

## ENGINEERING

### Natural and Applied Sciences Division

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### Engineering A.S. Degree

Engineers are the people who design and build the systems, structures, and products that make the world run. Engineers are employed in research, development, design, construction, manufacturing, and operations of technical projects related to almost all aspects of modern life, including the environment, communications, transportation, food production, medicine and health, space exploration, housing, consumer products, and energy.

Cabrillo College offers a two-year lower division engineering program that prepares students for transfer with full junior standing in all engineering disciplines to colleges and universities in California and across the United States. The first two years of the engineering curriculum at most colleges and universities are similar with specialization commencing in the junior year. There are many engineering disciplines and the following are the primary ones: Aerospace, Agricultural, Architectural, Biomedical, Biological, Chemical, Civil, Computer, Electrical, Environmental, Industrial, Manufacturing, Materials, Mechanical, Nuclear, Petroleum, and Software.

An engineering student at Cabrillo does not need to select a major branch of engineering study until applying for transfer to a university; however, some of the course requirements for transfer depend on the student's intended major and the transfer university. Completion of the appropriate lower division core courses below is essential in facilitating progress as an upper division engineering transfer student.

For transfer to California public universities, go to [www.assist.org](http://www.assist.org) to determine the lower division major requirements. Additionally, for CalPoly-SLO, also consult admissions: [calpoly.edu/applicants/transfer/criteria.html](http://calpoly.edu/applicants/transfer/criteria.html). For California private universities and out-of-state universities, go to the universities' transfer web site to determine the transfer requirements. It is important that engineering students meet with the Engineering Department, STEM Counselor, or other transfer counselor for advisement to develop their semester-by-semester educational plan.

### Learning Outcomes

The Cabrillo College Core Competencies (with an emphasis in the study of Engineering):

1. Communication: Reading, Writing, Listening, Speaking, and/or Conversing
2. Critical Thinking and Information Competency: Analysis, Computation, Research, Problem Solving
3. Global Awareness: An appreciation of Scientific Processes, Global Systems and Civics, and Artistic Variety
4. Personal Responsibility and Professional Development: Self-Management and Self-Awareness, Social and Physical Wellness, Workplace Skills

### Model Program for Engineering

This program has been adopted by the Engineering Liaison Council

of the California Intersegmental Council.

This Associate Degree requires 60 units appropriate to your educational goal, to include general education and at least 30 units in a major. Courses should be selected to meet the lower-division major preparation requirements at your intended transfer university - these specific requirements can be found at [www.assist.org](http://www.assist.org) for 4-year public institutions in California. Please see a counselor for advisement to ensure you are taking the best possible courses given your goal.

The department presents the following suggested Model Program for this major. The courses listed below may or may not be appropriate depending on your specific goal. Please see a counselor for advisement for transfer to any 4-year institution.

### A.S. General Education

**21 Units**

#### Core Courses (39 Units)

**The following core course is recommended to help determine the field of engineering to pursue:**

ENGR 5            Engineering as a Profession..... 2

**The following core courses meet lower-division requirements for ALL engineering majors and transfer universities:**

MATH 5A        Analytic Geometry and Calculus I..... 5

MATH 5B        Analytic Geometry and Calculus II..... 5

MATH 5C        Analytic Geometry and Calculus III..... 5

PHYS 4A        Physics for Scientists and Engineers I ..... 5

PHYS 4B        \*Physics for Scientists and Engineers II..... 5

**The following core courses meet lower-division requirements for MOST engineering majors and transfer universities:**

CHEM 1A        General Chemistry I ..... 5

CS 11            Introduction to Programming Concepts and Methodology, C++ ..... 4

or

CS 12J          Introduction to Programming Concepts and Methodology, Java ..... 4

