

This certificate training provides a background for employment in a civil engineering office or for field work in support of and under the direction of a professional engineer or licensed surveyor. Typical employment is in a surveying office recording data, preparing subdivision maps, street and highway proposals, and grading maps. Employment opportunities exist in both private industry and local and county government agencies that employ engineering assistants.

Learning Outcome(s):

Students will be able to identify, analyze, and explain the basic parts of common land surveying instruments and their function by way of a multiple field exercises and cite how accurate surveys can be used to avoid or resolve property legal disputes.

Major requirements for the associate degree:

Course	Units
ENGR 100B Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 118 Surveying	4
ENGR 183 CAD I - Computer Aided Drafting	3
ENGR 184 CAD II - Computer Aided Drafting	3
ENGR 187 3D CAD with Civil 3D	3.5
GEOL 101 Introduction to Geology	3
GEOL 101L Introduction to Geology Laboratory	1
MATH 160 Trigonometry	4
Select ONE of the Following:	Units
ENGR 122 Engineering Drawing	3
— or —	
ENGR 125 Engineering Graphics	3
Select ONE of the Following:	Units
ENGR 119 Advanced Plane Surveying	4
— or —	
ENGR 205 Engineering Programming and Problem-Solving	3
Total Units	29.5-30.5

Engineering Computer Aided Drafting and Design Degree

Program code: sac.enrca.as

The Engineering Computer Aided Drafting and Design degree program is for students who have or are working toward an engineering discipline background for transfer or employment and seek competency in Computer Aided parametric 2D and 3D drafting and design. Class problems and project work includes civil, surveying, mechanical, electronic, architecture, and other CADD applications.

Learning Outcome(s)

Students will produce a series of 2D and 3D Parametric CAD technical drawings using several industry CAD applications.

Major requirements for the associate degree:

Core Courses:	Units
ENGR 100A Introduction to Engineering	2
— or —	
ENGR 100B Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 122 Engineering Drawing	3
— or —	
ENGR 125 Engineering Graphics	3
ENGR 183 CAD I - Computer Aided Drafting	3
ENGR 184 CAD II - Computer Aided Drafting	3
ENGR 186 AutoCAD 3-Dimensional Drawing	3

ENGR 154	AEC BIM with Revit	5
ENGR 103	Solidworks Basic Solid Modeling	3

Students may also wish to take other ENGR courses from the following recommended list:

ENGR 012	AEC Print Reading	3
ENGR 027	Electronic Drafting	3
ENGR 051	Basic Technical Drawing	3
ENGR 110	Advanced CAD Applications	0.5-4
ENGR 114	Geometric Dimensioning and Tolerancing	3
ENGR 115	Cooperative Work Experience Education-Occupational	1-4
ENGR 124	Advanced Drawing	3
ENGR 130A	CATIA Beginning Solid Modeling	3
ENGR 130B	CATIA Intermediate Solid Modeling	3
ENGR 142	Architecture/Civil Engineering/Construction (AEC Drawing)	4
ENGR 187	3D CAD with Civil 3D	3.5

Total Units 24

Computer Aided Drafting and Design Certificate (Transcripted)

Program code: sac.enrca.ca

The certificate program is for students who have or are working toward an engineering discipline background, and seek competency in Computer Aided parametric 2D and 3D drafting and design. Class problems and project work include civil, surveying, mechanical, electronic, architecture, and other CADD applications.

Learning Outcome(s):

Students will produce a series of 2D and 3D Parametric CAD technical drawings using several industry CADD applications.

Core Courses: Units

ENGR 100A	Introduction to Engineering	2
	– or –	
ENGR 100B	Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 122	Engineering Drawing	3
	– or –	
ENGR 125	Engineering Graphics	3
ENGR 183	CAD I - Computer Aided Drafting	3
ENGR 184	CAD II - Computer Aided Drafting	3
ENGR 186	AutoCAD 3-Dimensional Drawing	3
ENGR 154	AEC BIM with Revit	5
ENGR 103	Solidworks Basic Solid Modeling	3

Students may also wish to take other engineering courses from the following recommended list:

ENGR 012	AEC Print Reading	3
ENGR 027	Electronic Drafting	3
ENGR 051	Basic Technical Drawing	3
ENGR 110	Advanced CAD Applications	0.5-4
ENGR 114	Geometric Dimensioning and Tolerancing	3
ENGR 115	Cooperative Work Experience Education-Occupational	1-4
ENGR 124	Advanced Drawing	3
ENGR 130A	CATIA Beginning Solid Modeling	3
ENGR 130B	CATIA Intermediate Solid Modeling	3
ENGR 142	Architecture/Civil Engineering/Construction (AEC) Drawing	4

