Applied Physics, BS

Learning Outcomes

Applied physics majors will be able to:

- demonstrate competency in applying the basic laws of physics in a focused area of physics and a related applied field;
- solve complex, real-world problems using the principles of physics; and
- demonstrate competency in using theoretical tools and basic instrumentation, and in analyzing the data obtained.

Requirements

The Bachelor of Science with a major in applied physics requires a minimum of 120 s.h., including at least 56–87 s.h. of work for the major. Total credit required for the major depends on a student's choice of concentration. Students must maintain a grade-point average of at least 2.00 in all courses for the major and in all UI courses for the major. They must also complete the College of Liberal Arts and Sciences GE CLAS Core.

The major in applied physics is intended primarily for students interested in a broad program of study in physics combined with a significant concentration of courses in a field that has immediate application to high-technology industries. The degree provides a foundation for a wide range of employment opportunities in high-technology industries, including research and development, product design and testing, sales, and quality control. It is also designed to include exposure to physics sufficient to allow students to continue with graduate studies in either physics or astronomy.

An essential component of each concentration is the successful completion of a related one-semester internship or practicum experience in a research laboratory (an applied physics research report is required for the latter option). Well-prepared students will be able to complete the degree in four years. Students should work closely with their advisors on a graduation plan.

All applied physics students complete a common set of courses that includes calculus, linear algebra, physics, and an experiential learning course. They also complete the courses required for their chosen concentration. The department encourages students to take additional coursework; advisors can suggest electives that will enrich programs and help students prepare for graduate work. Flexibility to customize an area of concentration or to develop a unique concentration is available in consultation with the applied physics coordinator.

Students who want to earn a double major in applied physics and astronomy must choose their coursework carefully; see the section titled "Double Major in Applied Physics and Astronomy."

Students who earn a BS in applied physics may not earn a BA or BS in physics.

The BS with a major in applied physics requires the following courses. Many upper-level physics courses have prerequisites; students should consult their advisors when choosing courses numbered 3000 or above.

Requirements	Hours
Common Requirements	34-41
Concentration Area Courses	22-46

Common Requirements

Students in all concentrations must successfully complete the following courses or their equivalents.

Mathematics

Course #	Title	Hours
All of these:		
MATH:1850 & MATH:1860	Calculus I-II	8
MATH:2700	Introduction to Linear Algebra	4
MATH:2850	Calculus III	4
Or all of these:		
MATH:1550	Engineering Calculus I	4
MATH:1560	Engineering Calculus II	4
MATH:2550	Engineering Matrix Algebra	2
MATH:3550	Engineering Vector Calculus	3

Physics

Course #	Title	Hours
One of these sequences:		
PHYS:1611-PHYS:1612	Introductory Physics I-II	8
PHYS:1701 & PHYS:1702 & PHYS:2703	Physics I-II - Physics III (strongly preferred)	12
All of these:		
PHYS:2704	Physics IV	4
PHYS:3710	Intermediate Mechanics	3
PHYS:3741	Introduction to Quantum Mechanics I	3
PHYS:3811	Electricity and Magnetism I	3

Experiential Learning

Course #	Title	Hours
One of these:		
A one-semester industrial internship (requires a research report)		
A one-semester practicum in a research laboratory (requires a research report)		

Concentrations

Students select one of four concentration areas, or, with approval from the applied physics advisor, a custom concentration is permitted, such as acoustics and propulsion science.

Computer Science Concentration

Course #	Title	Hours
All of these:		
PHYS:3730	Statistical Physics	3
PHYS:3756	Intermediate Laboratory	3
PHYS:3812	Electricity and Magnetism II	3
PHYS:3850	Electronics	4

CS:1210	Computer Science I: Fundamentals	4
CS:2210	Discrete Structures	3
CS:2230	Computer Science II: Data Structures	4
One additional computer science course numbered 3000 or above		3
Two of these:		
CS:2630	Computer Organization	4
CS:2820	Introduction to Software Development	4
CS:3330	Algorithms	3

Optics Concentration

Course #	Title	Hours
All of these:		
PHYS:3730	Statistical Physics	3
PHYS:3756	Intermediate Laboratory	3
PHYS:3812	Electricity and Magnetism II	3
PHYS:3850	Electronics	4
PHYS:4720	Introductory Optics	3
Two of these:		
PHYS:4726	Electro Optics	3
PHYS:4728	Introductory Solid State Physics	3
PHYS:4820	Optical Signal Processing	3

