

PHYSICS, BS

for the degree of Bachelor of Science in Physics

The Illinois Physics program provides students with outstanding opportunities to explore modern scientific mysteries. As a physics major at Illinois, students will develop a deep conceptual and mathematical understanding of the world. Our flexible program is designed to prepare students for a wide range of fulfilling careers or post-graduate paths.

The Physics curriculum provides a rigorous foundation in physics, mathematics, and laboratory technique. The students' selected program track will allow the student to fine-tune their individual program of study to best suit interests and career goals. Whether students plan to enter the private sector, become a teacher, or continue their education through graduate study, students can explore how the Illinois Physics Bachelor of Science in Physics can meet their goals.

In consultation with the academic advisor, each student will elect a set of technical or professional courses covering a cohesive body of knowledge. Each program track will add a minimum of twenty (20) hours to the physics core curriculum.

Students may select from a list of pre-approved tracks or design a custom track subject to departmental approval. Physics courses used to satisfy the Flexible Physics Core Electives and Physics Lab Electives may not be used to satisfy the track requirements, with the exception of the Graduate Study Track.

The current pre-approved options, requiring 20-24 credit hours of course work, are:

- Astrophysics Track
- Business Track
- Computational Physics Track
- Nuclear Physics Track
- Graduate Study Track
- Pre-Med
- Pre-Law

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Graduation Requirements

Minimum hours required for graduation: 128 hours

Minimum Technical GPA (<https://go.grainger.illinois.edu/TechnicalGPA/>): 2.0 TGPA is required for Math and Physics courses. See **Technical GPA** (<https://go.grainger.illinois.edu/TechnicalGPA/>) to clarify requirements.
Minimum Overall GPA: 2.0

University Requirements

Minimum of 40 hours of upper-division coursework, generally at the 300- or 400-level. These hours can be drawn from all elements of the degree. Students should consult their academic advisor for additional guidance in fulfilling this requirement.

The university and residency requirements can be found in the Student Code (<https://studentcode.illinois.edu/article3/part8/3-801/>) (§ 3-801) and in the Academic Catalog (<http://catalog.illinois.edu/general-information/degree-general-education-requirements/>).

General Education Requirements

Follows the campus General Education (Gen Ed) requirements (<https://courses.illinois.edu/gened/DEFAULT/DEFAULT/>). Some Gen Ed requirements may be met by courses required and/or electives in the program.

Code	Title	Hours
	Composition I	4-6
	Advanced Composition	3
	Humanities & the Arts (6 hours)	6
	Natural Sciences & Technology (6 hours)	6
	fulfilled by PHYS 211, PHYS 212, CHEM 102	
	Social & Behavioral Sciences (6 hours)	6
	Cultural Studies: Non-Western Cultures (1 course)	3
	Cultural Studies: US Minority Cultures (1 course)	3
	Cultural Studies: Western/Comparative Cultures (1 course)	3
	Quantitative Reasoning (2 courses, at least one course must be Quantitative Reasoning I)	6-10
	fulfilled by MATH 221 or MATH 220; MATH 231, MATH 241, MATH 285, PHYS 211, PHYS 212, CS 101 or CS 124	
	Language Requirement (Completion of the third semester or equivalent of a language other than English is required)	0-15

Major Requirements

Orientation and Professional Development

Code	Title	Hours
ENG 100	Grainger Engineering Orientation Seminar (External transfer students take ENG 300.)	1
PHYS 110	Physics Careers	0
Total Hours		1

Foundational Mathematics and Science

Code	Title	Hours
MATH 221	Calculus I (MATH 220 may be substituted. MATH 220 is appropriate for students with no background in calculus. 4 of 5 credit hours count towards degree.)	4
MATH 231	Calculus II	3
MATH 241	Calculus III	4
MATH 257	Linear Algebra with Computational Applications (MATH 415 or MATH 416 may be substituted)	3
MATH 285	Intro Differential Equations (Both MATH 441 and MATH 442 together may be substituted.)	3
PHYS 211	University Physics: Mechanics	4
PHYS 212	University Physics: Elec & Mag	4
PHYS 213	Univ Physics: Thermal Physics	2
PHYS 214	Univ Physics: Quantum Physics	2
CHEM 102	General Chemistry I	3

CHEM 103	General Chemistry Lab I	1
CS 101	Intro Computing: Engrg & Sci	3
or CS 124	Introduction to Computer Science I	
Total Hours		36

Foundational Physics

Code	Title	Hours
PHYS 225	Relativity & Math Applications	2
PHYS 325	Classical Mechanics I	3
PHYS 427	Thermal & Statistical Physics	4
PHYS 435	Electromagnetic Fields I	3
PHYS 486	Quantum Physics I (PHYS 485 may be substituted.)	4
Total Hours		16

Program Tracks

Code	Title	Hours
Students are required to complete one track. Tracks may be selected from one of the departmentally approved lists below. Students may devise an alternative, custom track with a set of courses approved by the department.		16-24

