



Computer Science

2022-2023 HANDBOOK



PennState
College of Engineering

**ELECTRICAL ENGINEERING
AND COMPUTER SCIENCE**

Table of Contents

| | |
|--|-----------|
| WELCOME | 3 |
| THE COMPUTER SCIENCE MAJOR | 4 |
| PROGRAM OBJECTIVES | 4 |
| STUDENT OUTCOMES | 5 |
| ADVISING AND PROCEDURES FOR THE MAJOR | 5 |
| ENTRANCE TO THE MAJOR (ETM), CONCURRENT MAJORS, CHANGE OF MAJOR..... | 6 |
| DEGREE AUDITS..... | 6 |
| REGISTRATION AND SUGGESTED ACADEMIC PLAN | 7 |
| PREREQUISITE COURSES..... | 7 |
| TRANSFER CREDIT | 8 |
| COOPERATIVE EDUCATION PROGRAM AND INTERNSHIPS..... | 8 |
| HONORS PROGRAM | 8 |
| MINORS..... | 8 |
| WAIVERS, EXCEPTIONS, AND PETITIONS | 9 |
| ACADEMIC INTEGRITY | 9 |
| COMPUTER SCIENCE TOPICS | 10 |
| GRADUATION REQUIREMENTS | 10 |
| C-REQUIREMENTS | 11 |
| COMPUTER SCIENCE AND ENGINEERING (34 CREDITS) | 11 |
| COMPUTER SCIENCE ELECTIVES (12 CREDITS)..... | 12 |
| COMMUNICATIONS (9 CREDITS)..... | 13 |
| QUANTIFICATION AND STATISTICS (20 CREDITS)..... | 14 |
| GENERAL EDUCATION KNOWLEDGE DOMAINS (31-32 CREDITS) | 14 |
| SUPPORTING COURSES (6 CREDITS) | 14 |
| FOREIGN LANGUAGE PROFICIENCY (4 CREDITS)..... | 16 |
| DEPARTMENT LIST (GENERAL ELECTIVE) GUIDELINES (10-14 CREDITS) | 16 |
| FIRST YEAR SEMINAR (1 CREDIT)..... | 18 |
| SOURCES OF INFORMATION | 18 |

Welcome

This handbook has been prepared for your use as a guide for your studies and as a means of providing you with much of the information that you may need as you continue to work towards your degree. We hope that you read it carefully, and we invite your inquiries about any of the questions or issues that are related to your program. The Academic Affairs staff in W209 Westgate is here to serve you.

Please watch for announcements of special courses, news related to scheduling or textbooks, and other special opportunities delivered via a departmental email list.

Again, welcome to Computer Science and Engineering. We wish you well in your studies and offer our services to assist you.

Tom La Porta

Director, School of Electrical Engineering and Computer Science

Chita Das

Head, Department of Computer Science and Engineering

John Hannan

Associate Head, Department of Computer Science and Engineering

Mark Mahon

Faculty Advisor, School of Electrical Engineering and Computer Science

Alisha Simon

Academic Advisor, Department of Computer Science and Engineering

Susie Solo

Academic Advisor, Department of Computer Science and Engineering

Sana Waqar

Academic Advisor, Department of Computer Science and Engineering

The Computer Science Major

The Department of Computer Science and Engineering was created in 1993 with the merger of the Computer Engineering Program and the Computer Science Department. The department offers B.S. degrees in computer science (CMPSC) and computer engineering (CMPEN) through the College of Engineering. It also offers the Computational Option of the inter-college Data Sciences B.S. degree.

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 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.

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 and programming languages, mathematical foundations of computing, and advanced topics in software design and application development. 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. This program is intended to produce computer science professionals and not merely technicians with some training in computer programming. Success requires a strong aptitude in mathematics.

Program Objectives

Graduates of our Computer Science degree will be prepared with technical knowledge and professional skills for the practice and future development in their profession along different career paths. We expect them to engage in continuous learning activities, to continue to communicate effectively and work collaboratively with internal and external stakeholders in multidisciplinary and multicultural work environments, and to maintain a strong commitment to ethical practices in their profession. Due to their experience in our program, within few years of their graduation we expect our graduates to have the following career and professional accomplishments:

1. Those employed in industry and focused on technical accomplishments will demonstrate professional advancement by their promotion or other recognition of their technical skills.
2. Those who pursue additional formal education related to their technical skills, either directly or soon after graduation, will have completed or be near completion of a graduate degree or other technical certification.

