Engineering

Overview

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.

Roadmaps

Road maps lay out all of the courses you need to take for a given degree or certificate.

Get a Road map! Explore Ways to Complete These Programs (/academics/arc-program-road-maps)

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.

Catalog Date: June 1, 2020

Degree Requirements

<table>
<thead>
<tr>
<th>COURSE CODE</th>
<th>COURSE TITLE</th>
<th>UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 400</td>
<td>General Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>ENGR 310</td>
<td>Engineering Survey Measurements</td>
<td>4</td>
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<tr>
<td>ENGR 312</td>
<td>Engineering Graphics</td>
<td>3</td>
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<td>Properties of Materials</td>
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</tr>
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<td>Statics</td>
<td>3</td>
</tr>
<tr>
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<td>5</td>
</tr>
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</tr>
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</tr>
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<td>Differential Equations</td>
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</tr>
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<td>PHYS 410</td>
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<td>5</td>
</tr>
<tr>
<td>PHYS 421</td>
<td>Electricity and Magnetism</td>
<td>4</td>
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</table>

Total Units: 47

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.

Catalog Date: June 1, 2020

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**Engineering (ENGR) Courses**

**ENGR 300 Introduction to Engineering**

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.

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.

**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.

**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.

**Degree Requirements**

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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) Courses**

**ENGR 300 Introduction to Engineering**

| Units:       | 1                                      |
| Hours:       | 18 hours LEC                           |
| Prerequisite:| None.                                  |
| Advisory:    | Eligible for ENGRD 310 or ENGRD 312 AND ENGW 300; OR ESLR 340 AND ESLW 340. |
| Transferable:| CSU, UC                                |
| Catalog Date:| June 1, 2020                           |

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 373 with a grade of "C" or better  
**Advisory:** Eligible for ENGRD 310 or ENGRD 312 AND ENGW 300; OR ESLR 340 AND ESLW 340.  
**Transferable:** CSU; UC  
**Catalog Date:** June 1, 2020

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, earthwork quantity calculations, and manual and CAD (computer-aided drafting) production of engineering plans.

**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.
- use field work data to produce manual and CAD engineering plans.
- describe the surveyor's role in developing civil engineering projects.

**ENGR 312 Engineering Graphics**

**Units:** 3  
**Hours:** 36 hours LEC; 72 hours LAB  
**Prerequisite:** None.  
**Advisory:** MATH 373 with a grade of "C" or better  
**Transferable:** CSU; UC  
**Catalog Date:** June 1, 2020

This course covers the principles of engineering drawings in visually-communicated engineering designs and an introduction to computer-aided design (CAD). Topics include the development of visualization skills, orthographic projections, mechanical dimensioning and tolerancing practices, the engineering design process, and design analysis. Assignments develop sketching and 2D and 3D CAD skills. The use of solid modeling CAD software is an integral part of the course.

**Student Learning Outcomes**

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

- apply rules of orthographic projection to create multi-view drawings.
- create pictorials from orthographic views.
- use computer-aided design (CAD) software to create 2D engineering drawings, including working drawings and assembly drawings.
- use CAD software to create 3D models and assemblies.
- create auxiliary and section views of an object following correct conventions.
- apply standards of dimensioning and tolerancing to engineering drawings.
- apply the engineering design process to a design project.

**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  
**Catalog Date:** June 1, 2020

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 412 Properties of Materials**

**Units:** 4  
**Hours:** 54 hours LEC; 54 hours LAB  
**Prerequisite:** CHEM 400 and PHYS 410 with grades of "C" or better  
**Transferable:** CSU; UC  
**Catalog Date:** June 1, 2020
This course presents the internal structures and resulting behaviors of materials used in engineering applications, including metals, ceramics, polymers, composites, and semiconductors. It emphasizes developing the ability both to select appropriate materials to meet engineering design criteria and to understand the effects of heat, stress, imperfections, and chemical environments upon material properties and performance. Laboratories provide opportunities to directly observe the structures and behaviors discussed in the course, to operate testing equipment, and to analyze experimental data. This course was formerly known as ENGR 413.

Student Learning Outcomes

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

- explain the relationship between the internal structure of materials and their macroscopic properties.
- analyze and explain methods of altering the structure of materials by mechanical, chemical, or thermal means in order to change material properties.
- perform mathematical calculations in materials applications.
- interpret and evaluate data regarding the properties, processing, and performance characteristics of materials, and use it as a basis to recommend appropriate material(s) to meet engineering design criteria.
- measure material properties and/or evaluate processing treatments using standard materials testing equipment and techniques.
- compose laboratory reports that communicate the collection, analysis (including statistical), and interpretation of experimental data according to professional engineering standards.

ENGR 420 Statics

- Units: 3
- Hours: 54 hours LEC
- Prerequisite: MATH 401 and PHYS 410 with grades of "C" or better
- Transferable: CSU; UC
- Catalog Date: June 1, 2020

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: 0.5 - 3
- Hours: None.
- Prerequisite: CSU
- Transferable: CSU
- Catalog Date: June 1, 2020

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.

ENGR 499 Experimental Offering in Engineering

- Units: 0.5 - 4
- Hours: None.
- Prerequisite: CSU
- Transferable: CSU
- Catalog Date: June 1, 2020

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