

Area: Science and Engineering  
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Degrees: A.S. - Civil Engineering  
 A.S. - Electrical Engineering  
 A.S. - Mechanical Engineering

The Engineering program offers courses necessary to transfer to a four-year university where students can complete a bachelor's degree in various branches of engineering.

Most lower division engineering programs require the following ARC courses: Mathematics 400, 401, 402, 420; Physics 410, 421, 431; Chemistry 400; Engineering 401, 413, 420. Students should consult the institution to which they wish to transfer for specific lower division requirements.

## DEGREES

### Civil Engineering Degree

**Major Code: 011109A01**

This degree provides the foundation in mathematics, science, and engineering needed to transfer to a four-year institution as a major in civil engineering. The courses in this degree meet most of the lower division requirements for several nearby universities. Since each university has its own unique requirements, additional coursework will be required prior to transfer. Students should meet with a counselor to determine which additional courses are required for successful transfer to a particular institution.

#### Student Learning Outcomes

*Upon completion of this program, the student will be able to:*

- solve problems by applying knowledge of mathematics, including differential and integral calculus and differential equations.
- solve problems by applying knowledge of science, including chemistry and physics.
- use technology to increase productivity.
- apply knowledge of mathematics, science, and engineering to identify, formulate, and solve basic civil engineering problems.
- describe the ethical and professional responsibilities of an engineer and situations where engineering solutions can impact society.

Requirements for Degree		47.5 Units
CHEM 400	General Chemistry I .....	5
ENGR 310	Engineering Survey Measurements.....	4
ENGR 312	Engineering Graphics.....	3
ENGR 413	Properties of Materials.....	4.5
ENGR 420	Statics.....	3
MATH 400	Calculus I.....	5
MATH 401	Calculus II.....	5
MATH 402	Calculus III.....	5
MATH 420	Differential Equations.....	4
PHYS 410	Mechanics of Solids and Fluids.....	5
PHYS 421	Electricity and Magnetism.....	4

Associate Degree Requirements: The Civil Engineering Associate in Science (A.S.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

### Electrical Engineering Degree

**Major Code: 011110A01**

This degree provides the foundation in mathematics, science, and engineering needed to transfer to a four-year institution as a major in electrical engineering. The courses in this degree meet most of the lower division requirements for several nearby universities. Since each university has its own unique requirements, additional coursework will be required prior to transfer. Students should meet with a counselor to determine which additional courses are required for successful transfer to a particular institution.

#### Student Learning Outcomes

*Upon completion of this program, the student will be able to:*

- solve problems by applying knowledge of mathematics, including differential and integral calculus and differential equations.
- solve problems by applying knowledge of science, including chemistry and physics.
- use technology to increase productivity.
- apply knowledge of mathematics, science, and engineering to identify, formulate, and solve basic electrical engineering problems.
- describe the ethical and professional responsibilities of an engineer and situations where engineering solutions can impact society.

Requirements for Degree		37 Units
CHEM 400	General Chemistry I .....	5
ENGR 401	Introduction to Electrical Circuits and Devices.....	4
MATH 400	Calculus I.....	5
MATH 401	Calculus II.....	5
MATH 402	Calculus III.....	5
MATH 420	Differential Equations.....	4
PHYS 410	Mechanics of Solids and Fluids.....	5
PHYS 421	Electricity and Magnetism.....	4

Associate Degree Requirements: The Electrical Engineering Associate in Science (A.S.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

### Mechanical Engineering Degree

**Major Code: 011111A01**

This degree provides the foundation in mathematics, science, and engineering needed to transfer to a four-year institution as a major in mechanical engineering. The courses in this degree meet most of the lower division requirements for several nearby universities. Since each university has its own unique requirements, additional coursework will be required prior to transfer. Students should meet with a counselor to determine which additional courses are required for successful transfer to a particular institution.

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(Mechanical Engineering Degree continued)

### Student Learning Outcomes

Upon completion of this program, the student will be able to:

- solve problems by applying knowledge of mathematics, including differential and integral calculus and differential equations.
- solve problems by applying knowledge of science, including chemistry and physics.
- use technology to increase productivity.
- apply knowledge of mathematics, science, and engineering to identify, formulate, and solve basic mechanical engineering problems.
- describe the ethical and professional responsibilities of an engineer and situations where engineering solutions can impact society.