ENGR 187	Advanced 3-D Civil CAD	3
Total Units		24

Engineering Drafting and Design Option I-Engineering Drafting and Design Degree

Program code: sac.enrdd.as

The associate degree curriculum in engineering drafting and design has two options to prepare a student for employment in an engineering, architectural, civil engineering, or a construction office as a drafter, designer, or an engineering technician. Actual work in this field for both options is similar. Job tasks include preparation of drawings and plans (board and computer), sketches, layouts, diagrams, schematics, illustrations, material lists, and size and material specifications. Opportunity for employment exists in both private industry and city and county government agencies which employ drafters, designers, and engineering technicians.

The Option I degree prepares the student for employment as a professional drafter or designer in the mechanical, aerospace, manufacturing, biomedical, or industrial engineering fields. Designer jobs may additionally require some industry experience. Many courses are applicable to lower-division preparation leading to a bachelor's degree in engineering technology at a four-year institution.

Learning Outcome(s):

Students will develop knowledge and skills necessary to select & develop engineering careers; be able to produce engineering drawings that conform to industry standards; be able to create parts & drawings using 3D solid modeling software; fabricate basic parts using standard machining equipment.

Required Courses: (for the associate degree, students must also complete general education coursework Plan A, B, or C, per the college catalog)

Course		Units
ENGR 100A	Introduction to Engineering	2
ENGR 122	Engineering Drawing	3
	– or –	
ENGR 125	Engineering Graphics	
ENGR 124	Advanced Drawing	3
ENGR 130A	CATIA Beginning Solid Modeling	3
ENGR 103	Solidworks Basic Solid Modeling	3
ENGR 131	Engineering Mechatronics Technology Survey	0.5
ENGR 158	Basic Machining Concepts and Operations	3
Select six (6) additional units from the following list:		Units
ENGR 114	Geometric Dimensioning and Tolerancing	3
ENGR 130B	CATIA Intermediate Solid Modeling	3
ENGR 133	Basic Mechatronics Technology Survey	3
ENGR 104	Solidworks Intermediate Solid Modeling	3
MATH 160	Trigonometry	4
Total Units		23.5

Engineering Drafting and Design Option I-Engineering Drafting and Design Certificate (Transcripted)

Program code: sac.enrdd.ca

The certificate curriculum in engineering drafting and design has two options to prepare a student for employment in an engineering, architectural, civil engineering, or a construction office as a drafter, designer, or an engineering technician. Actual work in this field for both options is similar. Job tasks include preparation of drawings and plans (board and computer), sketches, layouts, diagrams, schematics, illustrations, material lists, and size and material specifications. Opportunity for employment exists in both private industry and city and county government agencies which employ drafters, designers, and engineering technicians.

The Option I certificate prepares the student for employment as a professional drafter or designer in the mechanical, aerospace, manufacturing, biomedical, or industrial engineering fields. Designer jobs may additionally require some industry experience. Many courses are applicable to lower-division preparation leading to a bachelor's degree in engineering technology at a four-year institution.

Learning Outcome(s):

Students will develop knowledge and skills necessary to select & develop engineering careers; be able to produce engineering drawings that conform to industry standards; be able to create parts & drawings using 3D solid modeling software; fabricate basic parts using standard machining equipment.

Major Requirements for the certificate:

Course	Units
ENGR 100A Introduction to Engineering	2
ENGR 103 Solidworks Basic Solid Modeling	3
ENGR 122 Engineering Drawing	3
— or —	
ENGR 125 Engineering Graphics	
ENGR 124 Advanced Drawing	3
ENGR 130A CATIA Beginning Solid Modeling	3
ENGR 131 Engineering Mechatronics Technology Survey	0.5
ENGR 158 Basic Machining Concepts and Operations	3
Select six (6) additional units from the following list:	Units
ENGR 114 Geometric Dimensioning and Tolerancing	3
ENGR 130B CATIA Beginning Solid Modeling	3
ENGR 133 Basic Mechatronics Engineering Technology	3
ENGR 104 Solidworks Intermediate Solid Modeling	3
MATH 160 Trigonometry	4
Total Units	23.5

Engineering Drafting and Design Option II-Architectural/Civil Engineering/Construction Drafting and Design Degree

Program code: sac.enrce.as

This option is designed specifically to prepare the student for employment as a professional drafter/designer in the Architectural, Civil Engineering and Construction fields (AEC). The drafter/designer works closely with the architect, developer and other professionals in the development and construction of AEC projects.