3. Those who pursue career paths or formal education unrelated or tangential to their degree program will have applied their broad educational skills, including analytical problem solving, communication and independent learning, towards a new discipline.
4. Those employed by government or industry and focused on leadership will demonstrate professional advancement through expanded leadership responsibility based on their acquired technical knowledge and experience.
5. Those employed by government or industry and focused on management will demonstrate professional advancement through expanded management responsibilities based on their acquired management training and experience.

Student Outcomes

The following Student Outcomes summarize the skills acquired through the computer science degree program:

1. Analyze a complex computing problem and apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement, and evaluate a computing-based solution to meet a 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.

Advising and Procedures for the Major

If you are a student at University Park who is intending to major in computer science but who has not yet officially entered the major, you can make an appointment through Starfish to meet with an adviser at the **Engineering Advising Center (EAC)**, 208 Hammond Building, 863-1033.

If you are a student who has officially entered the computer science major, you can find your assigned adviser's name and email address in LionPATH. **If you communicate via e-mail, always use your Penn State account**, not another account such as Gmail. For non-advising issues (questions about e-petition status, course controls, etc.) see one of the CSE staff in W209 Westgate during regular business hours.

Information about all majors at Penn State is listed in the *Undergraduate Bulletin* at <https://bulletins.psu.edu/undergraduate/>. The *Bulletin* is updated yearly, so make sure to refer to the version of the Bulletin for the semester that you began at Penn State. Clarifications to the *Bulletin* are noted in this handbook, so it should be used in conjunction with the *Bulletin*.

The final responsibility for selecting courses and meeting degree requirements is yours. The role of your adviser is to suggest, recommend, and remind you of the requirements of the major and rules of the University.

Do not rely on LionPATH to correctly categorize your courses. LionPATH only understands the degree requirements as specified in the Bulletin and will therefore occasionally place courses into an inappropriate category. This handbook contains additional restrictions and explanations. To ensure that you meet degree requirements, you must have your degree audit reviewed by your advisor periodically. You should submit petitions to correct any mis-categorization by LionPATH. Failure to do so may result in delaying your graduation until degree requirements are met.

Because computer science is such a rapidly changing field, adjustments in course content and/or course offerings should be expected. It will be to your advantage to keep abreast of new course offerings, current course enhancements, and allowable course substitutions through regular contact with your adviser and the department office.

Entrance to the Major (ETM), Concurrent majors, Change of major

For the entrance-to-major requirements, see the “How to Get in” section of the Computer Science major page in the University Bulletin for the year that you began at Penn State: <https://bulletins.psu.edu/undergraduate/archive/>

Due to over enrollment, the computer science and computer engineering majors are controlled majors. This means for entrance to the major you must successfully complete the required ETM courses **AND** you must have the needed minimum cumulative GPA for your ETM year when you are in the ETM credit window specified in the *Bulletin*. Because of this, the CSE Department will not approve requests for transfers from other colleges and universities, requests for change of major after a student has been admitted to a major, requests for computer engineering or science as a second (or later) concurrent major, nor for either major as a sequential major.

Because of the close relationship to computer science, concurrent majors in computer science and computer engineering or computer science and computational data sciences are not permitted. It is possible to obtain a concurrent major with another non-enrollment-controlled program.

Degree Audits

Instructions on how to run a degree audit are available at https://tutorials.lionpath.psu.edu/public/S_RunningDegreeAudit/. You are responsible for periodically checking your degree audit on LionPATH to verify that the courses you have taken and plan to take will satisfy your degree requirements and that you are on track to complete your degree when you expect to complete it. You are encouraged to meet with an advisor to review your degree audit to verify this information. **Do not rely on LionPATH to place your courses into their appropriate categories.** Do not use a what-if report to check your degree requirements once you are in your major – what-if reports are for students who have not entered their major yet and may not show the correct set of requirements for students who have entered their major.

