**COMPUTER SCIENCE, B.S. (ENGINEERING)**

**Begin Campus:** Any Penn State Campus  
**End Campus:** University Park

**Program Description**
Computer Science is the study of computation, including its principles and foundations, its efficient implementation, its analysis, and its practical use in a wide range of different application areas. Computer Science is far more than just programming and no other science or engineering discipline has had a greater impact in such diverse areas as commerce, communication, entertainment, finance, medicine, the social sciences, the physical sciences and the life sciences. Computer Science impacts our daily lives in a multitude of ways and computer scientists are instrumental in driving these changes. Computer Science transforms the way we look at and live in our world.

The mission of our undergraduate program is to prepare our students for a wide range of careers as computer scientists, software engineers, software developers, and related positions in the field of computing. Our curriculum covers fundamental programming techniques and skills, broad knowledge of computer hardware, operating systems, programming languages, the mathematical foundations of computing, and advanced topics in software design and application development. Recurrent themes in the program include security, algorithmic complexity, cooperating systems, performance evaluation, and software correctness. This curriculum provides students with the skills needed to design, develop, evaluate, and analyze software solutions to a wide spectrum of computational problems and prepares them to be leaders in the rapidly changing field of computing throughout their careers.

**What is Computer Science?**
Computer scientists design and build software: from small web applications to operating systems and from stand-alone applications for desktop use to integrated systems found in places like the International Space Station. The study of computer science offers an educational foundation in not only system programming, database management, and data visualization, but also the unique and evolving fields of computer game development and network security. You’ll learn to use algorithms, design efficiencies, and computer system applications to improve the productivity of businesses, industry, education, and government—wherever there is a computer, there is a need for computer scientists.

**You Might Like This Program If...**
You excel in mathematics and physics will do well in computer science. Our areas of specialization build on these skills.

**Entrance to Major**
This program currently has administrative enrollment controls. Administrative Enrollment Controls are initiated when limitations of space, faculty, or other resources in a major prevent accommodating all students who request them. Students must follow the administrative enrollment controls that are in effect for the semester that they enter the university.

**First-Year Students Entering Summer 2018, Fall 2018, Spring 2019**
In order to be eligible for entrance to this major, students must satisfy the following requirements:

- 40-59 cumulative credits (credits completed at Penn State for which a quality letter grade was earned)
- completed with a grade of C or better: CMPSC 122 or CMPSC 132, MATH 140, MATH 141, MATH 230, PHYS 211, and PHYS 212
- earned a minimum of 3.00 cumulative GPA

**Students Who Entered Prior to Summer 2018**
Students who entered the University prior to the summer 2018 semester should view the administrative enrollment controls for the semester that they entered the university (http://advising.psu.edu/entrance-major-requirements) on the Academic Advising Portal.

**Degree Requirements**
For the Bachelor of Science degree in Computer Science, a minimum of 127 credits is required:

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Education</td>
<td>45</td>
</tr>
<tr>
<td>Requirements for the Major</td>
<td>106-108</td>
</tr>
</tbody>
</table>

24 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 9 credits of GN courses; 6 credits of GQ courses; 9 credits of GWS courses.

**General Education**
Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (http://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

**Foundations (grade of C or better is required.)**
- Quantification (GQ): 6 credits
- Writing and Speaking (GWS): 9 credits

**Knowledge Domains**
- Arts (GA): 6 credits
- Health and Wellness (GHW): 3 credits
- Humanities (GH): 6 credits
- Social and Behavioral Sciences (GS): 6 credits
- Natural Sciences (GN): 9 credits

**Integrative Studies (may also complete a Knowledge Domain requirement)**
- Inter-Domain or Approved Linked Courses: 6 credits
**University Degree Requirements**

**First Year Engagement**
All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

**Cultures Requirement**
6 credits are required and may satisfy other requirements
- United States Cultures: 3 credits
- International Cultures: 3 credits

**Writing Across the Curriculum**
3 credits required from the college of graduation and likely prescribed as part of major requirements.