Students will acquire knowledge of AEC terms, abbreviations, graphics and standards for application and preparation of AEC drawings and plans.

Learning Outcome(s):

Students will acquire knowledge of AEC terms, abbreviations, graphics and standards for application and preparation of AEC drawings and plans.

Major requirements for the associate degree:

Course	Units
ENGR 100B Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 112 Society and the Built Environment	3
ENGR 142 Architecture/Civil Engineering/Construction (AEC) Drawing	4
ENGR 154 (AEC) BIM with Revit	5
ENGR 183 CAD I - Computer Aided Drafting	3
ENGR 184 CAD II - Computer Aided Drafting	3
ENGR 186 AutoCAD 3-Dimensional Drawing	3
ENGR 201 Residential and Light Commercial Construction Practices and Estimating	4
Total Units	27

Engineering Drafting and Design Option II-Architectural/Civil Engineering/Construction Drafting and Design Certificate (Transcripted)

Program code: sac.enrce.ca

This option is designed specifically to prepare the student for employment as a professional drafter/designer in the Architectural, Civil Engineering and Construction fields (AEC). The drafter/designer works closely with the architect, developer and other professionals in the development and construction of AEC projects.

Learning Outcome(s):

Students will acquire knowledge of AEC terms, abbreviations, graphics and standards for application and preparation of AEC drawings and plans.

Major requirements for the associate degree and certificate:

Course	Units
ENGR 100B Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 112 Society and the Built Environment	3
ENGR 142 Architecture/Civil Engineering/Construction (AEC) Drawing	4
ENGR 154 (AEC) BIM with Revit	5
ENGR 183 CAD I - Computer Aided Drafting	3
ENGR 184 CAD II - Computer Aided Drafting	3
ENGR 186 AutoCAD 3-Dimensional Drawing	3
ENGR 201 Residential and Light Commercial Construction Practices and Estimating	4
Total Units	27

Engineering Mechatronics Technology Degree

Program code: sac.enemt.as

This associate degree has a strong emphasis on hands-on design, fabrication, and testing; and leads to employment as a mechanical, industrial, or manufacturing engineering technician. Opportunities for employment exist primarily in private manufacturing industries such as industrial, biomedical, or aerospace.

Learning Outcome(s):

Students will know about engineering-related careers; be able to use 3D solid modeling CAD software to produce models and industry-standard drawings; and will be able to do hands-on mechatronics fabrication, including working with micro-controllers.

Major requirements for the associate degree: (for the associate degree, students must also complete general education coursework Plan A, B, or C, per the college catalog)

Required Courses:	Units
ENGR 100A Introduction to Engineering	2
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 Engineering Mechatronics Technology Survey	0.5
ENGR 132 Introduction to Robotics	2.5
ENGR 133 Basic Mechatronics Engineering Technology	3
ENGR 134 Intermediate Mechatronics Engineering Technology	3
ENGR 135 Advanced Mechatronics Engineering Technology	3
Electives (select 3 units from the following list):	Units
ENGR 158 Basic Machining Concepts and Operations	3
ENGR 240 Dynamics	3
ENGR 250 Electric Circuits	3
ENGR 250L Electric Circuits Laboratory	1
ENGR 281 Properties of Engineering Materials	3
Total Units	23

Engineering Mechatronics Technology Certificate (Transcripted)

Program code: sac.enemt.ca

The certificate curriculum in Engineering Mechatronics Technology has a strong emphasis on hands-on design, fabrication, and testing; and leads to employment as a mechanical, industrial, or manufacturing engineering technician. Opportunities for employment exist primarily in private manufacturing industries such as industrial, biomedical, or aerospace.

Learning Outcome(s):

Students will know about engineering-related careers; be able to use 3D solid modeling CAD software to produce models and industry-standard drawings; and will be able to do hands-on mechatronics fabrication, including working with micro-controllers.

