COMPUTER SCIENCE

UNDERGRADUATE HANDBOOK

FOR THE COMPUTER SCIENCE MAJOR IN THE

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COLLEGE OF ENGINEERING

AT THE

PENNSYLVANIA STATE UNIVERSITY

Effective Summer, 2006

Department of Computer Science and Engineering:
342E Information Sciences and Technology Building
Phone: 865-9505
Hours: Monday - Friday; 8:00 a.m. - 5:00 p.m.
## (Some) University Park Offices and Phone Numbers

<table>
<thead>
<tr>
<th>Office/Division</th>
<th>Phone Number</th>
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</thead>
<tbody>
<tr>
<td>College of Engineering:</td>
<td></td>
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<tr>
<td>Dean’s Office, 101 Hammond</td>
<td>865-7537</td>
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<tr>
<td>Associate Dean of Undergraduate Studies, 101 Hammond</td>
<td>863-3750</td>
</tr>
<tr>
<td>International Engineering Programs, 205 Hammond</td>
<td>863-1032</td>
</tr>
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<td>Office of Student Services, 208 Hammond</td>
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<td>Engineering Advising Center, 208 Hammond</td>
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<td>Assistant Dean for Student Services, 208F Hammond</td>
<td>865-7539</td>
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<td>Multicultural Engineering Program, 208 Hammond</td>
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<td>Adult Learner Services, 323 Boucke</td>
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<td>Distance Education (correspondence courses), 207 Mitchell</td>
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<td>Division of Undergraduate Studies (DUS), 118 (lobby) Grange</td>
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<td>University Learning Resource Center, 220 Boucke</td>
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<td>Office of Student Aid (financial), 314 Shields</td>
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<td>General information, HUB Desk, First Floor Lobby</td>
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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 2006 - 2007. The information in this Handbook pertains to students starting at the University Summer 2006, Fall 2006, or Spring 2007. Students who enrolled at the University in an earlier year should refer to the appropriate earlier version of the Computer Science Undergraduate Handbook. For information about the Computer Engineering degree, refer to the Computer Engineering Undergraduate Handbook. All of these documents are available in the department office, 342E Information Sciences and Technology Building. (If you are at a campus other than University Park, you should contact the College of Engineering representative at your location).

Although this Handbook lists all requirements for the Computer Science major, only those specific to Computer Science are described in detail. Other requirements are discussed only briefly with references to more comprehensive supporting documents. Hard copies of these documents can be obtained from a Dean’s office or local bookstore. Many are available on-line through the World Wide Web or Gopher. A list of useful web resources is provided below. For easy reference, resource names are printed in bold throughout the Handbook.

- **Semester Course Schedules**
- **DUS Advising Resource**
- **Department of Computer Science & Engineering**
- **Penn State University**
- **Engineering Advising Center**
- **Bulletin of Baccalaureate Degree Programs**
- **University Faculty Senate Policies for Students**
- **Student Guide to General University Policies and Rules**
- **Registrar's Schedule of Courses**
- **General Education & Cultural Diversity in the Curriculum**
- **eLion**

For additional information, you can contact the Engineering Advising Center (208 Hammond, 863-1033), the Assistant Dean for Student Services (208F Hammond, 865-7539), or the Department of Computer Science and Engineering (342E Information Sciences and Technology Building, 865-9505). The structure in the Department of Computer Science and Engineering includes a Director of Academic Affairs and an Undergraduate Secretary, both of whom can provide information and guidance during your academic career.
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 both Computer Science (CMPSC) and Computer Engineering (CMPEN) through the College of Engineering.

The Computer Science undergraduate major at Penn State has two phases. The first phase introduces the concepts of modern computer science, including structured programming languages and efficient, productive programming. The second phase examines data structures, programming languages, and computer systems in detail. Course work involves writing computer applications and polishing programming skills.

The baccalaureate program in Computer Science provides a fundamental education to prepare students for positions in industry, government, education, or commerce, or to pursue graduate study. The Computer Science curriculum is organized with two goals in mind. First, upon graduation a student must be prepared to meet immediate demands in solving computational problems. Second, a student must have sufficient understanding of basic principles and concepts in computer science to avoid technological obsolescence in the rapidly changing information technology environment.

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. Because of the close relationship to computer science, simultaneous degrees and dual majors in Computer Engineering and Computer Science are not permitted.
Advising and Procedures for Major

If you are a first- or second-year student at University Park who is intending to major in Computer Science, you will see an adviser at the Engineering Advising Center (EAC), 208 Hammond Building, 863-1033. This office is open Monday through Friday, 8:00 a.m. to 5:00 p.m. (Walk-in advising is available but appointments are encouraged).

