

# ENGINEERING

## Contact Information

### Division

Sciences and Mathematics

### Dean

Randy Lehr

### Associate Dean

Megan D'Errico

### Division Office

V 211, Rocklin Campus

## Overview

The Engineering Department offers courses that satisfy the lower division engineering requirements of most California colleges and universities. Students may begin their study of chemical, civil, electrical, or mechanical engineering at Sierra College. Job openings abound in many engineering fields.

TRANSFER MAJOR REQUIREMENTS in Engineering are available in the Counseling Center. In all cases, students should consult with a counselor for specific transfer requirements. Four-year graduates in Engineering are qualified for positions in research, building industry, manufacturing and business.

## Faculty

### Philip H. Pattengale

#### Professor, Engineering

A.A., Fresno City College

B.S., California Polytechnic State University, San Luis Obispo

M.S., California State University, Sacramento

## Engineering Advisory Committee

- Roya Borman, Sacramento Municipal Utility District
- Don Carroll, Western Engineering Contractors, Loomis
- Ronald Chiaratti, Norris Electric, Auburn
- Steve Culley, CalTrans, Auburn
- Jeffrey Hahn, Covanta Energy, Lafayette
- John Haskell, Western Engineering Contractors, Loomis
- Tom Holdredge, Holdredge and Kull, Nevada City
- B. George Kniazewycz, Renovare International, Inc., Alameda
- Steve Leach, R.C.D. Engineering, North San Juan
- Patrick Leonhardt, Energy Absorption Systems, Rocklin
- Leo R. Martinez, Contractual Engineer, Grass Valley
- Arthur Perkins, P.E., Consultant, Moraga
- Steve Sarantopolis, Cranmer Engineering, Grass Valley
- Tom Tinucci, Wellhead Electric Company, Inc., Sacramento
- Terence Vollrath, Consultant, Placerville
- Brian Yeh, General Electric Company, Walnut Creek

## Degrees/Certificates

### Associate Degree

- Engineering (p. 1)

### Certificates of Achievement

- Civil Engineering Technology (p. 2)
- General Engineering Technology (p. 2)

## Engineering

### AA or AS Degree

The Engineering major recognizes a concentration in the field of Engineering. Successful completion of the curriculum in Engineering prepares engineering students for transfer to four-year colleges or universities. In all cases, students should consult with a counselor for more information on university admission and transfer requirements. Students must fulfill the following major requirements with grades of "C" or better, complete a minimum of 60 degree-applicable semester units (12 of which must be completed at Sierra College) with a grade point average of at least 2.0 and complete one of the following three general education patterns:

- Sierra College Associate Degree Requirements (<http://catalog.sierracollege.edu/archive/2022-2023/student-resources/general-education/associate-degree-requirements/>);
- California State University General Education Breadth (<http://catalog.sierracollege.edu/archive/2022-2023/student-resources/general-education/california-state-university-general-education-breadth-requirements/>) pattern;
- Intersegmental General Education Transfer Curriculum (IGETC) (<http://catalog.sierracollege.edu/archive/2022-2023/student-resources/general-education/intersegmental-general-education-transfer-curriculum-igetc/>).

### Required Courses

Code	Title	Units
CHEM 0001A	General Chemistry I (OR)	5-6
or CHEM 0003A & CHEM 0003B	General Chemistry I - Part 1 and General Chemistry I - Part 2	
ENGR 0130	Statics	3
ENGR 0140B	Materials Science and Engineering	4
ENGR 0151	Engineering Graphics	4
MATH 0030	Analytical Geometry and Calculus I	4
MATH 0031	Analytical Geometry and Calculus II	4
MATH 0032	Analytical Geometry and Calculus III	4
<b>Select one of the following physics course combinations:</b>		<b>4</b>
PHYS 0210 & 0210L	Principles of Physics: Electricity and Magnetism and Principles of Physics Laboratory: Electricity and Magnetism	
PHYS 0215 & 0215L	Principles of Physics: Heat, Waves and Modern Physics and Principles of Physics Laboratory: Heat, Waves and Modern Physics	
<b>Select 6 units from the following (if not used above):</b>		<b>6</b>
CHEM 0001B	General Chemistry II	
ENGR 0095	Internship in Engineering (up to 4 units)	
ENGR 0101	Engineering Seminar	
ENGR 0110	Introduction to Engineering Design	
ENGR 0137	Manufacturing Processes	
ENGR 0180	Engineering Surveying	

