

Applied Physics, B.S.

The goal of the undergraduate majors in Physics and Applied Physics is to develop expert problem solvers with a broad understanding of physical principles. The programs are flexible and prepare students for careers in industrial research, applications programming, education, law, or business, as well as for graduate study in astronomy, biomedical physics, engineering, or physics.

Students choose a major in either pure Physics or Applied Physics. The major in Physics includes a standard track for graduate study in physics, a Specialization in Astrophysics, and Concentrations in Computational Physics, the Philosophy of Physics, and Physics Education. The major in Applied Physics allows students to combine physics courses with courses from overlapping disciplines, such as materials science, electrical engineering, geosciences, biomedical imaging, or other fields. Annual mandatory meetings with faculty advisors assist students in selecting the right program for their aptitudes and interests.

Different sequences of lower-division physics courses are distinguished by their intended audience, their mathematical prerequisites, and the extent to which they offer preparation for more advanced courses. These aspects of the introductory courses are summarized as follows:

Physics 3: *Intended audience:* Premedical students, Biological Sciences majors. *Prerequisites:* concurrent enrollment in MATH 2A. *Preparation for advanced courses:* PHYSICS 7D with permission.

Physics 7: *Intended audience:* Physical Sciences and Engineering majors. *Prerequisite:* concurrent enrollment in MATH 2B. *Preparation for advanced courses:* PHYSICS 51A or PHYSICS 61A.

Physics 12-21: *Intended audience:* Nonscience majors. *Prerequisites:* none. *Preparation for advanced courses:* none.

Students may be admitted to the Physics or Applied Physics majors upon entering the University as freshmen, via change of major, or as transfer students from other colleges and universities. Information about change of major policies is available in the Physical Sciences Student Affairs Office and at the UCI Change of Major Criteria website (<http://www.changeofmajor.uci.edu/>). For transfer student admission, preference will be given to junior-level applicants with the highest grades overall and who have satisfactorily completed the following required courses: one year of approved calculus and one year of calculus-based physics with laboratory for engineering and physics majors. Completion of multivariable calculus, linear algebra, and differential equations is recommended.

All students must meet the University Requirements (<http://catalogue.uci.edu/informationforadmittedstudents/requirementsforabachelorsdegree/>).

School Requirements: None

Departmental Requirements

A. Complete the following:	
MATH 2A	Single-Variable Calculus I
or MATH 5A	Calculus for Life Sciences I
MATH 2B	Single-Variable Calculus II
MATH 2D- 2E	Multivariable Calculus I and Multivariable Calculus II
MATH 3A	Introduction to Linear Algebra
MATH 3D	Elementary Differential Equations
PHYSICS 50	Introductory Mathematical Physics
PHYSICS 61A	Modern Physics for Majors
or PHYSICS 51A	Modern Physics
PHYSICS 111A	Classical Mechanics
PHYSICS 112A	Electromagnetic Theory
PHYSICS 113A	Quantum Mechanics
PHYSICS 115A	Statistical Physics
B. Complete one of the following series:	
PHYSICS 7C- 7LC- 7D- 7LD- 7E	Classical Physics and Classical Physics Laboratory and Classical Physics and Classical Physics Laboratory and Classical Physics
or	