Registration and Suggested Academic Plan

At least several weeks before it is time to register for the next semester's courses, refer to this handbook and consult with your adviser to determine an appropriate set of courses. It is very important to schedule on your assigned scheduling date— **courses fill up quickly, and if you delay for even a few days, you may not be able to get into recommended courses for the next semester!**

For a copy of the suggested academic plan for the major, refer to the Computer Science major page in the University Bulletin for the year that you began at Penn State: <https://bulletins.psu.edu/undergraduate/archive/>. In addition, a flowchart showing course prerequisites is available at <https://advising.engr.psu.edu/degree-requirements/flowcharts.aspx>. Keep in mind that the flowchart shows the latest version of the CMPSC requirements – while the flowchart is very helpful for understanding course sequencing, make sure to refer to the Bulletin for the year you began at PSU or your degree audit to confirm the classes you need to take and C-requirements since your requirements may be slightly different than those listed on the flowchart.

Re-ordering your course schedule from the suggested plan will not necessarily delay graduation. The key to completing 127 credits over 4 years is to average approximately 16 credits per semester. Though many students do maintain this pace, it is not unusual for students to take lighter loads some semesters and to delay graduation or to take summer classes. Some electives are not offered every semester and most third and fourth year classes are not offered in the summer, so please be careful in your scheduling.

Please realize that although all the courses listed on the plan in the Bulletin are required for the degree, they need not be taken during the semesters shown in the charts. You may enroll in courses earlier than the semester that they are listed on the academic plan as long as you meet any prerequisites and controls on the courses. In particular, CMPSC 360 and CMPSC 465 should be taken one or two semesters earlier if you wish to improve your chances for highly competitive internships with companies such as Google. Classes that are not a prerequisite to any other courses can usually be taken in a later semester than they are listed on the plan without causing course sequencing issues.

You should be sure to check course prerequisites before you deviate from the suggested schedule. Care should be exercised to be sure core courses are taken in the proper sequence and in a timeframe allowing you to meet entrance to major requirements. You should not wait until your last semester to take C-required courses.

Prerequisite Courses

If a CMPEN or CMPSC course has prerequisites, you must complete the prerequisite course before taking the successor course. For most courses an appropriate grade for prerequisite purposes is a grade of D or higher. If the prerequisite course is a “Prescribed C or better” course and you receive a grade of D, then you may register for the next course but you still must retake the prerequisite course. Waiving of prerequisites is typically only approved in specific circumstances in which the student can show prior learning of the prerequisite content, such as a student having completed a transfer course which was very similar to the listed prerequisite

course. Prerequisite override requests are submitted through LionPATH. For instructions about that process, see the document “Requesting a Prerequisite Override” at <https://lionpathsupport.psu.edu/student-help/>.

Transfer Credit

In addition to taking courses at any Penn State campus, you may be able to earn credit by transferring credits from another school. Before taking a course at another university, use the transfer credit tool in LionPATH and check with your adviser to be sure the course will transfer usefully.

If you hope to use a transfer course that you have not taken yet to replace a CMPSC or CMPEN course, email a copy of the course syllabus to Prof. Hannan (jjh9@psu.edu) before enrolling in the course to check whether it will be allowed to count for that requirement. If Prof. Hannan approves the use of the transfer credit, you will then need to fill out a petition at <https://coursesub.psu.edu/> to have the transfer credit count correctly on your degree audit.

Note that CMPSC 473, CMPSC 461, CMPSC 464, CMPSC 465 and the writing courses (CMPSC 431W or CMPSC 483W) must be taken at Penn State.

Cooperative Education Program and Internships

The cooperative education program provides work experience by alternating periods of academic study and full-time employment in industry or government. The program typically starts at the beginning of the junior year and consists of three rotations, providing a cumulative work experience of one year. Up to 3 credits of co-op may be used for your department list requirement.

If you prefer less of a time commitment, you can pursue one or more summer internships. You earn 1 credit per internship (maximum of 2 credits total) that can be used for your department list requirement.

Instructions for registering for co-op and internship credit can be found at <https://career.engr.psu.edu/students/undergraduate/intern-coop/credit-options/courses.aspx>.

If you are not a formal co-op or internship student, you may still take related summer jobs; however, you may not claim credits for jobs you arrange outside of the formal programs.

Honors Program

Students in the Schreyer Honors College (Atherton Hall, 863-2635) may earn honors in computer science by completing a thesis with a member of the CSE faculty. See an honors adviser if you are interested in finding out more. (The department office, W209 Westgate Building, can identify the honors advisers for you).

Minors

A minor is a specialization of at least 18 credits that supplements a major. If a course meets a requirement for your major and your minor, it can count for both the major and the minor. For

information about all minors offered at Penn State, including the course requirements and the advising contact for the minor, refer to the *Undergraduate Bulletin*.