ENGR 0220	Programming and Problem Solving in Engineering
ENGR 0230	Dynamics
ENGR 0260	Electric Circuits
ENGR 0260L	Electric Circuits Laboratory
MATH 0033	Differential Equations and Linear Algebra
PHYS 0210 & 0210L	Principles of Physics: Electricity and Magnetism and Principles of Physics Laboratory: Electricity and Magnetism
PHYS 0215 & 0215L	Principles of Physics: Heat, Waves and Modern Physics and Principles of Physics Laboratory: Heat, Waves and Modern Physics
<b>Total Units</b>	<b>38-39</b>

## Civil Engineering Technology

### Certificate of Achievement

Successful completion of the curriculum in Civil Engineering Technology will prepare students for entry-level positions as civil engineering technicians. The certificate is designed to provide knowledge and career technical skills in mathematics, physics, chemistry and civil engineering to assist engineers in fields such as surveying, construction, architecture, environmental, material testing, public utilities and land use. The certificate is not equivalent to an associate degree.

#### Required Courses

Code	Title	Units
BUS 0250	Computer Applications for Business	3
CHEM 0001A or CHEM 0003A & CHEM 0003B	General Chemistry I (OR) General Chemistry I - Part 1 and General Chemistry I - Part 2	5-6
ENGR 0101	Engineering Seminar	1
ENGR 0151	Engineering Graphics	4
ENGR 0180	Engineering Surveying	4
MATH 0027	Trigonometry	4
MECH 0010	Fundamentals of Electronics	4
<b>Select one of the following physics course combinations:</b>		<b>5</b>
PHYS 0105 & 0105L	General Physics I and General Physics I Laboratory	
PHYS 0205 & 0205L	Principles of Physics: Mechanics and Principles of Physics Laboratory: Mechanics	
<b>Select 3-5 units from the following:</b>		<b>3-5</b>
ENGR 0110	Introduction to Engineering Design	
ENGR 0137	Manufacturing Processes	
GEOG 0090	Introduction to Geographic Information Systems (GIS)	
PHYS 0110 & 0110L	General Physics II and General Physics II Laboratory	
PHYS 0210 & 0210L	Principles of Physics: Electricity and Magnetism and Principles of Physics Laboratory: Electricity and Magnetism	
<b>Total Units</b>		<b>33-36</b>

## General Engineering Technology

### Certificate of Achievement

Successful completion of the curriculum in General Engineering Technology will prepare students for entry-level positions as engineering technicians. The certificate is designed to provide knowledge and career technical skills in mathematics, physics, chemistry and engineering to assist engineers in fields such as fabrication, HVAC, building maintenance, environmental, industrial, safety, mechanical equipment and medical equipment. The certificate is not equivalent to an associate degree.

#### Required Courses

Code	Title	Units
BUS 0250	Computer Applications for Business	3
CHEM 0001A or CHEM 0003A & CHEM 0003B	General Chemistry I (OR) General Chemistry I - Part 1 and General Chemistry I - Part 2	5-6
ENGR 0101	Engineering Seminar	1
ENGR 0151	Engineering Graphics	4
MATH 0027	Trigonometry	4
MECH 0010	Fundamentals of Electronics	4
<b>Select one of the following physics course combinations:</b>		<b>5</b>
PHYS 0105 & 0105L	General Physics I and General Physics I Laboratory	
PHYS 0205 & 0205L	Principles of Physics: Mechanics and Principles of Physics Laboratory: Mechanics	
<b>Select 6-10 units from the following:</b>		<b>6-10</b>
CHEM 0001B	General Chemistry II	
ENGR 0110	Introduction to Engineering Design	
ENGR 0137	Manufacturing Processes	
ENGR 0220	Programming and Problem Solving in Engineering	
ENGR 0230	Dynamics	
MATH 0029	Pre-Calculus Mathematics	
PHYS 0110 & 0110L	General Physics II and General Physics II Laboratory	
PHYS 0210 & 0210L	Principles of Physics: Electricity and Magnetism and Principles of Physics Laboratory: Electricity and Magnetism	
<b>Total Units</b>		<b>32-37</b>

