COMPUTER SCIENCE + PHYSICS, BS

for the degree of Bachelor of Science in Computer Science plus Physics

Physics focuses on quantitative descriptions for the behavior of physical systems. Computer science has a natural place in the study of physics. Computer science enables much more advanced computation than that available using pen and paper. These computational advances dramatically increase the complexity of physical systems that can be described quantitatively.

The Illinois CS+Physics program blends our physics and computer science degrees to give students the skills to both understand and carry out quantitative models of physical systems. This collaboration between Computer Science and Physics provides an innovative program for students who are interested in the intersection between computing and physics.

Students in the CS + Physics program will develop mastery in areas ranging from numerical methods and machine learning to algorithms for computational science and quantum computing. The program combines the domain expertise in Physics, including its computational aspects, with the broad-based expertise in computing from Computer Science. This unique approach allows students to bridge these two areas.

Students enrolled in CS+Physics have ample opportunity to explore both their interests in Physics and Computer Science through the selection of technical electives. In consultation with the academic advisor, each student will elect a set of technical courses broadening their knowledge of both Physics and Computer Science. Technical electives add a minimum of seventeen (17) hours to the core Physics and Computer Science combined curriculum.

The top-10 rated Physics and Computer Science programs provide students the unique opportunity to receive instruction from the top scientists in both subjects.

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Graduation Requirements

Minimum hours required for graduation: 128 hours

Minimum Technical GPA (http://catalog.illinois.edu/undergraduate/engineering/computer-science-physics-bs/go.grainger.illinois.edu/TechnicalGPA/): 2.0.
TGPA is required for CS, 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		
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 124, CS 128, CS 225		
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
Highly recommended, optional 1 credit hour course, CS 100 Computer Science Orientation. Credit hour counts toward free electives.		
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	3-4
or MATH 416	Abstract Linear Algebra	
MATH 285	Intro Differential Equations	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
CS 361	Probability & Statistics for Computer Science	3-4
or STAT 400	Statistics and Probability I	
Total Hours		**32-34**

Computer Science Core

Code	Title	Hours
CS 124	Introduction to Computer Science I	3
CS 128	Introduction to Computer Science II	3
CS 173	Discrete Structures	3
CS 222	Software Design Lab	1
CS 225	Data Structures	4
Choose one of the following options:		8-9
CS 233 & CS 341	Computer Architecture and System Programming	
OR		
CS 340	Introduction to Computer Systems	
& Two CS 400-level courses	Any two (2) 400-level CS courses above CS 403, excluding CS 491 and distinct from any 400-level courses taken to satisfy other requirements. If either or both of the courses are chosen for 4 credits, the extra credit hours will count towards free electives.	
CS 374	Introduction to Algorithms & Models of Computation	4
CS 357	Numerical Methods I	3
or CS 450	Numerical Analysis	
CS Technical Elective	Any 400-level CS course above CS 403, excluding CS 491, and distinct from any 400-level courses taken to satisfy other requirements.	3
Total Hours		**32-33**

Physics Core

Code	Title	Hours
PHYS 225	Relativity & Math Applications	2
PHYS 246	An Introduction to Modern Computational Physics	2
PHYS 325	Classical Mechanics I	3
PHYS 435	Electromagnetic Fields I	3
PHYS 486	Quantum Physics I	3-4
or PHYS 485	Atomic Phys & Quantum Theory	
PHYS 446	Modern Computational Physics	3
PHYS technical elective: Choose from CS or PHYS 300- or 400-level courses		14
Total Hours		**30-31**

Free Electives

Code	Title	Hours
Additional coursework, 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/)		13 - 17
Total Minimum 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.

Students must fulfill their Language Other Than English requirement by successfully completing a third level of a language other than English. For more information see the corresponding section on the Degree and General Education Requirements page *(*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, so that there are at least 128 credit hours earned toward the degree.

First Year

First Semester	Hours
MATH 221 (MATH 220 may be substituted)	4
PHYS 110	0
ENG 100 (External transfer students take ENG 300)	1
CS 124	3
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 a Cultural Studies designation)	3
	15

Total Hours 15

First Year

Second Semester	Hours
MATH 231	3
PHYS 211	4
CS 128	3
CS 173	3

General Education course (Choose a Humanities or Social/Behavioral Science course) or Composition I	3
	16

Total Hours 16

Second Year

First Semester	**Hours**
MATH 241	4
PHYS 212	4
PHYS 225	2
CS 225	4
General Education course (Choose a Humanities or Social/Behavioral Science course with a Cultural Studies designation)	3
	17

Total Hours 17

Second Year

Second Semester	**Hours**
MATH 285	3
PHYS 213	2
PHYS 214	2
PHYS 246	2
CS 233 or 340	4
CS 222	1
General Education course (Choose a Humanities or Social/Behavioral Science course with a Cultural Studies designation)	3
	17

Total Hours 17

Third Year

First Semester	**Hours**
MATH 257 (MATH 416 may be substituted)	3
PHYS 325	3
CS 361 (STAT 400 may be substituted)	3
PHYS Technical Elective course	3
General Education course (Advanced Composition)	3
	15

Total Hours 15

Third Year

Second Semester	**Hours**
CS 357 or 450	3
PHYS 435	3
CS Technical Elective course	3
PHYS Technical Elective course	3
Language Other Than English (3rd level)	4
	16

Total Hours 16

Fourth Year

First Semester	**Hours**
PHYS 485 (PHYS 486 may be substituted)	3
CS 374	4
Free Elective course	3
Free Elective course	3
Free Elective course	2
	15

Total Hours 15

Fourth Year

Second Semester	**Hours**
PHYS 446	3
PHYS Technical Elective course	4
PHYS Technical Elective course	4
CS 341 (or CS Technical Elective course)	4
Free Elective course	2
	17

Total Hours 17

Total Hours: 128

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The Department of Physics Undergraduate Studies Office—together with guidance from the Physics Undergraduate Studies Committee—will work to collect, compile, evaluate, and report on the learning outcomes for its courses. This work will include, but not be limited to:

1. Informal Early Feedback:
   Students in each major-specific course will be invited to participate in a survey to help the department and instructors evaluate the students' understanding of the course learning objectives, outcomes, and course goals. Summary reports will be made available to instructors and the department leadership.
2. Evaluation of Direct Student Learning and Other Summative Learning Assessments:
   Final examinations (i.e., questions and student work) will be collected for evaluation of learning outcomes. This will include evaluation of the assessments' usefulness in evaluation of learning outcomes, as well as the mastery of the outcomes by students. Anonymized student work will be used for the evaluation. Summary reports will be made available to instructors and the Department leadership.

Additionally, CS will follow its standard student outcomes assessment process for the core CS courses, in the same manner as it uses for continuous assessment of the CS BS program.

1. Indirect Evaluation of Student Learning:
   Indirect measures of student learning will include current enrollment, including demographic information.
2. Degree completion rates, including information regarding:
   a. Semesters to completion
   b. Degree program requirements
   c. Semesters to complete specified intra-degree program requirements
   d. Choke-points in degree completion progression
   e. Course updates and revisions
   f. Desirable new courses
   g. Demographic trends

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Physics (https://physics.illinois.edu)

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

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

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