or

ENGR 30        \*\*Computer Applications in Engineering..... 4

ENGR 10        \*Engineering Communication ..... 2

ENGR 15        \*\*Circuits..... 4

ENGR 25        Graphics and Design ..... 4

ENGR 35        \*\*Statics ..... 3

ENGR 45        \*Engineering Materials..... 4

MATH 6        Introduction to Linear Algebra ..... 3

MATH 7        Introduction to Differential Equations ..... 3

PHYS 4C        \*\*Physics for Scientists and Engineers III..... 5

**The following core courses meet lower-division requirements for SOME engineering majors and transfer universities:**

CHEM 1B        General Chemistry II ..... 5

CHEM 12A       Organic Chemistry I ..... 3

CHEM 12AL     Organic Chemistry Laboratory I..... 2

CHEM 12B       Organic Chemistry II ..... 3

CHEM 12BL     Organic Chemistry Laboratory II ..... 2

CS 19            C++ Programming ..... 4

or

CS 20J          Java Programming ..... 4

CS 21            \*\*Introduction to Data Structures and Algorithms..... 4

CS 23            \*\*Discrete Mathematics ..... 4

CS 24            \*Elementary Computer Organization ..... 4

ENGR 1A        \*Surveying ..... 4

ENGR 12        Machining Processes ..... 1.5

ENGR 26	**Solid Modeling.....	1
PHYS 4D	***Modern Physics .....	3
(any of the courses above; at least 12 units of ENGR courses)		

**Total Units** **60**

\*Fall only; \*\*Spring only; \*\*\*Fall, even year only

## Engineering Courses

### ENGR 1A Surveying

4 units; 3 hours Lecture, 3 hours Laboratory

Prerequisite: MATH 3 or high school trigonometry or MATH 4 or equivalent skills.

Recommended Preparation: ENGR 25 (may be taken concurrently); Eligibility for ENGL 1A/1AH /1AMC/1AMCH; READ 100.

Repeatability: May be taken a total of 1 time.

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; construction applications; and GPS. Extensive field work using tapes, levels, transits, theodolites, total stations, and GPS. Fall semester only.

*Transfer Credit:* Transfers to CSU; UC.

### ENGR 3 How Things Work

3 units; 3 hours Lecture

Recommended Preparation: READ 100; MATH 154; ENGL 100 or ESL 100 and ENGL 100L or Assessment into ENGL 1A.

Repeatability: May be taken a total of 1 time.

Covers how everyday things work and is intended for students in all disciplines. Opportunities are provided for students to experiment with everyday technology in order to discover the principles of science. Mechanical, electrical, biomedical, environmental, and computer systems are explored through experimentation and observation.

*Transfer Credit:* Transfers to CSU; UC.

### ENGR 5 Engineering as a Profession

2 units; 2 hours Lecture

Recommended Preparation: ENGL 100 or ESL 100 and ENGL 100L or Assessment into ENGL 1A; READ 100.

Repeatability: May be taken a total of 1 time.

Provides information to evaluate the engineering profession as a personal career choice. Explores the branches of engineering, the functions of an engineer, and the industries in which they work. Presents an introduction to the methods of engineering analysis, design and problem solution emphasizing the interface of the engineer with society and engineering ethics. Explains the engineering education process and explores effective strategies for students to reach their full academic potential.

*Transfer Credit:* Transfers to CSU; UC.

### ENGR 10 Engineering Communication

2 units; 2 hours Lecture, 1 hour Laboratory

Prerequisite: ENGL 1A/1AH/1AMC/1AMCH.

Recommended Preparation: READ 100.

Repeatability: May be taken a total of 1 time.

Develops written, computer, and oral communication skills in analyzing and presenting data in solving engineering problems. Builds analysis, computation, teamwork, and presentation skills; teaches writing and organizing principles for effective technical writing; and utilizes computer applications to create and present engineering projects. Fall semester only.

*Transfer Credit:* Transfers to CSU; UC, with conditions: In order for transfer credit to be granted for ENGR 10, ENGR 5 must also be taken.

### ENGR 12 Machining Processes

1.5 unit; 1 hour Lecture, 2 hours Laboratory

Recommended Preparation: ENGL 100 or ESL 100 and ENGL 100L or Assessment into ENGL 1A; READ 100.

Repeatability: May be taken a total of 1 time.

Provides hands-on experience with fabrication of mechanical components and assemblies using conventional, automatic, and numerical control tools. Identifies hazards associated with specific machine tools and processes, and ways of reducing risk of injury.

*Transfer Credit:* Transfers to CSU.

### ENGR 15 Circuits

4 units; 3 hours Lecture, 3 hours Laboratory

Prerequisite: PHYS 4B.

Hybrid Requisite: Completion of or concurrent enrollment in MATH 7.

Recommended Preparation: Eligibility for ENGL 1A/1AH/1AMC/1AMCH; READ 100.

Repeatability: May be taken a total of 1 time.

Analyzes the DC and AC electrical circuits containing resistors, capacitors, inductors, dependent sources, operational amplifiers, and/or switches. Basic circuit laws, network theorems, and computer analysis are used to solve DC steady state circuits, RC, RL, and RLC DC transient circuit and sinusoidal AC steady-state circuits. Power and energy analysis is performed throughout the course. Spring semester only.