Popular minors for students in our department include:

- 1) Engineering Leadership Development
- 2) Entrepreneurship and Innovation
- 3) Mathematics
- 4) Statistics
- 5) Computer Engineering
- 6) Cybersecurity Computational Foundations

Waivers, Exceptions, and Petitions

In order to graduate from Penn State, all requirements on your degree audit must be marked “satisfied.” If you hope to use a course in a way that it does not automatically fill in on your audit, you must submit a petition at <https://coursesub.psu.edu/> so that it can be determined whether the substitution you are requesting will be permitted and, if so, your degree audit can be updated. Be sure to submit course substitution petitions prior to taking courses and prior to the semester in which you plan to graduate so that you have time to make adjustments if your petition is not approved.

Note that petitions that require College level approval (exceptions/waivers to College & University requirements, such as general education requirements) must be submitted BEFORE the semester in which you plan to graduate.

Academic Integrity

Recognizing not only the value of integrity in the academic environment, but also its value for the practicing computer scientist and for society at large, we in the department urge you to act as a responsible professional while you are a student. Academic integrity is defined as follows in Faculty Senate rule 49-20:

“Academic integrity is the pursuit of scholarly activity free from fraud and deception and is an educational objective of this institution. Academic dishonesty includes, but is not limited to, cheating, plagiarizing, fabricating of information or citations, facilitating acts of academic dishonesty by others, having unauthorized possession of examinations, submitting work of another person or work previously used without informing the instructor, or tampering with the academic work of other students.”

The EECS School maintains a specific [Academic Integrity Statement](https://www.eecs.psu.edu/students/resources/EECS-CSE-Academic-Integrity.aspx) at <https://www.eecs.psu.edu/students/resources/EECS-CSE-Academic-Integrity.aspx> related to programming courses.

It is commonly accepted that people learn better if they can interact, discuss, and assist each other in solving problems and understanding concepts. Yet persons submitting identical homework papers overstep the bounds of beneficial interaction. The specific limits of acceptable collaboration will be spelled out by the instructor in each course in the course syllabus. The

specifics may vary from course to course, but you are always responsible for keeping your work private and inaccessible to others. Do not, for any reason, show another student a part of your code or write code for another student. Do not put your code online in any location that might be publicly accessible. Any collaboration that exceeds these guidelines or the instructor's guidelines will be considered cheating. Clearly, professionals share ideas, but they should not use another's work without clear acknowledgement of who did the work. Academic dishonesty in any form is not condoned or tolerated.

Computer Science Topics

Students achieve breadth in computer science through a series of required courses. Background in software related areas is gained through CMPSC 121 or 131, CMPSC 122 or 132, CMPSC 221, CMPSC 311, CMPSC 465, CMPSC 461, and CMPSC 473. Background in theory is gained through CMPSC 360, CMPSC 465, and CMPSC 464. Background in hardware areas is gained through CMPEN 270 and CMPEN 331. It is recommended that you take one programming course a semester (CMPSC 121 or 131, 122 or 132, 221, 311, 473) until CMPSC 473 is complete (if possible). Although it is recommended that you take CMPSC 121 or 131 in your first semester, your graduation will not be delayed if you take it in the second semester.

Note that none of CMPSC 494, CMPSC 494H, CMPSC 495, CMPSC 496, CMPEN 494, CMPEN 494H, CMPEN 495, or CMPEN 496 may be used as a technical elective. CMPSC 499 and CMPEN 499 may only be used for technical electives if you are given prior permission via a petition. Some CMPSC 497 or CMPEN 497 courses may be allowed as a 400-level CMPEN/CMPSC elective, but you should make sure to receive permission to use the 497 class for this requirement before taking the course.

Issues related to the integration of hardware and software, and hardware-software tradeoffs are discussed in the required courses CMPSC 311, CMPEN 331, and CMPSC 473, as well as some elective courses such as CMPEN 472 and CMPEN 473.

Students receive an appropriate introduction to various specialized mathematics topics in a sequence of required courses that include CMPSC 360, STAT 318, STAT 319, and MATH 220. A variety of methods for modeling computer processes and systems are introduced in the required courses CMPSC 465, CMPEN 331, and CMPSC 473.