Astrophysics Track **21**

ASTR 210	Introduction to Astrophysics	3
Choose 3 courses from the following:		
ASTR 350	The Big Bang, Black Holes, and the End of the Universe	3
or ASTR 406	Galaxies and the Universe	
ASTR 404	Stellar Astrophysics	3
ASTR 405	Planetary Systems	3
ASTR 414	Astronomical Techniques	4
Choose a minimum of 6 hours of courses from the following Physics Electives List:		
PHYS 246	An Introduction to Modern Computational Physics	2
PHYS 326	Classical Mechanics II	3
PHYS 370	Introduction to Quantum Information and Computing	3
PHYS 436	Electromagnetic Fields II	3
PHYS 460	Condensed Matter Physics	4
PHYS 470	Subatomic Physics	4
PHYS 487	Quantum Physics II	4
Choose one lab from Physics Lab List:		
PHYS 371	Project Design and Execution in a Physics Context	3
PHYS 401	Classical Physics Lab	3
PHYS 402	Light	4
PHYS 403	Modern Experimental Physics	5
PHYS 404	Electronic Circuits	5
PHYS 407	Experimental Biological Physics	4
PHYS 446	Modern Computational Physics	3

Business Track **21**

TE 100	Introduction to Innovation, Leadership and Engineering Entrepreneurship	1
Choose 11 hours from the following:		

ES 471	Seminar in Energy & Sustainability Engineering	1
IE 420	Financial Engineering	3
SE 400	Engineering Law	3
TE 360	Lectures in Engineering Entrepreneurship	1
TE 333	Creativity, Innovation, Vision	4
TE 461	Technology Entrepreneurship	3
TE 450	Startups: Incorporation, Funding, Contracts, & Intellectual Property	3
TE 466	High-Tech Venture Marketing	2
Choose a minimum of 6 hours of courses from the following Physics Electives List:		
PHYS 246	An Introduction to Modern Computational Physics	2
PHYS 326	Classical Mechanics II	3
PHYS 370	Introduction to Quantum Information and Computing	3
PHYS 436	Electromagnetic Fields II	3
PHYS 460	Condensed Matter Physics	4
PHYS 470	Subatomic Physics	4
PHYS 487	Quantum Physics II	4
Choose one lab from Physics Lab List:		
PHYS 371	Project Design and Execution in a Physics Context	3
PHYS 401	Classical Physics Lab	3
PHYS 402	Light	4
PHYS 403	Modern Experimental Physics	5
PHYS 404	Electronic Circuits	5
PHYS 407	Experimental Biological Physics	4
PHYS 446	Modern Computational Physics	3
Computational Physics Track 24		
CS 173	Discrete Structures	3
or MATH 213	Basic Discrete Mathematics	
CS 225	Data Structures	4
Choose 3 classes from the following:		
CS 357	Numerical Methods I	3
CS 418	Interactive Computer Graphics	3
CS 450	Numerical Analysis	3
ECE 408	Applied Parallel Programming	4
PHYS 246	An Introduction to Modern Computational Physics	2
PHYS 446	Modern Computational Physics	3
Choose a minimum of 6 hours of courses from the following Physics Electives List:		
PHYS 326	Classical Mechanics II	3
PHYS 370	Introduction to Quantum Information and Computing	3
PHYS 436	Electromagnetic Fields II	3
PHYS 460	Condensed Matter Physics	4
PHYS 470	Subatomic Physics	4
PHYS 487	Quantum Physics II	4
Choose one lab from Physics Lab List:		
PHYS 371	Project Design and Execution in a Physics Context	3

PHYS 401	Classical Physics Lab	3
PHYS 402	Light	4
PHYS 403	Modern Experimental Physics	5
PHYS 404	Electronic Circuits	5
PHYS 407	Experimental Biological Physics	4
Nuclear Physics Track		22
NPRE 402	Nuclear Power Engineering	3
PHYS 470	Subatomic Physics	4
Choose 2 classes from the following:		
NPRE 321	Introduction to Plasmas and Applications	3
NPRE 421	Plasma and Fusion Science	3
NPRE 429	Plasma Engineering	3
NPRE 435	Radiological Imaging	3
NPRE 441	Radiation Protection	4
NPRE 445	Interaction of Radiation with Matter	4
NPRE 451	NPRE Laboratory	3
NPRE 455	Neutron Diffusion & Transport	4
Choose a minimum of 6 hours of courses from the following Physics Electives List:		
PHYS 246	An Introduction to Modern Computational Physics	2
PHYS 326	Classical Mechanics II	3
PHYS 370	Introduction to Quantum Information and Computing	3
PHYS 436	Electromagnetic Fields II	3
PHYS 460	Condensed Matter Physics	4
PHYS 487	Quantum Physics II	4
Choose one lab from Physics Lab List:		
PHYS 371	Project Design and Execution in a Physics Context	3
PHYS 401	Classical Physics Lab	3
PHYS 402	Light	4
PHYS 403	Modern Experimental Physics	5
PHYS 404	Electronic Circuits	5
PHYS 407	Experimental Biological Physics	4
PHYS 446	Modern Computational Physics	3
Graduate Study Track		16
Take the following three courses from the Physics Electives List:		
PHYS 326	Classical Mechanics II	3
PHYS 436	Electromagnetic Fields II	3
PHYS 487	Quantum Physics II	4
Choose two labs from Physics Lab List:		
PHYS 371	Project Design and Execution in a Physics Context	3
PHYS 401	Classical Physics Lab	3
PHYS 402	Light	4
PHYS 403	Modern Experimental Physics	5
PHYS 404	Electronic Circuits	5
PHYS 407	Experimental Biological Physics	4
PHYS 446	Modern Computational Physics	3

