

PHYSICS

Physics Program Learning Outcomes (<https://catalog.csudh.edu/program-learning-outcomes/natural-behavioral-sciences/bachelor-science-physics-learning-outcomes/>)

College of Natural and Behavioral Sciences

Department of Physics

Bachelor of Science

Degree Roadmaps

Electrical Engineering Option

General Physics Option

Physical Science Option

Minor

Physics

Faculty

Jim Hill, Department Chair

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Department Office: NSM B-202, (310) 243-3591

Emeritus Faculty

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Program Description

Physics is the study of the natural world at its foundation. As such it is the basis of other disciplines such as biology, medicine, chemistry, computer science, geology, astronomy and engineering. Physicists study the world from the smallest particles of matter (quarks and leptons), nuclei, atoms, and molecules; through forces and motions which determine properties of solids, liquids, gases, and plasmas; to descriptions of the behavior of matter on all scales up to stars, galaxies, and even the origin and fate of the universe. Other researchers explore how physics itself can be learned. Physics is also the base of most engineering. The department encourages student-faculty interaction in all these areas.

For the traditional physics baccalaureate degree, the department offers a General Physics Option, which provides access to advanced theoretical and technical careers. In addition, students may gain experience by participating in research projects (e.g. neutrino experiments, nuclear physics experiments, and Physics Education Research).

Since many physics majors find their niche in teaching, the department offers a Physical Science Option tailored to meet education standards and satisfy waiver requirements for a single subject teaching credential. The Physics faculty are committed to teaching excellence, and to teacher education in the sciences. The department provides essential laboratory hands-on experience in understanding and demonstrating science.

For students intending to pursue graduate work or employment in Electrical Engineering, the department offers an Electrical Engineering option, intended to facilitate a seamless transition after graduation. An agreement in place with the CSU Fullerton College of Electrical Engineering and Computer Science allows students to satisfy all of the course requirements for admission to an MS program at CSU Fullerton.

The Physics Minor has flexible upper division requirements to encourage students majoring in other fields to broaden their expertise to fit a niche

in contemporary technology or research. Students are invited to meet with a physics advisor to map areas of interest and expertise. The most successful physics minors distinguish themselves as mathematics majors in applied math, computer science majors in computer hardware, chemistry students in physical chemistry, music majors in electronics and instrumentation, and clinical science majors with elements of nuclear physics (modern physics).

Features

The most important feature of the Physics Department is its excellent full-time faculty, all members of which hold the doctorate. They are dedicated to excellence in teaching and are active in research and other scholarly activities.

Another attractive feature of the department is its small class size, allowing students to interact frequently and effectively with instructors within and outside of class. It also permits instructors to easily identify students in need of additional assistance, and to supply such assistance. Many of our majors work part-time in local high-tech organizations. Upper-division courses are often offered in late afternoon or evening to make courses more accessible for these students.

Progress in this science often depends on our innovation in designing advanced experimentation to observe natural phenomena (when driven to its limits), or in computational or mathematical modeling to match a complex phenomenological response. Since new discoveries and techniques are instantly shared with the global community, the department is committed to introducing students to computer analysis techniques and internet web literacy. Excellent computer facilities are available on campus.

Academic Advising

All prospective students should meet with a Physics department faculty member to learn more about the physics major and minor and to receive assistance in planning a schedule of courses. All physics majors must review their course list with a physics advisor prior to registration each semester.

Preparation

Prior to beginning a program in physics students are required to complete two years of high school algebra, one year of trigonometry and one year of geometry. Two years of laboratory science and four years of college preparatory English are required. Prior courses in computer programming and calculus are recommended.

Students transferring from an articulating community college should have completed three semesters of calculus (through differential and integral calculus of several variables), two semesters of calculus-based physics and one semester of general chemistry. If those students have not had an introduction to modern physics and/or mathematical physics, they must take PHY 134 General Physics III (4) and PHY 306 Math Methods In Physics (3) as soon as possible upon arrival at CSUDH. Transfer students are responsible for checking in advance that their general electives will meet transfer requirements. A transfer student who is given credit for the lower division should be able to complete our physics upper division in two years.