If you are a junior or senior who has been admitted into the Computer Science major or a University Scholar, you will be assigned a faculty adviser in the Computer Science and Engineering Department. If you do not know your assigned adviser’s name or office address, ask in the department office in 342E Information Sciences and Technology Building. This information is also available from eLion.

Required courses for the Computer Science major and a suggested schedule are given on the following pages. Information about all majors at Penn State are listed in the Bulletin of Baccalaureate Degree Programs. The Bulletin is updated yearly and should be used along with this Handbook. Exceptions to the Bulletin are noted here.

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. (Two helpful references for University procedures on-line are: University Faculty Senate Policies for Students, and the Student Guide to General University Policies and Rules). When meeting with your adviser, always take a copy of your recent audits, grade reports, transcript, your present schedule, and your plan for at least the next semester’s courses.

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 an adviser and the department office.

Entrance to the Major – The Computer Science major is under administrative enrollment controls. This means that only a limited number of students who have met specific requirements are admitted to the major. Available computing facilities, faculty and teaching assistants, and space constraints determine this limit. Currently, the combined limit for Computer Science and Computer Engineering is 190 students. Entrance to major is available to a student only once. For students entering Penn State in Summer 2006, Fall 2006, or Spring 2007, the only time you may enter the Computer Science major is Spring 2008.

To qualify for the Computer Science major,

(1) You must complete MATH 140, MATH 141, PHYS 211, and CSE 122 with a grade of C or better in each by the end of Spring semester, 2008. Note that, unlike other engineering majors, Computer Science requires CSE 122, not CHEM 12, for determining entrance to the major.

(2) You must be enrolled in the College of Engineering (ENGR major) or DUS (declared as heading toward engineering major).
(3) You should complete at least two full semesters of coursework appropriate to the major. You should be taking CSE 260 and CSE 271 during your second year in order to make normal progress. Be sure you’re accumulating credits at a minimum rate of 30 credits per calendar year. Be aware that a deferred grade or withdrawal should be discussed with an adviser so that your schedule is not judged "inappropriate."

(4) Early in Spring semester, 2008, you must complete a Sophomore Application to Major form and submit it by the published deadline. (See College of Engineering Undergraduate Programs Guide 2006 – 2007 for more details).

Students who meet the qualifications listed above will be selected for the Computer Science major starting with the student with the highest cumulative grade-point average and continuing down until the limit of 190 students has been reached. For the purpose of entrance to major, your grade-point average is evaluated after the Fall semester of your second year. So if your grade point average after Fall 2007 is in the highest 190 sophomore students selecting Computer Science or Computer Engineering as their major, you will be admitted to the major. Note, that if you have met the qualifications and your Fall 2007 cumulative grade-point average is 3.0 or greater, you are guaranteed entrance to major regardless of the student limit.

In summary, during your first two years, you must complete CSE 122, MATH 140, MATH 141, and PHYS 211 with a grade of C or better in each. You must declare your intended major as CMPSC, schedule your courses wisely, and maintain a high grade point average.

**Change of Major** – If you discover an interest in other areas of study or you are not admitted into Computer Science, you should explore other possible majors and alternatives at the Engineering Advising Center or at any DUS Advising Resource.

**Concurrent Major** – Concurrent majors will not be allowed in Computer Science and Computer Engineering.

**Registration** – Each semester, you register for classes by planning what you need to take (referring to this Handbook and the College of Engineering Undergraduate Programs Guide 2006 – 2007), by checking with your adviser, and then by following the instructions in the Schedule of Courses that is published each semester. (You can also find out what courses are still open, what courses have had sections added, etc., on-line at the Registrar’s Schedule of Courses website).

Re-ordering your course schedule will not necessarily delay graduation. The key to completing 126 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. Needed credits are often taken during the summer (not necessarily at University Park) or by independent learning. Some students will elect to attend for a 9th semester. Some electives are not offered every semester, so please be careful in your scheduling. This is especially true for co-op students.
Schedule Changes -- Schedule adjustments (course adds/drops) may be made online using elion during the first 10 calendar days of each semester. Detailed instructions, costs, and deadlines are provided in the Schedule of Courses. After this time, you may still adjust your schedule, but any change is considered a late add or a late drop and requires an adviser's signature. You have a limit of 16 late-drop credits, so consultation with your adviser is important. (REMEMBER: A student who has not yet been admitted to the major should seek advice at the Engineering Advising Center; a student who has been admitted should see the assigned faculty adviser in Computer Science and Engineering).