Students can learn to use a number of computer-aided design tools through certain laboratory courses and in regular lecture courses. These include a digital schematic capture and simulation tool in CMPEN 270; a hardware design language in CMPEN 331; a hardware description language simulator in CMPEN 431; and computer vision software tools in CMPEN/EE 454.

All students study multiple high-level programming languages such as Python, Java, C, and C++. Students study assembly language in CMPEN 331. In CMPSC 461, students study general language principles and explore various programming paradigms. Students gain extensive experience in both Microsoft and UNIX operating systems.

Graduation Requirements

To graduate from the University, every student must:

- (1) Complete the course requirements for his or her major (including earning Cs or higher in all C-required courses) and
- (2) Earn at least a 2.0 cumulative grade-point average for all courses taken at the University

C-requirements

Some courses for the major require a grade of C or higher to graduate. If you have officially entered your major, the easiest way to see which classes require a grade of C or higher is to check your degree audit. On your degree audit, some sections are labeled as requiring a C or higher, and the classes used toward those sections are the ones that require a grade of C or above. If a class is being used in a section of the degree audit that does not have a label about a C or higher being required, a D or above will fulfill that requirement.

If you have not declared your major yet, you can use the Bulletin to see the classes that are C-required for you. The academic plan, with C-required classes labeled, is available on the Computer Science major page in the University Bulletin for the year that you began at Penn State: <https://bulletins.psu.edu/undergraduate/archive/>.

Computer Science and Engineering (34 credits)

- CMPEN 270 (4) – Introduction to Digital Systems (Concurrent: PHYS 212)
- CMPEN 331 (3) – Computer Organization and Design (CMPEN 271 or CMPEN 270; CMPSC 121 or CMPSC 131 or CMPSC 201)
- CMPSC 121 (3) – Introduction to Programming Techniques (MATH 110 or MATH 140 concurrently or as a prerequisite) OR
CMPSC 131 (3) – Programming and Computation I Fundamentals (MATH 110 or MATH 140 concurrently or as a prerequisite)
- CMPSC 122 (3) – Intermediate Programming (CMPSC 121 or CMPSC 131) OR
CMPSC 132 (3) - Programming and Computation II Data Structures (CMPSC 121 or CMPSC 131)
- CMPSC 221 (3) – Object Oriented Programming with Web-Based Applications (CMPSC 122 or CMPSC 132)
- CMPSC 311 (3) – Systems Programming (CMPSC 221)
- CMPSC 360 (3) – Discrete Mathematics for Computer Science (Concurrent: CMPSC 122 or CMPSC 132)
- CMPSC 461⁺ (3) – Programming Language Concepts (CMPSC 221, CMPSC 360)
- CMPSC 464⁺ (3) – Introduction to the Theory of Computation (CMPSC 465)

- CMPSC 465[†] (3) – Data Structures and Algorithms (CMPSC 360 or MATH 311W)
- CMPSC 473[†] (3) – Operating Systems (CMPSC 311, CMPEN 331)

[†]Neither transfer credits nor study abroad credits may substitute.

Computer Science Electives (12 credits)

There are three categories of computer science electives required for the CMPSC major:

1. Select 3 credits from the following list (prerequisites appear in parentheses). When you complete one of these courses, it will also cover the Writing Across the Curriculum requirement for your major.
 - CMPSC 483W (3) – Software Design Methods (CMPSC 311; CMPSC 365)
 - CMPSC 431W (3) – Database Management Systems (CMPSC 221; ENGL 202C)
2. Select 6 credits from the following list (prerequisites appear in parentheses). These courses are referred to as “CMPSC elective” in the *Bulletin* and “Computer Science Elective” on the CMPSC flowchart.
 - CMPSC 442 (3) – Artificial Intelligence (CMPSC 221. Concurrent: CMPSC 465)
 - CMPSC 443 (3) – Introduction to Computer and Network Security (CMPEN 362. Concurrent: CMPSC 473)
 - CMPSC 447 (3) – Software Security (CMPSC 443)
 - CMPSC 448 (3) – Machine Learning ((STAT 319 or STAT 415) and (CMPSC 122 or CMPSC 132))
 - CMPSC 450 (3) – Concurrent Scientific Programming (CMPSC 121, CMPSC 201 or CMPSC 202; MATH 220; MATH 230 or MATH 231)
 - CMPSC 451 (3) – Numerical Computations (3 credits of programming; MATH 230 or MATH 231)
 - CMPSC 455 (3) – Introduction to Numerical Analysis I (MATH 220; MATH 230 or MATH 231; and 3 credits of programming)
 - CMPSC 456 (3) – Introduction to Numerical Analysis II (CMPSC 455)
 - CMPSC 458 (3) – Fundamentals of Computer Graphics (CMPSC 311; MATH 220; MATH 230 or MATH 231)
 - CMPSC 466 (3) - Introduction to Quantum Computation (MATH 220 and (MATH 318 or STAT 318 or MATH 414 or STAT 414 or MATH 418 or STAT 418))