Career Possibilities

Graduates find technical positions in industry, government or teaching; or pursue advanced degrees for research, design, or analysis in physics, engineering or related fields. The campus is surrounded with electronics,

aerospace, and semiconductor companies, among others, who hire physicists to work in applications of optics, electrical engineering, biophysics, computer science, geophysics, aerospace, and astronomy.

Scholarships for Full-time Physics Majors

Contact the Physics Department Office, NSM B-202, for information on three scholarships that the department offers each year.

Graduation with Honors

An undergraduate student may be a candidate for graduation with Honors in the Physics major provided he or she has fulfilled the following:

1. Has filed an approved graduation check for a B.S. in Physics during the current academic year with the General Physics, Physical Science, or Electrical Engineering option;
2. Has attained an overall CSUDH GPA of 3.35 and a GPA in the Physics major of 3.25;
3. Has or will have taken upon graduation the last 12 semester units of upper division requirements and the last 20 units overall in residence at CSUDH. Transfer units may be included if they help the student satisfy the GPA requirements;
4. Has been reviewed and recommended by the Physics faculty for graduation with honors in Physics.

Departmental-Professional Organizations, and Co-curricular Activities

The CSUDH Science Society, Society of Physics Students and Sigma Pi Sigma (National Physics Honor Society) cooperate in offering lectures, social programs and field trips to promote student participation in and enjoyment of the sciences. These activities are enriching and greatly enhance our students' growth within our community of scholars. In addition, faculty are often willing to sponsor inexpensive student memberships in national physics organizations which publish ongoing research in a variety of areas of physics and engineering. The department sponsors a colloquium series with talks a few times each semester on various topics in physics and engineering.

Bachelor of Science in Physics

Total Course Requirements for the Bachelor's Degree

See the "Requirements for the Bachelor's Degree (<https://catalog.csudh.edu/general-information/baccalaureate-degrees-undergraduate-studies/>)" in the University Catalog for complete details on general degree requirements. A minimum of 40 units, including those required for the major, must be upper division.

Elective Requirements

Completion of elective courses (beyond the requirements listed below) to reach a total of a minimum of 120.

General Education Requirements (49 units)

See the "General Education (<https://catalog.csudh.edu/general-information/double-counting-general-education-courses/general-education/>)" requirements in the University Catalog or the Class Schedule for the most current information on General Education requirements and course offerings.

Please note that the classes required for the Physics major satisfy the B1, B3, and B4 General Education requirements.

Graduation Writing Assessment Requirement

See the "Graduation Writing Assessment Requirement (<https://catalog.csudh.edu/general-information/graduate-writing-examination/>)" in the University Catalog.

Minor Requirements

Single field major, no minor required.

Major Requirements (75-80 units)

Students must select one of the options listed. The following courses, or their approved transfer equivalents, are required of all candidates for this degree.

Each student must select one of the options listed.

Electrical Engineering Option (77 units)

The Electrical Engineering Option provides a broad understanding of physical principles and a solid preparation for advanced study in electrical engineering as well as theoretical and experimental physics including problem-solving. This option should be undertaken by those planning on pursuing continued studies towards an advanced degree in electrical engineering or other fields within engineering, physics, or related fields as well as careers as a technical staff member in a government or industrial lab. By virtue of an agreement with the CSU Fullerton College of Electrical Engineering and Computer Science, this option satisfies all of the course requirements for admission to an MS program in electrical engineering at CSU Fullerton.

A. Lower Division Requirements (38 units)

CHE 110 General Chemistry I (5)
 MAT 191 Calculus I (5)
 MAT 193 Calculus II (5)
 MAT 211 Calculus III (5)
 PHY 130 General Physics I (5)
 PHY 132 General Physics II (5)
 PHY 134 General Physics III (4)
 CSC 121 Introduction to Computer Science and Programming I (4)

B. Upper Division Requirements (39 units)

1. Required Courses (23 units)

PHY 306 Math Methods In Physics (3)
 PHY 310 Theoretical Mechanics I (3)
 PHY 320 Physical Optics (3)
 PHY 333 Analog Electronics (3)
 PHY 341 Advanced Laboratory (2)
 PHY 346 Thermal Physics (3)
 PHY 350 Electromagnetic Theory I (3)
 PHY 460 Quantum Mechanics I (3)

2. Required courses that are electives for the General Physics Option (16 units)

Classes with the EE course prefix are to be taken in the Electrical Engineering department at CSU Fullerton (16 units)
 EE 309 ()
 EE 310 ()
 EE 323 ()
 PHY 335 Digital Electronics (3)
 PHY 494 Independent Study (3)
 or
 PHY 498 Directed Research (1-3)
 or
 EE 498 ()

Note: This option requires taking 11-13 units of electrical engineering courses at CSU Fullerton during regular or summer sessions through concurrent enrollment while a student at CSUDH. Advising for the Electrical Engineering option will be provided by CSUDH as well as CSU Fullerton.

