

Engineering

| American River College

ARC's program provides the foundation in mathematics, physics, and engineering necessary to transfer to a four-year institution and complete a bachelor's degree in engineering. Students should consult the institution to which they wish to transfer for the specific lower division requirements.

[\(/academics/arc-program-road-maps\)](/academics/arc-program-road-maps)

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Associate Degrees

A.S. in Civil Engineering

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.

Degree Requirements

COURSE CODE	COURSE TITLE	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
Total Units:		47.5

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.

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.

A.S. in Electrical Engineering

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.

Degree Requirements

COURSE CODE	COURSE TITLE	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
Total Units:		37

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.

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 solutions can impact society.

A.S. in Mechanical Engineering

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.

Degree Requirements

COURSE CODE	COURSE TITLE	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
Total Units:		47.5

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.

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.

Engineering (ENGR)

ENGR 300 Introduction to Engineering

Units:	1
Hours:	18 hours LEC
Prerequisite:	None.
Advisory:	Eligible for ENGRD 310 or ENGRD 312 AND ENGWR 300; OR ESLR 340 AND ESLW 340.
Transferable:	CSU; UC

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.

Student Learning Outcomes

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

- describe the engineering and engineering technology professions and explain their place in society and industry.
- identify, compare, and contrast the various options in engineering and engineering technology, and coursework leading to them.
- evaluate engineering or engineering technology as a potential career objective, and explain the necessary aptitudes, abilities, and training needed to succeed in these professions.
- analyze the applicability of the engineering profession and related fields to life experience and interests.

ENGR 310 Engineering Survey Measurements

Units:	4
Hours:	54 hours LEC; 54 hours LAB
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.
Transferable:	CSU; UC

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.

Student Learning Outcomes

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

- compare survey equipment typically encountered by engineers.
- interpret and evaluate surveying related problems.
- formulate concepts from construction, surveying, and engineering topics to solve problems.
- construct a neat, well organized, logical presentation of surveying problems and their solutions.
- understand the surveyor's role in developing civil engineering projects.

ENGR 312 Engineering Graphics

Units:	3
Hours:	36 hours LEC; 72 hours LAB
Prerequisite:	None.
Transferable:	CSU; UC

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.

Student Learning Outcomes

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

- construct orthographic projections using manual and CADD techniques.
- generate and interpret engineering designs employing parallelism and perpendicularity.
- assess structural engineering problems applying vector graphics.
- diagram primary and secondary auxiliary views.
- calculate the true length, grade, and bearing of scaled features.
- propose a solution to a simple civil engineering design problem, culminating in an elevation plan and contour maps.
- diagram and analyze a pipeline layout, determining the points of intersection, piercing points, grade, and the angles between the various sections.

ENGR 401 Introduction to Electrical Circuits and Devices

Units:	4
Hours:	72 hours LEC
Prerequisite:	PHYS 421 with a grade of "C" or better
Corequisite:	MATH 420
Transferable:	CSU; UC

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.

Student Learning Outcomes

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

- interpret the effects of instrumentation used for measurement on those measurements.
- differentiate the optimum method of circuit analysis for a particular circuit configuration.
- evaluate boundary conditions on first- and second-order circuits.
- construct and evaluate the solutions to electrical circuit problems.
- verify solutions from one system by the design and analysis of an equivalent system that reduces the complexity of the original circuit.

ENGR 413 Properties of Materials

Units:	4.5
Hours:	72 hours LEC; 27 hours LAB
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.
Transferable:	CSU; UC
C-ID:	C-ID ENGR 140B

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.

Student Learning Outcomes

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

- explain the relationship between atomic structure and properties of engineering materials.
- analyze the properties of metals, polymers, concretes, and other engineering materials.
- apply principles of materials to unfamiliar problems and new materials.
- evaluate the properties of materials to draw conclusions as to which materials are suitable for specific engineering applications.
- perform mathematical calculations in materials applications.

ENGR 420 Statics

Units:	3
Hours:	54 hours LEC
Prerequisite:	MATH 401 and PHYS 410 with grades of "C" or better
Transferable:	CSU; UC
C-ID:	C-ID ENGR 130

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.

Student Learning Outcomes

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

- resolve basic engineering mechanics problems through the use of free-body diagrams and static equilibrium principles.
- analyze any equilibrium problem in a simple and logical manner.
- generate diagrams that summarize the relationship between load, shear, and bending moments.
- combine methodologies and principles of friction to solve problems involving dry friction.
- produce and solve equilibrium equations for forces on members of engineering structures such as trusses and frames.

ENGR 495 Independent Studies in Engineering

Units:	1 - 3
Hours:	54 - 162 hours LAB
Prerequisite:	None.
Transferable:	CSU

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.

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