Major requirements for the certificate:

Required Courses:	Units
ENGR 100A Introduction to Engineering	2
ENGR 103 Solidworks Basic Solid Modeling	3
— or —	
ENGR 130A CATIA Beginning Solid Modeling	3
ENGR 122 Engineering Drawing	3
— or —	
ENGR 125 Engineering Graphics	3
ENGR 131 Engineering Mechatronics Technology Survey	0.5
ENGR 132 Introduction to Robotics	2.5
ENGR 133 Basic Mechatronics Engineering Technology	3
ENGR 134 Intermediate Mechatronics Engineering Technology	3
ENGR 135 Advanced Mechatronics Engineering Technology	3
Electives (select 3 units from the following list):	Units
ENGR 158 Basic Machining Concepts and Operations	3
ENGR 240 Dynamics	3
ENGR 250 Electric Circuits	3
ENGR 250L Electric Circuits Laboratory	1

ENGR 281 Properties of Engineering Materials	3
Total Units	23

Energy Analysis Degree

Program code: sac.enea.as

This degree program trains students for work in energy analysis and auditing. Students completing training will be prepared for work performing Title 24 energy calculations or for work in utility companies or private companies that do energy analysis and auditing.

Learning Outcome(s):

Students will perform Title 24 energy calculations or work in utility companies or private companies that conduct energy analysis and auditing.

Take each of the following courses:

Course	Units
ENGR 012 AEC Blueprint Reading	3
ENGR 100B Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 183 CAD I-Computer Aided Drafting	3
ENGR 184 CAD II-Computer Aided Drafting	3
ENGR 165 Introduction to Energy	3
ENGR 175 Introduction to Energy Analysis	3
Total Units	17

Energy Analysis Certificate (Untranscripted)

Program code: sac.enea.cert

This certificate program trains students for work in energy analysis and auditing. Students completing training will be prepared for work performing Title 24 energy calculations or for work in utility companies, or private companies that do energy analysis and auditing.

Learning Outcome(s):

Students will perform Title 24 energy calculations or work in utility companies or private companies that conduct energy analysis and auditing.

Major requirements for the associate degree and certificate:

Course	Units
ENGR 012 AECBlueprint Reading	3
ENGR 100B Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 183 CAD I-Computer Aided Drafting	3
ENGR 184 CAD II-Computer Aided Drafting	3
ENGR 165 Introduction to Energy	3
ENGR 175 Introduction to Energy Analysis	3
Total Units	17

AutoCAD 2D Basics Certificate (Untranscripted)

Program code: sac.cad2d.cert

2D Computer Drafting Basics is a program for learning to create and edit technical drawings, as well as annotate designs. 2D drawings are used in a wide variety of industries and applications for industrial design of products, architectural, civil and construction drafting to develop plans, shop drawings, permit and patent drawings.

Learning Outcome(s):

Students will complete a set of basic 2D drawings that demonstrate their knowledge and skills with AutoCAD.

Major requirements for the associate degree:

Core Courses	Units
ENGR 100A Introduction to Engineering – or –	2
ENGR 100B Introduction to Architecture/Civil Engineering/ Construction (AEC)	2
ENGR 183 AutoCAD I-Computer Aided Drafting	3
ENGR 184 AutoCAD II-Computer Aided Drafting	3
Total Units	8

3D CAD Skill Builder Certificate (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.

Learning Outcome(s):

Students will complete a set of 3D drawings that demonstrate their knowledge and skills with Solidworks, Revit and AutoCAD.

Major Requirements for the certificate:

Course	Units
ENGR 103 Solidworks Basic Solid Modeling	3
ENGR 154 (AEC) BIM with Revit	5
ENGR 186 AutoCAD 3-Dimensional Drawing	3
Total Units	11

Civil 3D CAD Certificate (Untranscripted)**Program code:sac.c3cad.cert**

This certificate includes 3D land development/site design software, environmental design, transportation design, and geospatial information. Students will be exposed to engineering design principles using various information modeling techniques and sustainable design methodologies.

Learning Outcome(s):

Students will complete a set of Civil 3D drawings that demonstrate their knowledge and skills for Civil 3D work using Bentley and AutoDesk software.

Major Requirements for the certificate:

Course	Units
ENGR 100B Introduction to Architecture/Civil Engineering/ Construction (AEC)	2
ENGR 143 Fundamentals of Construction	3
ENGR 187 3D CAD with Civil 3D	3.5
Total Units	8.5

Engineering Mechanical 3D Solid Modeling CAD Certificate (Untranscripted)**Program code: sac.engr3d.cert**

Curriculum focuses on developing competency in parametric solid modeling CAD software that is used heavily in the mechanical, aerospace, industrial, & biomedical engineering fields. Skillsets learned are applicable to drafters, designers, engineering technicians, and engineers in these fields.

Learning Outcome(s):

Students will produce engineering drawings that conform to industry standards and be able to create parts as well as drawings using 3D solid modeling thru intermediate level.