## Courses

Understanding course descriptions (<http://catalog.sierracollege.edu/archive/2022-2023/student-resources/course-information/understanding-course-descriptions/>)

### ENGR 0028. Independent Study

*Units: 1-3*

Designed for students interested in furthering their knowledge at an independent study level in an area where no specific curriculum offering is currently available. Independent study might include, but is not limited to, research papers, special subject area projects, and research projects. See Independent Study page in catalog. (CSU, UC-with unit limitation)

**ENGR 0095. Internship in Engineering***Units: 0.5-4*

Designed for advanced students to work in an area related to their educational or occupational goal. Provides new on-the-job technical training under the direction of a worksite supervisor, allowing students to expand knowledge and skills in the chosen field. Mandatory orientation session and faculty approval to determine eligibility. One unit of credit is equal to each 60 hours of non-paid work, or each 75 hours of paid work. Students may earn up to a total of 16 units in internship courses (any course numbered 95 and PDEV 94). (CSU-with unit limitation)

**ENGR 0101. Engineering Seminar***Unit: 1*

Formerly known as ENGR 150

Hours: 18 lecture

Exploration of the engineering profession, focusing on branches of engineering and relationships between them, spectrum of work functions, professionalism and ethics. Includes orientation to Sierra College engineering program, evaluation of engineering as a personal career choice and participation in engineering activities. (CSU, UC)

**ENGR 0110. Introduction to Engineering Design***Units: 3*

Hours: 54 lecture

Explores the branches of engineering, the functions of an engineer, and the industries in which engineers work. Explains the engineering education pathways and explores effective strategies for students to reach their full academic potential. Presents an introduction to the methods and tools of engineering problem solving and design including the interface of the engineer with society and engineering ethics. Develops communication skills pertinent to the engineering profession. Introduces the fundamentals of engineering design, problem solving, planning, prototyping and some fabrication. (C-ID ENGR 110) (CSU, UC)

**ENGR 0130. Statics***Units: 3*

Formerly known as ENGR 35

Prerequisite: Completion of PHYS 205, PHYS 205L, and MATH 31 with grades of "C" or better

Advisory: Completion of ENGR 151 with grade of "C" or better

Hours: 54 lecture

A first course in engineering mechanics: properties of forces, moments, couples and resultants; two- and three-dimensional force systems acting on engineering structures in equilibrium; analysis of trusses, and beams; distributed forces, shear and bending moment diagrams, center of gravity, centroids, friction, and area and mass moments of inertia. Optional additional topics include fluid statics, cables, Mohr's circle and virtual work. (C-ID ENGR 130) (CSU, UC)

**ENGR 0137. Manufacturing Processes***Units: 3*

Formerly known as ENGR 37

Advisory: Completion of ENGR 151 with grade of "C" or better

Hours: 90 (36 lecture, 54 laboratory)

Application of multiple fabrication techniques including tools and materials required for the manufacture of a mechanical assembly. Introduction to design and documentation of a final product. Manufacturing processes in the areas of forming, joining, material removal, casting, welding, assembly and prototyping which includes hands on use of manufacturing equipment. Each student fabricates a final project based on principles of manufacturing. (CSU, UC)

**ENGR 0140B. Materials Science and Engineering***Units: 4*

Formerly known as ENGR 45

Prerequisite: Completion of PHYS 205 and 205L with grades of "C" or better; and completion with grade of "C" or better or concurrent enrollment in CHEM 1A

Hours: 108 (54 lecture, 54 laboratory)

Presents the internal structures and resulting behaviors of materials used in engineering applications, including metals, ceramics, polymers, composites, and semiconductors. The emphasis is upon 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, to analyze experimental data, and to prepare reports. (CSU, UC)