PHYSICS 3A- 3B- 3LB- 3C- 3LC	Basic Physics I and Basic Physics II and Basic Physics Laboratory and Basic Physics III and Basic Physics Laboratory
C. Complete one of the following:	
PHYSICS 53	Introduction to Programming and Numerical Analysis
I&C SCI 45C	Programming in C/C++ as a Second Language
MATH 9	Introduction to Programming for Numerical Analysis
EECS 10	Computational Methods in Electrical and Computer Engineering
EECS 12	Introduction to Programming
D. Complete one of the following:	
PHYSICS 60	Thermal Physics
CHEM 1C	General Chemistry
CHEM H2C	Honors General Chemistry
CHEM M3C	Majors Quantitative Analytical Chemistry
ENGRMAE 91	Introduction to Thermodynamics
E. Complete six units of lower-division laboratory using any combination of the following courses:	
PHYSICS 52A- 52B- 52C	Fundamentals of Experimental Physics and Fundamentals of Experimental Physics and Fundamentals of Experimental Physics
CHEM 1LC- 1LD	General Chemistry Laboratory and General Chemistry Laboratory
CHEM H2LA- H2LB	Honors General Chemistry Laboratory and Honors General Chemistry Laboratory
CHEM M2LA- M2LB	Majors General Chemistry Laboratory and Majors General Chemistry Laboratory
CHEM 51LB- 51LC	Organic Chemistry Laboratory and Organic Chemistry Laboratory
CHEM H52LA- H52LB	Honors Organic Chemistry Laboratory and Honors Organic Chemistry Laboratory
CHEM M52LA- M52LB	Majors Organic Chemistry Laboratory and Majors Organic Chemistry Laboratory
ENGR 7A- 7B	Introduction to Engineering I and Introduction to Engineering II
EECS 70LA- 70LB	Network Analysis I Laboratory and Network Analysis II Laboratory
F. Complete eight units of upper-division laboratory using any combination of the following courses:	
PHYSICS 106W	Advanced Data Acquisition, Analysis, and Scientific Writing
PHYSICS 120	Electronics for Scientists
PHYSICS 121W	Advanced Laboratory
PHYSICS 139	Observational Astrophysics
PHYSICS 193	Research Methods
PHYSICS 196C	Thesis in Physics III
or one approved upper-division laboratory course outside of Physics	
G. Complete two units of writing communication from the following courses:	
PHYSICS 194	Research Communication for Physics Majors ¹
PHY SCI 139W	Technical Writing and Communication Skills
EDUC 143BW	Classroom Interactions II
or alternate upper-division writing course with department approval	
H. Complete 32 additional units of coherently-related electives in accord with the following rules:	
- Up to eight units may be lower-division electives in physics such as PHYSICS 20, PHYSICS 61B, or PHYSICS H90	
- Any upper-division physics courses PHYSICS 100-150	

- Any graduate level physics courses PHYSICS 200-299 with approval of the Department Undergraduate Advisor
- Any combination of physics and non-physics courses pre-approved as a formal Concentration or Specialization
- Any other combination of physics and non-physics courses approved by the Physics Department Undergraduate Committee.

¹ PHYSICS 194 does not satisfy the University's upper-division writing requirement. It is a prerequisite course for PHYSICS 121W, which does satisfy the upper-division writing requirement.

NOTE: Students may not double major in Physics and Applied Physics.

Concentration in Biomedical Physics

The **Biomedical Physics Concentration** in Applied Physics is designed for the student who anticipates a career in physics applied to biology and medicine, such as health physics or radiological physics, or who intends to work in a scholarly field which deals with the physical aspects of biology or medicine, such as molecular biology or physiology. Completion of requirements for the Physics major is required, as are nine quarters of basic courses in biology and chemistry. Students who wish to follow the Biomedical Physics Concentration are advised to seek guidance early in their college careers. The requirements are such that coordination of a program in the second year is essential.

A. Complete the following:	
BIO SCI 97	Genetics
BIO SCI 98	Biochemistry
BIO SCI 99	Molecular Biology
B. Select one of the following:	
CHEM 1A- 1B- 1C	General Chemistry and General Chemistry and General Chemistry
or	
CHEM H2A- H2B- H2C	Honors General Chemistry and Honors General Chemistry and Honors General Chemistry
C. Select one of the following:	
CHEM 1LC- 1LD	General Chemistry Laboratory and General Chemistry Laboratory
or	
CHEM H2LA- H2LB	Honors General Chemistry Laboratory and Honors General Chemistry Laboratory
or	
CHEM M2LA- M2LB	Majors General Chemistry Laboratory and Majors General Chemistry Laboratory
D. Complete:	
CHEM 51A- 51B	Organic Chemistry and Organic Chemistry

Sample Program - Biomedical Physics Concentration in Applied Physics

Freshman		
Fall	Winter	Spring
CHEM 1A	CHEM 1B	CHEM 1C- 1LC
Sophomore		
Fall	Winter	Spring
CHEM 1LD	CHEM 51B	N/A
CHEM 51A		
Junior		
Fall	Winter	Spring
BIO SCI 97	BIO SCI 98	BIO SCI 99

Concentration in Engineering Physics

The **Engineering Physics Concentration** in Applied Physics is designed to provide appropriate education to students who anticipate a career in industrial or technological research. It combines the fundamental knowledge of physical processes obtained from physics courses with the technical knowledge obtained from engineering courses.