- CMPSC 467 (3) – Factorization and Primality Testing (CMPSC 360 or MATH 311W)
- CMPSC 471 (3) – Introduction to Compiler Construction (CMPSC 461)
- CMPSC 475 (3) – Applications Programming (CMPSC 221; CMPSC 311 or CMPSC 312; CMPSC 462 or CMPSC 465)
- CMPEN 362 (3) – Communication Networks (CMPEN 271 or CMPEN 270; Concurrent: STAT 301 or STAT 318 or STAT 401 or STAT 414 or STAT 418)
- CMPEN 431 (3) – Introduction to Computer Architecture (CMPEN 331 or CMPEN 371)
- CMPEN 454 (3) – Fundamentals of Computer Vision (MATH 230 or MATH 231; CMPSC 121 or CMPSC 201)
- CMPEN 462 (3) – Wireless Communications Systems and Security (CMPEN/EE 362)
- EE 456 (3) – Introduction to Neural Networks (CMPSC 201 or CMPSC 202; MATH 220)

Note: Students may take only one course for credit from CMPSC 451 and 455

Note: Some courses are NOT offered every semester or even every year.

3. Select 3 credits from any 400-level CMPSC or CMPEN course, **excluding 494, 495, 496, 499 and courses offered at non-UP locations which cover duplicate material (unless prior approval has been given for you to use a CMPSC or CMPEN 499 course). Some CMPSC 497 and CMPEN 497 courses may not be allowed, so check with your advisor before planning on taking CMPSC 497 or CMPEN 497 for this requirement.** This requirement is referred to as “CMPSC/CMPEN 400-level” in the *Bulletin* and “CMPSC/CMPEN 4XX” on the flowchart. The course you use for this requirement cannot double count with any other requirement for the CMPSC major. For example, you cannot use one of the prescribed courses as your CMPSC/CMPEN 400-level elective, and you may not use the same course that you are using for any of the other CMPSC elective categories. However, if you take extra courses from one of the other CMPSC elective categories (such as taking both CMPSC 431W and 483W or taking three classes from the second category of CMPSC electives), you may use the “extra” course for this requirement.

Communications (9 credits)

- ENGL 15 GWS (3) – Rhetoric and Composition (ENGL 30, ESL 15, or CAS/ENGL 137H may be substituted)
- ENGL 202C GWS (3) – Technical Writing
- CAS 100 A/B (3) – Effective Speech (CAS/ENGL 138H may be substituted)

Quantification and Statistics (20 credits)

- Mathematics (14 credits):
 - MATH 140 GQ (4) – Calculus with Analytic Geometry I
 - MATH 141 GQ (4) – Calculus with Analytic Geometry II
 - MATH 220 GQ (2) – Matrices
 - MATH 230 (4) – Calculus and Vector Analysis (combination of MATH 231 (2) and MATH 232 (2) may be substituted)
- Probability and Statistics (6 credits):
 - Either STAT (MATH) 318 and 319 OR STAT (MATH) 414 and 415 (STAT/MATH 418 may substitute for 318 or 414)

General Education Knowledge Domains (31-32 credits)

- Physics (8 credits):
 - PHYS 211 GN (4) – General Physics (mechanics)
 - PHYS 212 GN (4) – General Physics (electricity, magnetism)
- Additional natural science (2-3 credits):

Select 2 credits from PHYS 213 GN (2), 214 GN (2), or 3 credits from any GN except the following: ASTRO 1, 6, 7N, 10, 11, 120, 140; all BISC courses; all CHEM courses below 110 (except 3 credits of CHEM 106 can be used); PHYS 250, 251, all PHYS courses below PHYS 211, GEOSC 20.

Details for the remaining General Education requirements can be found in the [Baccalaureate Degree General Education Requirements](https://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/) at <https://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/>.

