Computer Science, B.S. (Engineering)

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

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>
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</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 campus 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 82-80 (http://senate.psu.edu/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/#82-80)). 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).

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMPSC 464</td>
<td>Introduction to the Theory of Computation</td>
<td>3</td>
</tr>
<tr>
<td>MATH 220</td>
<td>Matrices</td>
<td>2-3</td>
</tr>
<tr>
<td>MATH 230</td>
<td>Calculus and Vector Analysis</td>
<td>4</td>
</tr>
</tbody>
</table>
| Prescribed Courses: Require a grade of C or better  
| CMPEN 331 | Computer Organization And Design              | 3       |
| CMPSC 221 | Object Oriented Programming with Web-Based Applications | 3 |
| CMPSC 311 | Introduction to Systems Programming          | 3       |
| CMPSC 360 | Discrete Mathematics for Computer Science     | 3       |
| CMPSC 461 | Programming Language Concepts                  | 3       |
| CMPSC 465 | Data Structures and Algorithms                 | 3       |
| CMPSC 473 | Operating Systems Design & Construction       | 3       |
| ENGL 202C | Effective Writing: Technical Writing          | 3       |
| MATH 140  | Calculus With Analytic Geometry I             | 4       |
### Computer Science, B.S. (Engineering)

- **MATH 141** Calculus with Analytic Geometry II  
  4 credits

- **PHYS 211** General Physics: Mechanics  
  4 credits

- **PHYS 212** General Physics: Electricity and Magnetism  
  4 credits

#### Additional Courses

- Select 1 credit of First-Year Seminar  
  1 credit

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

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

#### Additional Courses: Require a grade of C or better:

- CMPS 121 Introduction to Programming Techniques  
  3 credits
  - or CMPS 131 Programming and Computation I: Fundamentals

- CMPS 122 Intermediate Programming  
  3 credits
  - or CMPS 132 Programming and Computation II: Data Structures

- CMPS 270 Digital Design: Theory and Practice  
  4 credits
  - or CMPS 271 Introduction to Digital Systems
  - & CMPS 275 and Digital Design Laboratory

- ENGL 15 Rhetoric and Composition  
  3 credits
  - or ENGL 137R Rhetoric and Civic Life I

- ENGL 138T Rhetoric and Civic Life II  
  3 credits
  - or CAS 100A Effective Speech
  - or CAS 100B Effective Speech

#### Supporting Courses and Related Areas

- Select 2-3 credits from the following:  
  2-3 credits
  - PHYS 213 General Physics: Fluids and Thermal Physics
  - PHYS 214 General Physics: Wave Motion and Quantum Physics

- Select 3 credits from the approved list of natural sciences courses

- Select 0-4 credits in a foreign language (second-semester proficiency)

- Select 10-14 credits from department list. Students may apply up to 3 credits of ROTC as department list credits and 3 credits of ROTC as GHW credits.

- Select 6 credits in non-CMPS or CMPS courses numbered 400-489 in consultation with adviser