Students in the Engineering Physics Concentration must complete 32 units of coherently related electives, with at least 24 of these units from courses in the Henry Samueli School of Engineering. Students may propose any sequence for approval by the Department Undergraduate Advisor. Pre-approved courses include:

EECS 70A	Network Analysis I
EECS 70B- 70LB	Network Analysis II and Network Analysis II Laboratory
EECS 170A- 170LA	Electronics I and Electronics I Laboratory
EECS 170B- 170LB	Electronics II and Electronics II Laboratory
EECS 170C- 170LC	Electronics III and Electronics III Laboratory
EECS 174	Semiconductor Devices
EECS 188	Optical Electronics
ENGRMAE 120	Heat and Mass Transfer
ENGRMAE 130A	Fluid Dynamics I
ENGRMAE 147	Vibrations

Sample Program - Engineering Physics Concentration in Applied Physics

Junior			
Fall	Winter	Spring	
N/A	EECS 70A	EECS 70B- 70LB	
Senior			
Fall	Winter	Spring	
EECS 170A- 170LA	EECS 170B- 170LB EECS 188	PHYSICS 106W EECS 170C- 170LC	

The Honors Program in Physics encourages all students majoring in Physics or Applied Physics to consider advanced work in one of the research areas of the Department. To qualify for Honors in Physics, students should begin a research project with a supervising faculty member no later than fall of their senior year and then complete three quarters of Honors Thesis in Physics (PHYSICS H196A-PHYSICS H196B-PHYSICS H196C). Students have to complete the H196 sequence and submit a final written thesis before graduation. If this work is deemed of honors quality by the program advisor, and the student's grade point average is at least 3.4 overall and 3.5 in physics courses, the student will graduate with Departmental Honors in Physics.

Physics 3 is a one-year course suitable for premedical students, students majoring in Biological Sciences, and nonscience majors. It surveys most of the important branches of physics. Laboratory work accompanies the course. Nonscience majors with some mathematical skill may wish to consider Physics 3 as an alternative to PHYSICS 12 through PHYSICS 21.

A student who decides to major in Physics after completing Physics 3 should meet with the Department Undergraduate Advisor for placement information.

Physics 7 is an intensive three-quarter course for students in Physical Sciences and Engineering who are interested in a more quantitative approach to introductory physics. Two units of laboratory work accompany the course.

Physics courses numbered between 12 and 21 are general education courses intended for nonscience majors. The content and format of PHYSICS 21 may vary from year to year.

The introduction to mathematical methods (MATH 2E, MATH 3A, MATH 3D, and PHYSICS 50), microscopic physics (PHYSICS 61A-PHYSICS 61B), and experimental physics (PHYSICS 52A-PHYSICS 52B-PHYSICS 52C) are normally taken in the sophomore year.

Courses numbered 100 and above are for Physics majors and other qualified students. Courses numbered between 111 and 115 emphasize the mathematical and theoretical structures that have unified our understanding of nature. It should be noted that multi-quarter courses such as 111A-B must be taken and passed in sequential order. Any student who is so inclined may take more than the minimum one quarter of advanced laboratory work. Courses numbered between 133 and 149 introduce active subdisciplines in current research. Independent research (PHYSICS 195, PHYSICS 196) is strongly encouraged. In PHYSICS 194, students learn the basics of writing about science, proper use of references and background material, presentation of research proposals, and more.

Transfer students are specifically advised to seek individual consultation with the Department Undergraduate Advisor before deciding on a program of courses.

All Physics and Applied Physics majors must complete the core courses listed with the sample programs. By the end of the junior year, each student is encouraged to select a concentration or track.

Note that alternatives to Physics major requirements can be approved upon petition to the Department and the Office of the Associate Dean. Furthermore, exceptionally prepared students are allowed to enroll in graduate-level courses; to do so requires the approval of the Department Undergraduate Advisor.

Sample Program - Physics Graduate School Track

Junior		
Fall		
PHYSICS 115A or 116		
Senior		
Fall	Winter	Spring
PHYSICS 113B	PHYSICS 113C	PHYSICS 135
PHYSICS 115A or 116	Physics Elective	PHYSICS 125B
Physics Elective		Physics Elective

Students preparing for graduate school in atmospheric science or physical oceanography should complete the minor in Earth and Atmospheric Sciences.

- Applied Physics, B.S.
- Physics, B.S.
- Physics, Ph.D.