Solid-State Electronics Concentration

Course #	Title	Hours
All of these:		
PHYS:3730	Statistical Physics	3
PHYS:4728	Introductory Solid State Physics	3
ECE:2400	Linear Systems I	3
ECE:2410	Principles of Electronic Instrumentation	4
ECE:3320	Introduction to Digital Design	3
ECE:3410	Electronic Circuits	4
ENGR:1300	Introduction to Engineering Computing	3
ENGR:2120	Electrical Circuits	3
ENGR:2730	Computers in Engineering	3
One of these:		
PHYS:3742	Introduction to Quantum Mechanics II	3
PHYS:3812	Electricity and Magnetism II	3

Medical Physics Concentration

Course #	Title	Hours
All of these:		
PHYS:3756	Intermediate Laboratory	3
PHYS:3850	Electronics	4
BIOL:1411-BIOL:1412	Foundations of Biology - Diversity of Form and Function	8
CHEM:1110 & CHEM:1120	Principles of Chemistry I-II	8
CHEM:2210 & CHEM:2220	Organic Chemistry I-II	6
CHEM:2410	Organic Chemistry Laboratory	3
Two additional biology courses numbered 2000 or above		6-8
One of these:		
BIOS:4120	Introduction to Biostatistics	3
STAT:3510	Biostatistics	3
One of these:		
PHYS:3730	Statistical Physics	3
PHYS:3742	Introduction to Quantum Mechanics II	3
PHYS:3812	Electricity and Magnetism II	3
PHYS:4750	Advanced Laboratory	3
PHYS:4905	Special Topics in Physics (when topic is physics of the body)	3

Undergraduate majors who plan to pursue graduate study are advised to go as far as they can beyond the minimum requirements, including further work in mathematics. In planning this work, they should be guided by the College of Liberal Arts and Sciences maximum hours rule: students earning a BS may apply a maximum of 56 s.h. earned in one department to the minimum 120 s.h. required for graduation, whether or not the coursework is accepted toward the requirements for the major. Students who earn more than 56 s.h. from one department may use the additional semester hours to satisfy requirements for the major (if the department accepts them), and the grades they earn become part of their grade-point average, but they cannot apply the additional semester hours to the minimum 120 s.h. required for graduation.

Double Major in Applied Physics and Astronomy

Students working toward a Bachelor of Science with a double major in applied physics and in astronomy must complete all requirements for both majors and must earn a minimum of 56 s.h. outside the Department of Physics and Astronomy in order to graduate. Students interested in earning a double major should consult with their advisors. See Requirements for a Bachelor's Degree on the College of Liberal Arts and Sciences website.

Honors

Honors in the Major

Students majoring in applied physics have the opportunity to graduate with honors in their major. Departmental honors students must maintain a University of Iowa grade-point average (GPA) of at least 3.33. To graduate with honors in the major, students must conduct an investigation under the guidance of a faculty member during their junior and senior years. They must present a written report of their research (honors thesis) and describe their research results at a departmental seminar.

University of Honors Program

In addition to honors in the major, students have opportunities for honors study and activities through membership in the

University of Iowa Honors Program. Visit Honors at Iowa to learn about the university's honors program.

Membership in the UI Honors Program is not required to earn honors in the applied physics major.

Career Advancement

Applied physics graduates have mastered skills that are readily transferable to a number of fields. They might choose to work in research, engineering, software development, teaching, finance, biomedical research, or consulting.

About 70% of physics and astronomy graduates go on to graduate school. With help from the department's in-house recruiting office, they win acceptance to some of the best graduate programs in the country.

The Pomerantz Career Center offers multiple resources to help students find internships and jobs.

Academic Plans

Four-Year Graduation Plan

The following checkpoints list the minimum requirements students must complete by certain semesters in order to stay on the university's Four-Year Graduation Plan. Courses in the major are those required to complete the major; they may be offered by departments other than the major department.

Before the third semester begins: MATH:1860 Calculus II and PHYS:1702 Physics II.

Before the fifth semester begins: PHYS:2703 Physics III, PHYS:2704 Physics IV, MATH:2700 Introduction to Linear Algebra, MATH:2850 Calculus III, one more course in the major, and up to four courses in another science or engineering department.

Before the seventh semester begins: two to four more courses in the major, up to three other science or engineering courses, and at least 90 s.h. earned toward the degree.

Before the eighth semester begins: two or three more courses in the major or other science or engineering courses and all or part of an academic year research experience or a summer research experience or internship as approved by the applied physics coordinator.