**ENGR 0151. Engineering Graphics***Units: 4*

Formerly known as ENGR 22A and ENGR 22B

Hours: 108 (54 lecture, 54 laboratory)

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

**ENGR 0180. Engineering Surveying***Units: 4*

Formerly known as ENGR 10

Prerequisite: Completion of MATH 27 with grade of "C" or better

Advisory: Completion with grade of "C" or better or concurrent enrollment in ENGR 151

Hours: 108 (54 lecture, 54 laboratory)

Applies theory and principles of plane surveying: office computations and design; operation of surveying field equipment; and production of engineering plans/maps. Topics include distances, angles, and directions; differential leveling; traversing; property/boundary surveys; topographic surveys/mapping; volume/earthwork; horizontal and vertical curves; land description techniques; and GPS. Extensive field work using tapes, levels, transits, theodolites, total stations, and GPS. (C-ID ENGR 180) (CSU, UC)

**ENGR 0220. Programming and Problem Solving in Engineering***Units: 4*

Prerequisite: Completion of MATH 30 and PHYS 205 and 205L with grades of "C" or better

Advisory: PHYS 205 may be taken concurrently

Hours: 108 (54 lecture, 54 laboratory)

Utilizes the MATLAB environment to provide students with a working knowledge of computer-based problem-solving methods relevant to science and engineering. It introduces the fundamentals of procedural and object-oriented programming, numerical analysis, and data structures. Examples and assignments in the course are drawn from practical applications in engineering, physics, and mathematics. (C-ID ENGR 220) (CSU, UC)

**ENGR 0230. Dynamics**

*Units: 3*

Prerequisite: Completion of ENGR 130 with grade of "C" or better

Advisory: Completion of ENGR 151 with grade of "C" or better

Hours: 54 lecture

Fundamentals of kinematics and kinetics of particles and rigid bodies. Topics include kinematics of particle motion; Newton's second law, work-energy and momentum methods; kinematics of planar motions of rigid bodies; work-energy and momentum principles for rigid body motion; Introduction to mechanical vibrations (optional). (C-ID ENGR 230) (CSU, UC)

**ENGR 0260. Electric Circuits**

*Units: 3*

Formerly known as ENGR 17

Prerequisite: Completion of MATH 32, PHYS 210 and PHYS 210L with grades of "C" or better; completion with grade of "C" or better or concurrent enrollment in MATH 33

Hours: 54 lecture

An introduction to the analysis of electrical circuits. Use of analytical techniques based on the application of circuit laws and network theorems. Analysis of DC and AC circuits containing resistors, capacitors, inductors, dependent sources, operational amplifiers, and/or switches. Natural and forced responses of first and second order RLC circuits; the use of phasors; AC power calculations; power transfer; and energy concepts. (CSU, UC)

**ENGR 0260L. Electric Circuits Laboratory**

*Unit: 1*

Formerly known as ENGR 17L

Prerequisite: Completion of PHYS 210 and 210L with grades of "C" or better

Corequisite: Concurrent enrollment in ENGR 260

Hours: 54 laboratory

An introduction to the construction and measurement of electrical circuits. Basic use of electrical test and measurement instruments including multimeters, oscilloscopes, power supplies, and function generators. Use of circuit simulation software. Interpretation of measured and simulated data based on principles of circuit analysis for DC, transient, and sinusoidal steady-state (AC) conditions. Elementary circuit design. Practical considerations such as component value tolerance and non-ideal aspects of laboratory instruments. Construction and measurement of basic operational amplifier circuits. (CSU, UC)

## **Program Student Learning Outcomes (PSLOs)**

- Identify and differentiate between the attributes of the various engineering disciplines as related to education and the workforce.
- Read, analyze, and compose industry standard technical engineering drawings.
- Model physical systems correctly through the use of engineering concepts and then apply advanced mathematical techniques to solve the system.
- Create technical reports that identify, analyze, and assess results taken from experiments that are performed within the engineering lab.
- Construct actual physical models from instructions and diagrams given to them by an instructor.