*Transfer Credit:* Transfers to CSU; UC.

### ENGR 25 Graphics and Design

4 units; 3 hours Lecture, 3 hours Laboratory

Prerequisite: MATH 153 or MATH 3 or MATH 4 or high school geometry.

Recommended Preparation: ENGL 100 or ESL 100 and ENGL 100L or Assessment into ENGL 1A; READ 100.

Repeatability: May be taken a total of 1 time.

Applies principles of engineering drawing in visually communicating engineering designs using freehand sketching, instrument drawing, and computer-aided drafting/design using AutoCAD. Topics include orthographic and pictorial drawings; descriptive geometry; detail and assembly drawings; dimensioning and tolerancing; and scales. Acquire an in-depth understanding of the engineering design process and improve creativity in solving engineering problems.

*Transfer Credit:* Transfers to CSU; UC.

**ENGR 26 Solid Modeling**

1 unit; 3 hours Laboratory

Hybrid Requisite: Completion of or concurrent enrollment in ENGR 25.  
Recommended Preparation: ENGL 100 or ESL 100 and ENGL 100L or Assessment into ENGL 1A; READ 100.

Repeatability: May be taken a total of 1 time.

Applies principles of solid modeling using Creo Parametric in engineering design and the production of engineering drawings. Construct parts, solid models, and assemblies. Plot three-dimensional drawings and dimensioned orthographic drawings. Produce engineering documentation packages. Spring semester only.

*Transfer Credit:* Transfers to CSU; UC.

**ENGR 30 Computer Applications in Engineering**

4 units; 3 hours Lecture, 3 hours Laboratory

Prerequisite: MATH 5A.

Recommended Preparation: Eligibility for ENGL 1A/1AH/1AMC/1AMCH; READ 100.

Repeatability: May be taken a total of 1 time.

Applies computer-based problem-solving methods relevant to engineering using the fundamentals of procedural and object-oriented programming, numerical analysis, and data structures. Applies numeric techniques and computer simulation to analyze and solve engineering-related problems.

*Transfer Credit:* Transfers to CSU; UC. C-ID: ENGR 220

**ENGR 35 Statics**

3 units; 3 hours Lecture

Prerequisite: PHYS 4A and MATH 5B.

Recommended Preparation: ENGR 25; ENGL 100 or ESL 100 and ENGL 100L or Assessment into ENGL 1A; READ 100.

Repeatability: May be taken a total of 1 time.

Analyzes force systems on rigid bodies in static equilibrium using two- and three-dimensional models and vector and scalar analysis methods. Topics include distributed force systems, friction, couples, moments; shear and bending moment diagrams; analysis of trusses, frames, and beams; centroids/center of mass; area and mass moment of inertia. Optional topics include cables, Mohr's circle and virtual work. Spring semester only.

*Transfer Credit:* Transfers to CSU; UC.

**ENGR 45 Engineering Materials**

4 units; 3 hours Lecture, 3 hours Laboratory

Prerequisite: PHYS 4A and CHEM 1A and ENGL 1A/1AH/1AMC/1AMCH.  
Recommended Preparation: ENGR 10 and CHEM 1B and READ 100.

Repeatability: May be taken a total of 1 time.

Presents the properties and performance of engineering materials and their relationship to the internal structure of materials. Applies the concepts of material science and engineering in testing materials using laboratory testing equipment. Utilizes analysis techniques in selecting the appropriate materials to meet engineering design criteria. Engineering materials include metals, polymers, ceramics, composites, and semiconductors. Fall semester only.

*Transfer Credit:* Transfers to CSU; UC.

**ENGR 98A Global Engineering**

2 units; 2 hours Lecture

Hybrid Requisite: ENGR 5.

Recommended Preparation: ENGL 100 or ESL 100, and READ 100, ENGR 25.

Repeatability: May be taken a total of 1 time.

Prepares students for the Engineering Abroad Program. Explores the interrelationship between people, culture, the global economy, the environment, sustainability, technology, ethics, engineering problem solving, and engineering design.

*Transfer Credit:* Transfers to CSU.

**ENGR 98B Engineering Abroad**

1 unit; 3 hours Laboratory

Prerequisite: ENGR 98A.

Recommended Preparation: ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Explores the interrelationship between engineering, technology, and culture through a service-learning or an experiential engineering abroad experience.

*Transfer Credit:* Transfers to CSU.