Requirements for Degree		47.5 Units
CHEM 400	General Chemistry I .....	5
ENGR 312	Engineering Graphics.....	3
ENGR 401	Introduction to Electrical Circuits and Devices.....	4
ENGR 413	Properties of Materials.....	4.5
ENGR 420	Statics.....	3
MATH 400	Calculus I.....	5
MATH 401	Calculus II.....	5
MATH 402	Calculus III.....	5
MATH 420	Differential Equations.....	4
PHYS 410	Mechanics of Solids and Fluids.....	5
PHYS 421	Electricity and Magnetism.....	4

Associate Degree Requirements: The Mechanical Engineering Associate in Science (A.S.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.

## Engineering

### ENGR 300 Introduction to Engineering 1 Unit

*Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.*

*Course Transferable to UC/CSU*

*Hours: 18 hours LEC*

This course is an introduction to the engineering and engineering technology professions, and their place in industry. It includes an explanation of the engineering and engineering technology options and curricula involved. Topics include an emphasis on problem-solving techniques used in engineering and engineering technology. This course is recommended for all entering engineering, engineering technology, and design technology students.

### ENGR 310 Engineering Survey Measurements 4 Units

*Prerequisite: MATH 330 or 373 with a grade of "C" or better*

*Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.*

*Course Transferable to UC/CSU*

*Hours: 54 hours LEC; 54 hours LAB*

This course covers the basic fundamentals of surveying for engineers. Electronic surveying instruments are used to develop the principles of measurement for distance, elevations, and angles. Additional topics include systematic and random errors, line directions, profiles and cross sections, traverse computations, horizontal and vertical curves, and earthwork quantity calculations. This course is intended for civil engineers, but may also be required for other programs.

### ENGR 312 Engineering Graphics 3 Units

*Course Transferable to UC/CSU*

*Hours: 36 hours LEC; 72 hours LAB*

This course covers the application of graphical tools to analyze, interpret, and solve engineering problems. The engineering design process is taught using manual and introductory interactive computer-aided design and drafting (CADD) tools to solve typical three-dimensional engineering problems. Topics include descriptive geometry, vector graphics, orthogonal projection, and primary and secondary auxiliary views. This course is intended for mechanical and civil engineering majors but may also be required for other programs.

### ENGR 401 Introduction to Electrical Circuits and Devices 4 Units

*Prerequisite: PHYS 421 with a grade of "C" or better*

*Corequisite: MATH 420*

*Course Transferable to UC/CSU*

*Hours: 72 hours LEC*

This course covers the fundamentals of electrical circuit theory and analysis for engineers. Topics include time domain circuit analysis techniques, circuit reduction techniques, frequency domain circuit analysis, first- and second-order circuits with natural and step responses, and operational amplifiers. This course provides a solid foundation for upper division engineering courses.

### ENGR 413 Properties of Materials 4.5 Units

*Prerequisite: CHEM 400 and PHYS 410 with grades of "C" or better*  
*Advisory: Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.*

*Course Transferable to UC/CSU*

*Hours: 72 hours LEC; 27 hours LAB*

This is an introductory course in the properties of materials used in engineering. It places emphasis upon the theory underlying the behavior of engineering materials. Additionally, it includes a laboratory component which covers the testing of metals, polymers, composites, wood, and other materials. (C-ID ENGR 140B)

### ENGR 420 Statics 3 Units

*Prerequisite: MATH 401 and PHYS 410 with grades of "C" or better*

*Course Transferable to UC/CSU*

*Hours: 54 hours LEC*

This course covers the study of bodies in equilibrium with emphasis on force systems, structures, distributed loads, and friction. It emphasizes analytical rather than graphical methods of problem solving. (C-ID ENGR 130)

### ENGR 495 Independent Studies in Engineering 1-3 Units

*Prerequisite: None*

*Course Transferable to CSU*

*Hours: 54-162 hours LAB*

Independent Study is an opportunity for the student to extend classroom experience in this subject, while working independently of a formal classroom situation. Independent study is an extension of work offered in a specific class in the college catalog. To be eligible for independent study, students must have completed the basic regular catalog course at American River College. They must also discuss the study with a professor in this subject and secure approval. Only one independent study for each catalog course will be allowed.