

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 twelve (12) 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 12-22 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 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

Minimum hours required for graduation: 128 hours

Minimum hours for graduation is 128, to include a minimum of 40 hours of upper-division coursework.

General education: Students must complete the Campus General Education requirements including the campus general education language requirement.

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	3
MATH 285	Intro Differential Equations (May be replaced by both MATH 441 and MATH 442.)	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 or CS 124	Intro Computing: Engrg & Sci Introduction to Computer Science I	3
Total Hours		36

Physics Technical Core

Code	Title	Hours
PHYS 225	Relativity & Math Applications	2
PHYS 325	Classical Mechanics I	3
PHYS 435	Electromagnetic Fields I	3
PHYS 486	Quantum Physics I (PHYS 485 may be substituted.)	4
Total Hours		12

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.		20-32
Astrophysics Track		25-27
ASTR 210	Introduction to Astrophysics	3
ASTR 350 or ASTR 406	The Big Bang, Black Holes, and the End of the Universe Galaxies and the Universe	3
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 Flexible Physics Core Electives List:		6
PHYS 246	Physics on the Silicon Prairie: An Introduction to Modern Computational Physics	2

PHYS 326	Classical Mechanics II	3	CS 357	Numerical Methods I	3
PHYS 370	Introduction to Quantum Information and Computing	3	CS 420	Parallel Progrmg: Sci & Engrg	3
PHYS 427	Thermal & Statistical Physics	4	CS 418	Interactive Computer Graphics	3
PHYS 436	Electromagnetic Fields II	3	CS 450	Numerical Analysis	3
PHYS 446	Modern Computational Physics	3	PHYS 246	Physics on the Silicon Prairie: An Introduction to Modern Computational Physics	2
PHYS 460	Condensed Matter Physics	4	PHYS 446	Modern Computational Physics	3
PHYS 470	Subatomic Physics	4	Choose a minimum of 6 hours of courses from the Flexible Physics Core Electives List:		
PHYS 487	Quantum Physics II	4	PHYS 326	Classical Mechanics II	3
Choose 1 course from the Physics Lab Electives List:			PHYS 370	Introduction to Quantum Information and Computing	3
PHYS 371	Project Design and Execution in a Physics Context	3	PHYS 427	Thermal & Statistical Physics	4
PHYS 401	Classical Physics Lab	3	PHYS 436	Electromagnetic Fields II	3
PHYS 402	Light	4	PHYS 460	Condensed Matter Physics	4
PHYS 403	Modern Experimental Physics	5	PHYS 470	Subatomic Physics	4
PHYS 404	Electronic Circuits	5	PHYS 487	Quantum Physics II	4
Business Track		30-32	Choose 1 course from the Physics Lab Electives List:		
ENG 471	Seminar Energy & Sustain Engrg	1	PHYS 371	Project Design and Execution in a Physics Context	3
IE 420	Financial Engineering	3	PHYS 401	Classical Physics Lab	3
SE 400	Engineering Law	3	PHYS 402	Light	4
TE 100	Introduction to Innovation, Leadership and Engineering Entrepreneurship	1	PHYS 403	Modern Experimental Physics	5
TE 360	Lectures in Engineering Entrepreneurship	1	PHYS 404	Electronic Circuits	5
TE 333	Creativity, Innovation, Vision	4	Nuclear Physics Track		22-26
TE 461	Technology Entrepreneurship	3	NPRE 402	Nuclear Power Engineering	3
TE 450	Startups: Incorporation, Funding, Contracts, & Intellectual Property	3	PHYS 470	Subatomic Physics	4
TE 466	High-Tech Venture Marketing	2	Choose 2 classes from the following:		
Choose a minimum of 6 hours of courses from the Flexible Physics Core Electives List:			NPRE 321	Introduction to Plasmas and Applications	3
PHYS 246	Physics on the Silicon Prairie: An Introduction to Modern Computational Physics	2	NPRE 421	Plasma and Fusion Science	3
PHYS 326	Classical Mechanics II	3	NPRE 429	Plasma Engineering	3
PHYS 370	Introduction to Quantum Information and Computing	3	NPRE 435	Radiological Imaging	3
PHYS 427	Thermal & Statistical Physics	4	NPRE 441	Radiation Protection	4
PHYS 436	Electromagnetic Fields II	3	NPRE 445	Interaction of Radiation with Matter	4
PHYS 446	Modern Computational Physics	3	NPRE 451	NPRE Laboratory	3
PHYS 460	Condensed Matter Physics	4	NPRE 455	Neutron Diffusion & Transport	4
PHYS 470	Subatomic Physics	4	Choose a minimum of 6 hours of courses from the Flexible Physics Core Electives List:		
PHYS 487	Quantum Physics II	4	PHYS 246	Physics on the Silicon Prairie: An Introduction to Modern Computational Physics	2
Choose 1 course from the Physics Lab Electives List:			PHYS 326	Classical Mechanics II	3
PHYS 371	Project Design and Execution in a Physics Context	3	PHYS 370	Introduction to Quantum Information and Computing	3
PHYS 401	Classical Physics Lab	3	PHYS 427	Thermal & Statistical Physics	4
PHYS 402	Light	4	PHYS 436	Electromagnetic Fields II	3
PHYS 403	Modern Experimental Physics	5	PHYS 446	Modern Computational Physics	3
PHYS 404	Electronic Circuits	5	PHYS 460	Condensed Matter Physics	4
Computational Physics Track		24-27	PHYS 487	Quantum Physics II	4
CS 173	Discrete Structures	3	Choose 1 course from the Physics Lab Electives List:		
or MATH 213	Basic Discrete Mathematics		PHYS 371	Project Design and Execution in a Physics Context	3
CS 225	Data Structures	4	PHYS 401	Classical Physics Lab	3
Choose 3 classes from the following:					

PHYS 402	Light	4
PHYS 403	Modern Experimental Physics	5
PHYS 404	Electronic Circuits	5
Graduate Study Track		20-24
Take the following four courses from the Flexible Physics Core Electives List:		14
PHYS 326	Classical Mechanics II	3
PHYS 427	Thermal & Statistical Physics	4
PHYS 436	Electromagnetic Fields II	3
PHYS 487	Quantum Physics II	4
Choose two labs from Physics Lab Electives List:		6-10
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

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/)		31-43
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			
First Semester	Hours	Second Semester	Hours
PHYS 110		0 PHYS 211	4
MATH 221 (MATH 220 may be substituted)		4 MATH 231	3
ENG 100		1 CS 101 (or CS 124)	3
CHEM 102		3 General Education (Choose a Humanities or Social/Behavioral Science course) or Composition I course	3-4
Composition I or General Education (Choose a Humanities or Social/Behavioral Science course)		4-3 General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)	3
CHEM 103		1	
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)		3	
		16	16
Second Year			
First Semester	Hours	Second Semester	Hours
PHYS 212		4 PHYS 213	2
MATH 241		4 MATH 285 (May be replaced by both MATH 441 and MATH 442.)	3
PHYS 225		2 PHYS 214	2
Track elective course		2 PHYS 325	3
General Education course (choose a Humanities or Social/Behavioral Science course with Cultural Studies designation)		3 Track elective course	3
		Free elective course	3
		15	16

Third Year

First Semester	Hours	Second Semester	Hours
PHYS 435		3 PHYS 486 (PHYS 485 may be substituted.)	4
MATH 257		3 Track elective course	3
Track elective course		4 Track elective course	3
Track elective course		4 Track elective course	2
General Education (Advanced Composition) course		3 Free elective course	4
		17	16

Fourth Year

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

Total Hours 128

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- 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/>)

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

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