**Total Minimum Credits**
A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

**Quality of Work**
Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

**Limitations on Source and Time for Credit Acquisition**
The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80). For more information, check the Suggested Academic Plan for your intended program.

**Requirements for the Major**
To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-44).

### Code | Title | Credits
---|---|---
CMPSC 464 | Introduction to the Theory of Computation | 3
ENGL 202C | Effective Writing: Technical Writing | 3
MATH 220 | Matrices | 2-3
MATH 230 | Calculus and Vector Analysis | 4
PHYS 212 | General Physics: Electricity and Magnetism | 4

*Prescribed Courses: Require a grade of C or better*

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPEN 331</td>
<td>Computer Organization And Design</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPSC 221</td>
<td>Object Oriented Programming with Web-Based Applications</td>
<td>3</td>
</tr>
<tr>
<td>CMPSC 311</td>
<td>Introduction to Systems Programming</td>
<td>3</td>
</tr>
<tr>
<td>CMPSC 360</td>
<td>Discrete Mathematics for Computer Science</td>
<td>3</td>
</tr>
<tr>
<td>CMPSC 461</td>
<td>Programming Language Concepts</td>
<td>3</td>
</tr>
<tr>
<td>CMPSC 465</td>
<td>Data Structures and Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CMPSC 473</td>
<td>Operating Systems Design &amp; Construction</td>
<td>3</td>
</tr>
<tr>
<td>MATH 140</td>
<td>Calculus With Analytic Geometry I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 141</td>
<td>Calculus with Analytic Geometry II</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 211</td>
<td>General Physics: Mechanics</td>
<td>4</td>
</tr>
</tbody>
</table>

**Additional Courses:**
Select 1 credit of First-Year Seminar
- ENGL 15 Rhetoric and Composition
  - or ENGL 137H Rhetoric and Civic Life I
- ENGL 138T Rhetoric and Civic Life II
  - or CAS 100A Effective Speech
  - or CAS 100B Effective Speech

Select one of the following:
- STAT/MATH 318 Elementary Probability
- STAT/MATH 414 Introduction to Probability Theory
- STAT/MATH 418 Introduction to Probability and Stochastic Processes for Engineering

Select 6 credits of the following:
- CMPEN 362 Communication Networks
- CMPEN 431 Introduction to Computer Architecture
- CMPEN 454 Fundamentals of Computer Vision
- CMPEN 442 Artificial Intelligence
- CMPEN 443 Introduction to Computer and Network Security
- CMPSC 444 Secure Programming
- CMPSC 450 Concurrent Scientific Programming
- CMPSC 451 Numerical Computations
- CMPSC 455 Introduction to Numerical Analysis I
- CMPSC 456 Introduction to Numerical Analysis II
- CMPSC 458 Fundamentals of Computer Graphics
- CMPSC 467 Factorization and Primality Testing
- CMPSC 471 Introduction to Compiler Construction
- CMPSC 475 Applications Programming
- EE 456 Introduction to Neural Networks

Select 3 credits from any CMPEN or CMPSC course numbered 400-489
- CMPEN 431W Database Management Systems
  - or CMPEN 483 Software Design Methods
- STAT/MATH 319 Applied Statistics in Science
  - or STAT/MATH 415 Introduction to Mathematical Statistics

**Additional Courses: Require a grade of C or better:**
- CMPSC 121 Introduction to Programming Techniques
  - or CMPSC 131 Programming and Computation I: Fundamentals
- CMPSC 122 Intermediate Programming
  - or CMPSC 132 Programming and Computation II: Data Structures
- CMPEN 270 Digital Design: Theory and Practice
or CMPEN 271 Introduction to Digital Systems & CMPEN 275 and Digital Design Laboratory

Supporting Courses and Related Areas
Select 2-3 credits of the following: 2-3

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>PHYS 213 General Physics: Fluids and Thermal Physics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 214 General Physics: Wave Motion and Quantum Physics</td>
<td>3</td>
</tr>
</tbody>
</table>

