COMPUTER SCIENCE, BSE

Computer scientists and engineers have revolutionized society and created the computer and telecommunications industries that are so important to human life and the world's economy. As a result of this revolution, expertise in computer science is essential in many new areas, including computer and network service and consulting companies, financial institutions, health industries, natural science labs and medical research labs, and other contexts where intensive manipulation of information is important. As a result, opportunities for computer scientists and engineers have expanded greatly, both in specialized fields as well as in numerous dual-career opportunities in which computer expertise is combined with advanced degrees in business, communication, engineering, law, medicine, and science.

For more information: https://www.seas.upenn.edu/prospective-students/undergrad/majors/computer-science/

Computer Science (CSCI) Major Requirements

37 course units are required.

Code	Title	Course Units
Engineering		
CIS 1100	Introduction to Computer Programming	1
CIS 1200	Programming Languages and Techniques I	1
CIS 1210	Programming Languages and Techniques II	1
CIS 2400	Introduction to Computer Systems	1
CIS 2620	Automata, Computability, and Complexity	1
CIS 3200	Introduction to Algorithms	1
CIS 4480	Operating Systems Design and Implementation	1
or CIS 5480	Operating Systems Design and Implementation	
CIS 4710	Computer Organization and Design	1
or CIS 5710	Computer Organization and Design	
CIS Elective [*,1]		4
CIS 4000	Senior Project	1
or CIS 4100	CIS Senior Thesis	
CIS 4010	Senior Project	1
or CIS 4110	CIS Senior Thesis	
Math and Natural Science		
MATH 1400	Calculus, Part I	1
MATH 1410	Calculus, Part II	1
or MATH 1610	Honors Calculus	
CIS 1600	Mathematical Foundations of Computer Science	1
CIS 2610	Discrete Probability, Stochastic Processes, and Statistical Inference	1
or ESE 3010	Engineering Probability	
or STAT 4300	Probability	
MATH 2400	Calculus, Part III	1
or MATH 2600	Honors Calculus, Part II	
or MATH 3120	Linear Algebra	
or MATH 3130	Computational Linear Algebra	
or MATH 3140	Advanced Linear Algebra	
MEAM 1100 & MEAM 1470	Introduction to Mechanics and Introduction to Mechanics Lab	1.5
or PHYS 0150	Principles of Physics I: Mechanics and Wave Motion	
or PHYS 0170	Honors Physics I: Mechanics and Wave Motion	
PHYS 0151	Principles of Physics II: Electromagnetism and Radiation	1.5
or PHYS 0171	Honors Physics II: Electromagnetism and Radiation	
or ESE 1120	Engineering Electromagnetics	
Math/Natural Science Elective		1
Technical Electives [*,2]		
Restricted or Unrestricted Technical Electives		1
Unrestricted Technical Electives		5
General Electives [3]		
EAS 2030	Engineering Ethics	1
or CIS 4230	Ethical Algorithm Design	
or CIS 5230	Ethical Algorithm Design	
or LAWM 5060	ML: Technology Law	
Select 4 Social Science or Humanities courses		4
Select 2 Social Science, Humanities or Technology in Business & Society courses		2
Free Elective		
Select 1 course unit of free electives		1
Total Course Units		**37**

* CIS and Technical Electives must include a course from each of the following lists:

- Networking: NETS 1500, NETS 2120, CIS 4510, CIS 5510, CIS 4550, CIS 5550, CIS 5050, CIS 5530
- Databases: CIS 4500, CIS 5500, CIS 4550, CIS 5550, CIS 2450, CIS 5450
- Distributed Systems: NETS 2120, CIS 4410, CIS 5410, CIS 4500, CIS 5500, CIS 5050, CIS 2450, CIS 5450
- Machine Learning/AI: CIS 4190, CIS 5190, CIS 4210, CIS 5210, CIS 5200, CIS 2450, CIS 5450, CIS 6200
- Project: NETS 2120, CIS 3410, CIS 3500, CIS 4120, CIS 5120, CIS 4410, CIS 5410, CIS 4500, CIS 5500, CIS 4550, CIS 5550, CIS 4600, CIS 5600, CIS 5050, CIS 5530, ESE 3500

The same course can count towards multiple lists, e.g., NETS 2120 and CIS 5450 together satisfy all five lists.

1 A CIS Elective is a CIS or NETS engineering course at the 1000 level or above, or ESE 3500 Embedded Systems/Microcontroller Laboratory (NOTE: not all CIS/NETS courses are **engineering** courses; please see the SEAS Undergraduate Handbook (https://ugrad.seas.upenn.edu/student-handbook/courses-requirements/engineering-courses/). At most, one CU of 1000-level coursework may be used as a CIS Elective.

2 All Technical Electives must be from the list of approved courses (https://advising.cis.upenn.edu/tech-electives/).

3 Must include a Writing Seminar (a list of approved Writing Seminars can be found in the SEAS Undergraduate Handbook (https://ugrad.seas.upenn.edu/student-handbook/courses-requirements/writing-courses/))

Concentrations

Students may select one of seven concentrations:

- Artificial Intelligence (4 CU)
- Cognitive Science (5 CU)
- Computational Biology (6 CU)
- Computer Vision (4 CU)
- Data Science (4 CU)
- Software Foundations (4 CU)
- Systems (5 CU)

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2024 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.
