

PHYSICAL SCIENCE AND ENGINEERING

Degrees and Certificates Offered:

- ▶ Physics: Associate in Science for Transfer (A.S.-T.)
- ▶ Physical Science and Engineering: Associate in Science (A.S.)
- ▶ Engineering Option: Associate in Science (A.S.)

Contact:
(408) 848-4701
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Physical Science and Engineering

A.S. Degree

This option provides a broad background in the sciences. Students completing this degree will have learned to integrate math and science to solve problems, have proficiency in laboratory techniques and analysis of experimental data, and will have demonstrated an ability to communicate effectively using written, oral, electronic, and graphical means. This degree will prepare students interested in transferring to four-year colleges or universities to pursue degrees in any of the natural or physical sciences (astronomy, chemistry, geology or geophysics, general science, meteorology, oceanography, physics, etc). Students electing this major are encouraged to consult the catalogs of the four-year schools to which they plan to transfer early in their Gavilan course work as requirements for transfer vary by institution. Engineers are responsible for designing and building everything that we use – airplanes, roads, machines, computers, buildings, artificial limbs.

Program Learning Outcomes: After completing this degree a student will be able to:

- ▶ demonstrate appropriate integration of math and science to solve real-world problems.
- ▶ demonstrate appropriate design and execution of experiments, as well as analysis and interpretation of the data.
- ▶ demonstrate an ability to communicate clearly using written, oral, electronic, and graphical means.
- ▶ Students are strongly advised to consult the appropriate college catalogs and their counselors to determine the specific lower division requirements if you are transferring to a 4-year institution.

REQUIREMENTS:

CHEM 1A/B:	General Chemistry (10 units)
MATH 1A/B:	Single-Variable Calculus & Analytic Geometry (8 units)
MATH 1C:	Multivariable Calculus (4 units)
MATH 2*:	Linear Algebra (3 units)
MATH 2C	Differential Equations (3 units)
ENGR 5*	C++ Scientific Programming (3 units)
PHYS 4A	Physics for Scientists and Engineers - Mechanics (4 units)
PHYS 4B	Physics for Scientists and Engineers- Electricity and Magnetism: (4 units)
PHYS 4C	Physics for Scientists and Engineers - Heat, Optics, Modern Physics (4 units)

Total for major: 43 units

Plus completion of general education requirements: units vary

* There are times when a course listed as a requirement for a major or certificate cannot be offered in a reasonable timeframe. Course substitutions and waivers will be considered by the department. Please contact the department chairperson. This information is available from the Office of Instruction (408) 848-4761

PHYSICAL SCIENCE AND ENGINEERING



Associate Degree
for Transfer™

Physics

A.S.-T Degree

The Associate in Science in Physics for Transfer degree is designed to prepare student for a seamless transfer into the CSU system to complete a baccalaureate degree in Physics.

Physics is the study of why and how the world we live in behaves the way it does. Using theories and laws based upon observation and testing, physics considers and describes the behavior of our everyday world including motion, forces, mechanical and thermal energy, waves, electricity and magnetism, and light.

Physics majors typically receive at least a Bachelor's degree and are prepared for many jobs in government and industry as well as being prepared to pursue graduate education in many fields of science and engineering.

The AS-T in Physics does not include some important lower-division classes that are required for a Bachelor's degree in Physics. Students taking courses at Gavilan who are preparing to transfer should take additional courses at Gavilan that are part of the lower-division preparation at CSU campuses so they are prepared to take upper-division major courses after transferring. Consult with the instructor or a counselor early in your first semester at Gavilan to ensure you will take all of the courses required for the major.

STUDENT LEARNING OUTCOMES: Upon completion of the AS-T in Physics, students will be able to:

- ▶ Demonstrate appropriate integration of math and physics concepts to solve real-world problems.
- ▶ Demonstrate appropriate design and execution of experiments, as well as analysis and interpretation of the data.
- ▶ Demonstrate an ability to communicate clearly using written, oral, and graphical means.