General Physics Option (78-79 units)

The General Physics Option provides a broad understanding of physical principles and a solid preparation in both theoretical and experimental problem-solving in physics. This option should be chosen by students planning a technical career in industry or government laboratories, or planning to continue study toward an advanced degree in physics, engineering or a related field. PHY 306 Math Methods In Physics (3) should be taken as early as possible in preparation for the upper division courses in Physics.

A. Lower Division Requirements (37-38 units)

1. Required Courses (34 units)

CHE 110 General Chemistry I (5)
 MAT 191 Calculus I (5)
 MAT 193 Calculus II (5)
 MAT 211 Calculus III (5)
 PHY 130 General Physics I (5)
 PHY 132 General Physics II (5)
 PHY 134 General Physics III (4)

2. Select one course from the following (3-4 units)

CSC 111 Introduction to Computers and Basic Programming (3)
 CSC 121 Introduction to Computer Science and Programming I (4)

B. Upper Division Requirements (41 units)

1. Required Courses (23 units)

PHY 306 Math Methods In Physics (3)
 PHY 310 Theoretical Mechanics I (3)
 PHY 320 Physical Optics (3)
 PHY 333 Analog Electronics (3)
 PHY 341 Advanced Laboratory (2)
 PHY 346 Thermal Physics (3)
 PHY 350 Electromagnetic Theory I (3)
 PHY 460 Quantum Mechanics I (3)

2. Electives (18 units)

Select 12 upper division units from Physics and 6 upper division units from Chemistry, Computer Science, Mathematics, and Physics.

Physical Science Option (75-76 units)

The Physical Science Option provides a broad understanding of the physical sciences, in particular, physics, chemistry, geology and mathematics. This option is designed for students interested in teaching physical science in secondary school or pursuing a general science field such as science journalism.

A. Lower Division Requirements (50-51 units)

1. Required Courses (47 units)

CHE 110 General Chemistry I (5)
 CHE 112 General Chemistry II (5)
 EAR 100 Physical Geology (3)
 EAR 101 Physical Geology Laboratory (1)
 EAR 200 Earth History & Evolution (3)
 EAR 201 Earth History Lab (1)
 MAT 191 Calculus I (5)
 MAT 193 Calculus II (5)
 MAT 211 Calculus III (5)
 PHY 130 General Physics I (5)

PHY 132 General Physics II (5)

PHY 134 General Physics III (4)

2. Select one course from the following (3-4 units)

CSC 101 Intro.to Computer Education (3)
 CSC 111 Introduction to Computers and Basic Programming (3)
 CSC 121 Introduction to Computer Science and Programming I (4)

B. Upper Division Requirements (25 units)

1. Required Courses (11 units)

PHY 320 Physical Optics (3)
 PHY 333 Analog Electronics (3)
 PHY 341 Advanced Laboratory (2)
 PHY 346 Thermal Physics (3)

2. Select additional work from CHE, CSC, EAR and/or PHY (14 units)

Note: Consult with a physics advisor to choose classes consistent with the requirements for the subject matter preparation program in physical science.

Minor in Physics (33 units)

The Physics minor has flexible upper division requirements to encourage students majoring in other fields to broaden their expertise in consultation with a physics advisor in preparation for careers bridging across several fields of study.

Requirements

A. Lower Division Required Courses (24 units)

MAT 191 Calculus I (5)
 MAT 193 Calculus II (5)
 PHY 130 General Physics I (5)
 PHY 132 General Physics II (5)
 PHY 134 General Physics III (4)

B. Upper Division Required Electives (9 units)

Select three upper division PHY courses with career guidance from advisors in both major and minor.