Supporting Courses (6 credits)

Guidelines: Choose six credits of **400-level non-CMPSC/CMPEN/DS** courses, having a **common theme**, that **support a career in computer science**. Courses typically approved for this requirement include 6 credits in mathematics (MATH) and/or statistics (STAT); 6 credits in information sciences (IST), or 6 credits in engineering leadership/entrepreneurship (ENGR, excluding co-op credits). Independent study credits may not be used. **Keep in mind that being**

from same subject area (e.g., two IST courses or two ENGR courses) does not always mean that courses would qualify as having a common theme. For example, there are business-focused 400-level IST classes and technical 400-level IST classes, and taking one of each type would not meet the CMPSC supporting course requirement. If you have any doubts about a pair of courses having a common theme, make sure to do a petition before taking the classes.

Most approved 400-level Math classes will automatically count as supporting courses on your degree audit; most other classes will not automatically count as a supporting course. **Using any course that does not automatically count on your audit as a supporting course requires a petition at <https://coursesub.psu.edu/>.** Because a petition could be denied, you should seek approval before taking the course. Note that you may need to take more than two courses to satisfy the 6-credit requirement.

Keep in mind that most 400-level courses have prerequisites; make sure that you will have met the prerequisites for the courses you plan to take for the supporting course requirement. Math courses are the most popular type of supporting courses taken by CMPSC students, in part because there are a number of 400-level Math courses CMPSC majors already meet the prerequisites for (since CMPSC majors are required to take Math 220, Math 230, etc.).

Examples of courses that are generally accepted as supporting courses include:

- Most courses with the prefix MATH, STAT, IST, EDSGN, or ENGR (excluding co-op credits). These are currently the types of courses most commonly used to fulfill the Supporting Courses requirement.
- Technical courses at the 400-level (not CMPSC/CMPEN); e.g., chemistry, physics, biology, engineering (because they provide additional technical depth or breath).
- Courses that relate to business or management; e.g., finance, accounting, marketing, economics (because most CMPSC majors must work in a business environment).
- Courses in linguistics (because the study of language relates to programming languages)
- Psychology, if the courses relate to cognition, perception, learning, memory, vision (because they relate to AI), but not say development through adulthood, abnormal psychology, social psychology, religious approaches to psychology.
- Philosophy, if the courses relate to ethics, logic, science, language, or similar topics.
- Foreign language courses that relate to communication in the language (because of its value in a global work environment).

Examples of courses that fail to meet the spirit of the requirement include:

- Crime, Law, and Justice (their one course on computer security is remedial for CMPSC majors).
- History, Sociology, English, Education, Communication, Instructional Systems, Military.
- Art, even though it might be loosely related to computer graphics or web development.
- Music, unless both courses deal with electronic music.
- MATH (STAT) 414, 415, 418 (these courses can only be applied to the statistics requirement for the CMPSC major).
- MATH (CMPSC) 451, 455, 456, 467 (cross-listed with CMPSC).

- MATH 470, 471, 493 (designed for education majors).
- MATH 494-499 courses (the content of these can vary by semester. Some MATH 497 or 499 courses may be allowed depending on the topic, but you should fill out a petition before taking the course to check.)

Foreign Language Proficiency (4 credits)

CMPSC majors are required to demonstrate proficiency equivalent to two semesters of a single foreign language. Most students can meet the CMPSC foreign language requirement in one of the following ways:

- Complete the 4th or higher year of a single foreign language in high school. In order to use this option, you must submit a petition at <https://coursesub.psu.edu/> and upload a copy of your high school transcript to your petition. If you do use high school classes to cover your language requirement, you must take 4 extra credits of department list to make up for the language credits that you did not take at Penn State.
- Complete the 2nd (or higher) semester of one foreign language; e.g. SPAN 2. Starting in a Penn State level 2 language course is appropriate if you studied that language for 2 or 3 years in high school.
- Complete two semesters (8 credits) of a NEW foreign language (other than the one you took in high school). The level 1 course (e.g., GER 1) can count as department list credits, and then the level 2 course (e.g., GER 2) will count for your language proficiency requirement.
- Successfully complete Penn State's proficiency testing in a foreign language. See <https://sgllc.la.psu.edu/proficiency-certification/> for information about signing up for language proficiency testing. If you meet your language requirement in this way, you must take 4 extra credits of department list to make up for the language credits that you did not take at Penn State.