3 credits from the approved list of natural sciences courses
Select 0-4 credits in a foreign language (second-semester proficiency) 0-4
Select 10-14 credits from department list. Students may apply up to 1-6 credits of ROTC as department list credits and 3 credits of ROTC as GHW credits.
Select 6 credits in non-CMPEN or CMPSC courses numbered 400-489 in consultation with adviser 6

Program Educational Objectives
In particular, within a few years after graduation, graduates in computer science should be able to:

1. Apply appropriate theory, practices, and tools to the specification, design, implementation, maintenance and evaluation of both large and small software systems.
2. Work in teams to design, implement, and/or maintain components of computer software systems.
3. Stay current through professional conferences, certificate programs, post-baccalaureate degree programs, or other professional educational activities.

Student Outcomes
Student outcomes describe what students are expected to know and be able to do by the time of graduation. The Computer Science program is designed to enable students to:

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet given set of computing requirements in the context of the program’s discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program’s discipline.
6. Apply computer science theory and software development fundamentals to produce computing-based solutions.

Academic Advising
The objectives of the university's academic advising program are to help advisees identify and achieve their academic goals, to promote their intellectual discovery, and to encourage students to take advantage of both in-and-out of class educational opportunities in order that they become self-directed learners and decision makers.

Suggested Academic Plan

Computer Science - Ending at University Park Campus
The course series listed below provides only one of the many possible ways to move through this curriculum. The University may make changes in policies, procedures, educational offerings, and requirements at any time. This plan should be used in conjunction with your degree audit (accessible in LionPATH as either an Academic Requirements or What If report). Please consult with a Penn State academic adviser on a regular basis to develop and refine an academic plan that is appropriate for you.

If you are starting at a campus other than the one this plan is ending at, please refer here:
http://advising.engr.psu.edu/degree-requirements/academic-plans-by-major.aspx

University Park
Kateilen Bair
Undergraduate Programs Assistant
Westgate Building
University Park, PA 16802
814-865-9505
kdb18@psu.edu

First Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CMPSC 131 or 121 (GQ)†‡</td>
<td>3</td>
<td>CMPSC 132 or 122*#</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 15, 30, or ESL 15 (GWS)†‡</td>
<td>3</td>
<td>MATH 141 or 141E (GQ)*#†</td>
<td>4</td>
</tr>
<tr>
<td>MATH 140 or 140E (GQ)‡#†</td>
<td>4</td>
<td>PHYS 211 (GN, PHYSICS 211L &amp; PHYSICS 211R)*#‡</td>
<td>4</td>
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<tr>
<td>General Education Course‡</td>
<td>3</td>
<td>First Year Seminar‡</td>
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<td>General Education Course‡</td>
<td>3</td>
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Second Year

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<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CAS 100A or 100B (GWS)†‡</td>
<td>3</td>
<td>CMPEN 270 (CMPEN 271 &amp; CMPEN 275)</td>
<td>4</td>
</tr>
<tr>
<td>CMPSC 221*</td>
<td>3</td>
<td>CMPSC 311†</td>
<td>3</td>
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<tr>
<td>MATH 220</td>
<td>2-3</td>
<td>CMPSC 360†</td>
<td>3</td>
</tr>
<tr>
<td>MATH 230*‡</td>
<td>4</td>
<td>Natural Science Elective (GN, See College Note below for options that DO NOT count)</td>
<td>2-3</td>
</tr>
<tr>
<td>PHYS 212 (GN, PHYSICS 212L &amp; PHYSICS 211R)*#‡</td>
<td>4</td>
<td>General Education Course‡</td>
<td>3</td>
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<td>16-17</td>
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Third Year

<table>
<thead>
<tr>
<th>Fall</th>
<th>Credits</th>
<th>Spring</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPEN 331*</td>
<td>3</td>
<td>CMPSC 473*</td>
<td>3</td>
</tr>
</tbody>
</table>
CMPSC 465* | 3 ENGL 202C (GWS)†‡ | 3
Foreign Language Level 002 Proficiency (see handbook for details) | 4 STAT 319 | 3
STAT 318 | 3 Computer Science Elective | 3
General Education Course† | 3 General Education Course† | 3