REQUIREMENTS: (24 units)

PHYS 4A	Physics for Scientists and Engineers - Mechanics (4 units)
PHYS 4B	Physics for Scientists and Engineers - Electricity and Magnetism(4 units)
PHYS 4C	Physics for Scientists and Engineers - Heat, Optics, Modern Physics (4 units)
MATH 1A	Single-Variable Calculus and Analytic Geometry (4 units)
MATH 1B	Single-Variable Calculus and Analytic Geometry (4 units)
MATH 1C	Multivariable Calculus (4 units)

Total units in the major: 24 units

Total units that may be double-counted: 7 units CSU / 7 IGETC

Completion of CSU GE Breadth: 39 units or IGETC:37 units

Electives: 4 units CSU / 6 units IGETC

Units for degree: 60 units

ALL ADT DEGREES REQUIRE:

1. Completion of 60 semester units or 90 quarter units that are eligible for transfer to the California State University, including both of the following:
 - A. The Intersegmental General Education Transfer Curriculum (IGETC) or the California State University General Education – Breadth Requirements.
 - B. A minimum of 18 semester units or 27 quarter units in a major or area of emphasis, as determined by the community college district.
2. Attainment of a minimum grade point average of 2.0.

ADTs also require that students must earn a C or better in all courses required for the major or area of emphasis. A "P" (Pass) grade is an acceptable grade for courses in the major.

Physical Science and Engineering: General Engineering

A.S. Degree

This option constitutes the lower-division core classes suggested by the Engineering Liaison Council (ELC), an organization composed of representatives from two- and four-year colleges and universities. Students completing this degree will have learned to identify various engineering problems and integrate math and science to solve them, have proficiency in the design, execution, analysis, and interpretation of experiments, demonstrate familiarity with the engineering design process, and will have demonstrated an ability to communicate effectively using written, oral, electronic, and graphical means. This degree will prepare students to transfer to four-year colleges or universities to pursue degrees in any of the engineering disciplines (aeronautical, chemical, civil, computer, electrical, industrial, materials, mechanical, etc.). Students electing this major are encouraged to consult the catalogs of the four-year schools to which they plan to transfer early in their Gavilan course work as requirements for transfer vary by institution.

Program Learning Outcomes: After completing this degree a student will be able to:

- ▶ identify, compare and contrast engineering problems and demonstrate integration of math and science to solve them.
- ▶ demonstrate appropriate design and execution of experiments, as well as analyze and interpret of the data.
- ▶ demonstrate the engineering design process by designing a system, component or process to meet a desired need.
- ▶ demonstrate an ability to communicate clearly using written, oral, electronic and graphical means.

Students are strongly advised to consult the appropriate college catalogs and their counselors to determine the specific lower division requirements if you are transferring to a 4-year institution.

REQUIREMENTS:

CHEM 1A/B	General Chemistry (10 units)
ENGL 1A	Composition (3 units)
ENGR 1	Graphical Communication and Design (3 units)
ENGR 2	Statics (3 units)
ENGR 3	Electric Circuit Analysis (4 units)
ENGR 4	Properties of Materials (3 units)
ENGR 5	C++ Scientific Programming (3 units)
MATH 1A/B	Single-Variable Calculus & Analytic Geometry (8 units)
MATH 1C	Multivariable Calculus (4 units)
MATH 2*	Linear Algebra (3 units)
MATH 2C	Differential Equations (3 units)
PHYS 4A	Physics for Scientists and Engineers - Mechanics (4 units)
PHYS 4B	Physics for Scientists and Engineers- Electricity and Magnetism (4 units)
PHYS 4C	Physics for Scientists and Engineers - Heat, Optics, Modern Physics (4 units)

Total for major: 59 units

Plus completion of general education requirements: units vary

Total units required: minimum of 60 units

* There are times when a course listed as a requirement for a major or certificate cannot be offered in a reasonable timeframe. Course substitutions and waivers will be considered by the department. Please contact the department chairperson. This information is available from the Office of Instruction (408) 848-4761.

General Education requirements: A student may complete the Gavilan College A.A./A.S. general education, the CSU-GE Breadth or the IGETC pattern, plus sufficient electives to meet a 60 unit total. See pages 49-57 or see a counselor for details.

NOTE: A course may be used to satisfy both general education and major courses. See "Double Counting Rule" on page 47.