If you were admitted to Penn State without meeting your World Language Admissions requirement (i.e., if you took less than 2 years of the same foreign language in high school) you must complete two semesters (8 credits) of a single foreign language; however, only 4 of those credits can be applied to your degree requirements.

Department List (General Elective) Guidelines (10-14 credits)

Choose enough credits to bring the total number of credits up to at least 127. If your US/IL course was not an Arts, Humanities, Social or Behavioral Sciences course, it may be counted in this list. These are sometimes called approved free electives or general electives and most classes at Penn State will qualify as department list, but the following restrictions apply:

- no courses not satisfying minimum requirements for baccalaureate degree program (see course descriptions in the *Bulletin*)

- no courses described as intended for non-science or non-technical majors in the course description in the *Bulletin*. (**You may take non-technical courses**, but you should look at the *Bulletin* to be sure the description doesn't say "for non-science majors only").
- no courses similar or remedial to a required course or course already taken (when in doubt, check with your advisor before scheduling the course). For example, you may not include 2 credits of MATH 140A or 2 credits of CHEM 106.
- not ENGL 4, 5, or any other remedial English
- no more than 3 additional credits of physical education
- no more than 3 credits of Cooperative Education
- no more than 2 credits of Engineering Internship
- no more than 3 credits of CHEM 106
- none of the following:
 - Astronomy (ASTRO) 1, 6, 7N, 10, 11, 120, 140
 - Biological Science (BISC) 1, 2, 3, 4
 - Chemistry (CHEM) 1, 3, 101, 108
 - Communication Arts and Sciences (CAS) 126, 283
 - Computer Science (CMPSC) 100, 101, 200, 201, 203
 - Cybersecurity Analytics and Operations (CYBER) 100
 - Earth and Mineral Sciences (EMSC) 150
 - English as a Second Language (ESL) 4
 - Information Science & Technology (IST) 140, 210, 220, 230, 240, 242, 261, 311, 361
 - Language and Literacy Education (LLED) 5, 10
 - Mathematics (MATH) 200, 201, MATH below 140
 - Philosophy (PHIL) 12
 - Physical Science (PHSC) 7
 - Physics (PHYS) 250, 251, PHYS below 211
 - Science, Technology, and Society (STS) 150
 - Statistics (STAT) below 318 except for STAT 200
 - Statistics (STAT) 401, 487

- STAT (MATH) 318, STAT (MATH) 319, STAT (MATH) 414, STAT (MATH) 415, STAT (MATH) 418

Because most classes at Penn State (that you are not already using for another degree requirement) can count toward department list, there isn't a list of all classes that can be used – it would be very long. Rather, refer to the list above of types of courses that are not eligible for this requirement.

First Year Seminar (1 credit)

Most CMPSC majors take a 1-credit first-year seminar in either their first or second semester at Penn State. If you did not take a first-year seminar that was a separate 1-credit course, you must make up the first-year seminar credit by taking an extra credit of coursework that is acceptable for the department list requirement. Then, submit a petition at <https://coursesub.psu.edu/> requesting to use the extra credit of department list coursework to fulfill the first-year seminar requirement on your degree audit.

Sources of Information

This *Handbook* provides program information specifically for the undergraduate computer science major. It should be used as a supplement to the *College of Engineering Undergraduate Programs Guide* that is available online. The information in this *Handbook* pertains to students who began at Penn State in Summer 2021, Fall 2021, or Spring 2022 semesters. Students beginning at Penn State in an earlier year should refer to the appropriate earlier version of the Handbook. Students in pre-major (ENGR) status may use this Handbook as a reference for scheduling; however, your official degree requirements will be established when you enter the major.

Although this *Handbook* lists all requirements for the computer science major, only those specific to computer science are described in detail. Other general College and University requirements are discussed only briefly with references to more comprehensive supporting documents. A list of links to useful web resources is provided below.

School of EECS – <http://eecs.psu.edu>

Engineering Advising Center – <https://advising.engr.psu.edu>

Bulletin of Baccalaureate Degree Programs – <http://bulletins.psu.edu/undergrad>

University Faculty Senate – <http://www.senate.psu.edu/policies/>

Student Affairs – <https://studentaffairs.psu.edu>

General Education – <https://gened.psu.edu>

LionPATH – <http://launch.LionPATH.psu.edu>

Association of Women in Computing - <http://www.awc.cse.psu.edu>

Association for Computing Machinery Student Chapter – <http://acm.psu.edu>