Fourth Year
Fall
Credits
Spring
Credits
CMPSC 431W or 483 | 3 CMPSC 461* | 3
CMPSC 464 | 3 CMPEN/CMPSC 4XX | 3
Department List Elective | 3 Computer Science Elective | 3
Department List Elective | 3 Department List Elective | 3
Supporting Course | 3 Supporting Course | 3
General Education Course (GHW)† | 1.5 General Education Course (GHW)† | 1.5

16 | 15

Total Credits 126-128
* Course requires a grade of C or better for the major
‡ Course requires a grade of C or better for General Education
# Course is an Entrance to Major requirement
† Course satisfies General Education and degree requirement

University Requirements and General Education Notes:

US and IL are abbreviations used to designate courses that satisfy University Requirements (United States and International Cultures).

W, M, X, and Y are the suffixes at the end of a course number used to designate courses that satisfy University Writing Across the Curriculum requirement.

GWS, GQ, GHW, GN, GA, GH, and GS are abbreviations used to identify General Education program courses. General Education includes Foundations (GWS and GQ) and Knowledge Domains (GHW, GN, GA, GH, GS, and Integrative Studies). Foundations courses (GWS and GQ) require a grade of ‘C’ or better.

Integrative Studies courses are required for the General Education program. n is the suffix at the end of a course number used to designate an Inter-Domain course and Z is the suffix at the end of a course number used to designate a Linked course.

All incoming Schreyer Honors College first-year students at University Park will take ENGL/CAS 137 in the fall semester and ENGL/CAS 138 in the spring semester. These courses carry the GWS designation and replace both ENGL 30 and CAS 100. Each course is 3 credits.

College Note

NATURAL SCIENCES ELECTIVE: Choose any GN-designated course EXCEPT the following: ASTRO 001, 010, 011, 120, or 140; all below CHEM 110 (except 3 credits of CHEM 106); all below PHYS 211; PHYS 250 or 251; all BI SC; and GEOSC 20.

CMPSC/CMPEN 4XX: Select any 400-489 CMPSC or CMPEN course offered at University Park.

Computer Science Elective: Select from department list. Restrictions may apply. Computer Science Electives are NOT offered every semester or even every year. Contact the department for information on which classes are scheduled to be offered during a given semester.

Department List Elective: Select from department list. Restrictions may apply. Students who complete the ROTC Program may substitute 3 ROTC credits for a Department List Elective. Students who complete the Cooperative Education Program may substitute 3 co-op credits for a Department List Elective.

Health and Physical Activity: Students who complete the ROTC Program may substitute 3 ROTC credits for the GHW requirement and 3 ROTC credits for a Department List Elective.

Supporting Course: Select from department list. Restrictions may apply.

Career Paths

Computer Science is far more than just programming and no other science or engineering discipline has had a greater impact in such diverse areas as commerce, communication, entertainment, finance, medicine, the social sciences, the physical sciences and the life sciences. Computer Science impacts our daily lives in so many ways and computer scientists are the ones who make this happen. Computer scientists transform the way we look at and live in the world.

Careers

Software engineer, mobile application developer, software application developer, system software developer, software project manager, cybersecurity analyst.

MORE INFORMATION ABOUT POTENTIAL CAREER OPTIONS FOR GRADUATES OF THE COMPUTER SCIENCE PROGRAM (http://www.eecs.psu.edu/students/graduate/EECS-Graduate-Prospective.aspx)

MORE INFORMATION ABOUT OPPORTUNITIES FOR GRADUATE STUDIES (http://www.eecs.psu.edu/students/graduate/EECS-How-to-apply-CSE.aspx)

Professional Resources

• Association for Computing Machinery Student Chapter (http://acm.psu.edu)
• Association of Women in Computing (http://www.awc.cse.psu.edu)

Contact

University Park
SCHOOL OF ELECTRICAL ENGINEERING AND COMPUTER SCIENCE
209 Electrical Engineering West
University Park, PA 16802
814-865-9505
kdb18@psu.edu

http://eecs.psu.edu/students/undergraduate/Majors-Minors-Certificates.aspx