Free Electives

Code	Title	Hours
Additional course work, subject to the Grainger College of Engineering restrictions to Free Electives, so that there are at least 128 credit hours earned toward the degree. (https://go.grainger.illinois.edu/FreeElectives/)		32-39
The number of free elective hours varies depending upon the total hours earned in Flexible Physics Electives, Physics Lab Electives, and Program Track.		
Total Hours of Curriculum to Graduate		128

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Sample Sequence

This sample sequence is intended to be used only as a guide for degree completion. All students should work individually with their academic advisors to decide the actual course selection and sequence that works best for them based on their academic preparation and goals. Enrichment programming such as study abroad, minors, internships, and so on may impact the structure of this four-year plan. Course availability is not guaranteed during the semester indicated in the sample sequence. The curriculum sequence can also be viewed via dynamic and static curricular maps (<https://grainger.illinois.edu/academics/undergraduate/majors-and-minors/physics-map/>), which include prerequisite sequencing.

Students must fulfill their Language Other Than English requirement by successfully completing a third level of a language other than English. See the corresponding section on the Degree and General Education Requirements (<http://catalog.illinois.edu/general-information/degree-general-education-requirements/>).

Free Electives: Additional course work, subject to the Grainger College of Engineering restrictions to Free Electives (<https://go.grainger.illinois.edu/FreeElectives/>), so that there are at least 128 credit hours earned toward the degree. The number of free elective hours varies depending upon the total hours earned in Flexible Physics Electives, Physics Lab Electives, and Program Track.

First Year	Hours
First Semester	
PHYS 110	0
MATH 221 (MATH 220 may be substituted)	4
ENG 100	1
CHEM 102	3
CHEM 103	1
Composition I or General Education course (Choose a Humanities or Social/Behavioral Science course)	4
General Education course (Choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
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Total Hours 16	

First Year	
Second Semester	Hours
PHYS 211	4
MATH 231	3
CS 101 or 124	3
Composition I or General Education course (Choose a Humanities or Social/Behavioral Science course)	3
General Education course (Choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
	16

Total Hours 16**Second Year**

First Semester	Hours
PHYS 212	4
MATH 241	4
PHYS 225	2
Track Elective course	2
General Education course (Choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
	15

Total Hours 15**Second Year**

Second Semester	Hours
PHYS 213	2
MATH 285 (May be replaced by both MATH 441 and MATH 442)	3
PHYS 214	2
PHYS 325	3
Track Elective course	3
Free Elective course	4
	17

Total Hours 17**Third Year**

First Semester	Hours
PHYS 435	3
MATH 257	3
Track Elective course	3
Track Elective course	4
General Education course (Choose an Advanced Composition)	3
	16

Total Hours 16**Third Year**

Second Semester	Hours
PHYS 486 (PHYS 485 may be substituted)	4

Free Elective course	3
Free Elective course	3
Track Elective course	3
Free Elective course	4
	17

Total Hours 17**Fourth Year**

First Semester	Hours
Track Elective course	4
Language Other Than English (3rd level)	4
Free Elective course	4
Free Elective course	4
	16

Total Hours 16**Fourth Year**

Second Semester	Hours
Track Elective course	3
Free Elective course	4
Free Elective course	4
Free Elective course	4
	15

Total Hours 15**Total Hours: 128**

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By the completion of their degree program, Physics graduates will be able to:

- Define and use fundamental principles of physics as defined and used by scientists and engineers.
 - Identify which fundamental principles should be applied to a specified situation.
 - Identify the tools used by scientists and engineers to use fundamental physical principles to solve problems.
 - Apply physics problem solving tools to known and novel problems.
- Analyze quantitative and qualitative data.
 - Design and execute physics experiments to answer open-ended questions.
 - Develop mathematical models to extract physics results from numerical data.
 - Communicate verbally and in writing experimental and theoretical results.
- Participate in cooperative groups to design, practice, and communicate physics and physics-related information to themselves and the community.
 - Develop physics and mathematics related problem-solving skills through participation in cooperative-learning groups.

- b. Design and execute physics experiments/research projects in a collaborative setting.
- c. Document, report, and present experimental results.

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Physics website (<https://physics.illinois.edu>)

Physics faculty (<https://physics.illinois.edu/people/directory/>)

The Grainger College of Engineering Admissions (<https://grainger.illinois.edu/admissions/>)

The Grainger College of Engineering (<https://grainger.illinois.edu/>)