During the eighth semester: enrollment in all remaining coursework in the major, all remaining CLAS Core courses, and a sufficient number of semester hours to graduate.

Sample Plan of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

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Course	Title	Hours
Academic Career		
Any Semester		
GE CLAS Core: Sustainability [a]		
	Hours	**0**
First Year		
Fall		
PHYS:1701	Physics I	4
CHEM:1110	Principles of Chemistry I [b]	4
MATH:1850	Calculus I [c]	4
RHET:1030 or ENGL:1200	Rhetoric: Writing and Communication or The Interpretation of Literature	3 - 4
CSI:1600	Success at Iowa	1
	Hours	**16-17**
Spring		
PHYS:1702	Physics II	4
CHEM:1120	Principles of Chemistry II	4
MATH:1860	Calculus II	4
RHET:1030 or ENGL:1200	Rhetoric: Writing and Communication or The Interpretation of Literature	3 - 4
	Hours	**15-16**
Second Year		
Fall		
PHYS:2703	Physics III	4
BIOL:1411	Foundations of Biology	4
MATH:2700	Introduction to Linear Algebra	4
GE CLAS Core: World Languages First Level Proficiency or elective course [d]		4 - 5
	Hours	**16-17**
Spring		
PHYS:2704	Physics IV	3 - 4
BIOL:1412	Diversity of Form and Function	4
MATH:2850	Calculus III	4
GE CLAS Core: World Languages Second Level Proficiency or elective course [d]		4 - 5
	Hours	**15-17**
Third Year		
Fall		
PHYS:3741	Introduction to Quantum Mechanics I	3
PHYS:3811	Electricity and Magnetism I	3
CHEM:2210	Organic Chemistry I	3
GE CLAS Core: Understanding Cultural Perspectives [e]		3
GE CLAS Core: World Languages Third Level Proficiency or elective course [d]		4 - 5
	Hours	**16-17**
Spring		
PHYS:3710	Intermediate Mechanics	3
PHYS:3850	Electronics	4
CHEM:2220	Organic Chemistry II	3
GE CLAS Core: Values and Society [e]		3
GE CLAS Core: World Languages Fourth Level Proficiency [d]		4 - 5
	Hours	**17-18**
Summer		
Internship: industrial internship or research practicum		3
	Hours	**3**
Fourth Year		
Fall		
PHYS:3756	Intermediate Laboratory	3

CHEM:2410	Organic Chemistry Laboratory	3
Major: biology course numbered 2000 or above [f]		3 - 4
GE CLAS Core: Historical Perspectives [e]		3
GE CLAS Core: Literary, Visual, and Performing Arts [e]		3
	Hours	**15-16**
Spring		
BIOS:4120 or STAT:3510	Introduction to Biostatistics or Biostatistics	3
Major: biology course numbered 2000 or above [f]		3 - 4
Major: medical concentration select one course [g]		3
GE CLAS Core: International and Global Issues [e]		3
GE CLAS Core: Social Sciences [e]		3
Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall) [h]		
	Hours	**15-16**
	Total Hours	**128-137**

a Sustainability must be completed by choosing a course that has been approved for Sustainability AND for one of these General Education areas: Natural Sciences; Quantitative and Formal Reasoning; Social Sciences; Historical Perspectives; International and Global Issues; Literary, Visual, and Performing Arts; or Values and Society.

b Enrollment in chemistry courses requires completion of a placement exam.

c Enrollment in math courses requires completion of a placement exam.

d Students who have completed four levels of a single language or two levels of two different languages in high school or college have satisfied the GE CLAS Core World Languages requirement. Students who have completed three levels of a single language may complete a fourth-level course in the same language or may choose an approved World Language and Cultural Exploration course. Enrollment in world languages courses requires a placement exam, unless enrolling in a first-semester-level course. Contact your academic advisor or CLAS Undergraduate Programs Office with questions concerning the World Languages requirement.

e GE CLAS Core courses may be completed in any order unless used as a prerequisite for another course. Students should consult with an advisor about the best sequencing of courses.

f Students in this concentration are required to complete two biology courses (BIOL) numbered 2000 or above (6-8 s.h.)

g Choose from PHYS:3730, PHYS:3742, PHYS:3812, PHYS:4750, or PHYS:4905.

h Please see Academic Calendar, Office of the Registrar website for current degree application deadlines. Students should apply for a degree for the session in which all requirements will be met. For any questions on appropriate timing, contact your academic advisor or Degree Services.