Major requirements for the certificate:

Required Courses:	Units
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 – or –	3
ENGR 125 Engineering Graphics	3
ENGR 131 Engineering Mechatronics Technology Survey	0.5
Total Units	15.5

Sustainable Building Operations Management Degree**Program code: sac.sbom.as**

The Associate of Science degree in High Performance Building Operation Management is focused towards career education training of students in sustainable methods for improving the operational performance of offices, schools, hospitals, and other residential and commercial buildings while working as Building Commissioning Professionals, Operations Professionals, Facility Managers and supporting positions. It will provide needed skilled and qualified workers, particularly as building technologies become more advanced.

Major requirements for the associate in science degree:

Course	Units
ENGR 100B Introduction to Architecture/Civil Engineering/ Construction (AEC)	2
ACCT 101 Financial Accounting	4
ENGR 142 Architecture/Civil Engineering/Construction (AEC) Drawing	4
ENGR 143 Fundamentals of Construction	3
ENGR 201 Residential and Light Commercial Construction Practices and Estimating	4
ENGR 203 Sustainable Construction and Facilities Management	3
ENGR 235 Statics and General Education requirements.	3
Total Units	23

Sustainable Building Operations Management Certificate (Transcripted)**Program code: sac.sbom.ca**

The certificate in High Performance Building Operation Management is focused towards career education training of students in sustainable methods for improving the operational performance of offices, schools, hospitals, and other residential and commercial buildings while working in Building Commissioning, Operations, Facility Manager and supporting positions. It will provide needed skilled and qualified workers, particularly as building technologies become more advanced.

Requirements for the certificate:

Course		Units
ENGR 100B	Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 112	Society and the Built Environment	3
ENGR 142	Architecture/Civil Engineering/Construction (AEC) Drawing	4
ENGR 143	Fundamentals of Construction	3
ENGR 201	Residential and Light Commercial Construction Practices and Estimating	4
ENGR 203	Sustainable Construction and Facilities Management	3
Total Units		19

Sustainable Facilities Management Certificate (Untranscribed)

Program code: sac.sufac.cert

The certificate in Sustainable Facilities Management is focused towards training the student in sustainable methods for improving the operational performance of offices, schools, hospitals, and other residential and commercial buildings. It will provide needed skilled and qualified workers, particularly as building technologies become more advanced.

Learning Outcome(s):

Students will use ecological terms, abbreviations, AEC graphics, codes, permits, construction accounting, and facility project procedures to allow work or continued study in sustainable facilities management.

Requirements for the certificate:

Course		Units
ENGR 142	Architecture/Civil Engineering/Construction (AEC) Drawing	4
ENGR 143	Fundamentals of Construction	3
ENGR 201	Residential and Light Commercial Construction Practices and Estimating	4
ENGR 202	Cost Accounting for Construction Engineering — or —	3
ACCT 202	Cost Accounting for Construction Engineering	3
ENGR 203	Sustainable Construction and Facilities Management	3
Total Units		17

Sustainable Facility Skill Builder Certificate (Untranscribed)

Program code: sac.sufsb.cert

This program of study introduces students to Renewables, Green HVAC and Building Automation Systems and Controls, which are fundamental building blocks of energy saving sustainable construction projects. It provides preparation for further study or for work or advancing career opportunities.

Career opportunities include employment in “green” building, design and construction, energy management, and sustainable public planning and policy development. Work is available in government agencies, consulting firms, construction, and non-profit organizations.

Learning Outcome(s):

Students of the Sustainable Facilities Skill Builder will gain skills and knowledge for renewable energy technologies, green HVAC systems, as well as building automation systems and controls.

Requirements for the certificate:

Course		Units
ENGR 100B	Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 177	Green HVAC	3
ENGR 195	Renewable Energy	3
ENGR 204	Building Automation & Controls	3
Total Units		11

Surveying Skill Builder Certificate (Untranscribed)

Program code: sac.ssb.cert

This program of study includes basics for students or industry professionals who wish to learn surveying basics in a certificate program either to continue studies towards a more comprehensive Civil Technology certificate, or A.S. degree or transfer into a B.S. program.

Learning Outcome(s):

Students will complete a set of surveying drawings that demonstrate their knowledge and skills using industry methods, tools and software.

Major requirements for the associate degree:

Course		Units
ENGR 100B	Introduction to Architecture/Civil Engineering/Construction (AEC)	2
ENGR 118	Surveying	4
ENGR 183	CAD I - Computer Aided Drafting	3
ENGR 184	CAD II - Computer Aided Drafting	3
ENGR 187	3D CAD with Civil 3D	3.5
Total Units		15.5