General Education – All students at the University are required to complete 46 credits of General Education. A General Education course can be identified by its course suffix. You will partially meet these requirements by taking specific courses required for the Computer Science major, and by following the general guidelines below.

General Education consists of the following categories:

- first year seminar - at least 1 credit - courses with the designation PSU will fulfill this requirement, as will courses with the suffix FYS
- writing/speaking - 9 credits - course suffix of GWS
- quantification - 6 credits - suffix of GQ
- health and physical activity - 3 credits - suffix GHS
- natural sciences - 9 credits - suffix GN
- arts - 6 credits - suffix GA
- humanities - 6 credits - suffix GH
- social and behavioral sciences - 6 credits - suffix GS

College of Engineering students will follow the University’s General Education guidelines; refer to the College of Engineering Undergraduate Programs Guide 2006 – 2007 and to the University’s Baccalaureate Degree Programs Bulletin for a complete list of available courses.

Check with your adviser if you would prefer to develop a sequence of 9 credits in arts, humanities, or social and behavioral sciences by substituting 3 credits from one of the other 2 areas. Please note: students may take a level III language course and use it as one of the AHS courses, but it cannot be the only course in an area; thus, it can only be the second or third course of the 9-6-[not the 3] sequence in any of the AHS areas. Petitions to use the 9-6-3-sequence option for meeting AHS requirements will be approved as long as the above requirements are met.

Writing Requirement – All Penn State students have a Writing Across the Curriculum graduation requirement. You must complete at least 3 credits of writing-intensive courses selected from "W" courses offered within the major or college of enrollment. Courses in the Computer Science major that fulfill this requirement are CSE 420W (Software Design Methods) and CSE 441W (Introduction to Database Management Systems).
**Diversity Requirement** – Beginning summer 2005, the Intercultural and International Competence (GI) requirement has been replaced by a requirement in United States Cultures (US) and International Cultures (IL). Courses approved to fulfill this requirement will be designated as US, IL, or both US and IL. The **degree audit** will monitor the completion of the requirement for each student based on his/her program year.

**Students admitted to baccalaureate degree status after spring 2005** must complete 3 credits in US and 3 credits in IL. If a student takes a 3-credit course that is both US and IL, to complete the requirement, he/she must take another 3-credit course that is US, IL, or both US and IL. Associate degree candidates must complete a 3-credit course that is US, IL, or both US and IL. Education abroad courses and other credit-bearing experiences such as internships that meet this requirement will be designated as US, IL, or both US and IL.

A good reference, updated yearly, is the small blue booklet General Education and Cultural Diversity in the Curriculum. Education Abroad is another option for fulfilling the diversity requirement.

**Sixth Semester Audit** – During your sixth semester, the department will send you a copy of your transcript or a computer audit and a requirement checklist for the major. A copy of the checklist appears on the last page of this Handbook. You must fill out the requirement checklist and return it so that your progress can be checked and any problems resolved before graduation. **If you have questions on your audit, it is your responsibility to talk to your adviser and/or to the undergraduate secretary (in 342E Information Sciences and Technology Building).**

**Graduation Requirements** – To graduate from the University, every student must:

1. Complete the course requirements for his or her major;
2. Earn at least a 2.0 cumulative grade-point average for all courses taken at the University; and
3. Earn at least a C in each of these courses: CSE 121, CSE 122, CSE 221, CSE 260, CSE 271, CSE 311, CSE 331, CSE 411, CSE 428, CSE 431, CSE 465, MATH 140, MATH 141, PHYS 211.

**Credit Acquisition** – In addition to taking courses at any Penn State campus, you can earn credit through Independent Learning (correspondence) or by transferring credits from another school. Before taking a course at another university, check with the Admissions office and your adviser to be sure the course will transfer usefully.

**Cooperative Education Program** – 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.

If you have interest in the co-op program, you should obtain advising no later than your fourth semester from the designated co-op adviser, who will help you plan work and study schedules. You may earn up to 6 credits toward graduation in the Department List requirements.

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) toward graduation in the Department List requirements.
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) have the option of pursuing an honors degree in Computer Science by participating in the Computer Science Honors Program. See an honors adviser if you are interested in finding out more about this program. (The department office, 342E Information Sciences and Technology Building, can identify the honors advisers for you).

**Minors** – A minor is a specialization of at least 18 credits that supplements a major. Some courses may concurrently meet the requirements of our major. Popular minors for students in our department include:

1) Engineering Leadership Development  
2) Engineering Entrepreneurship  
3) Mathematics  
4) Business/Liberal Arts

**Other Issues** – For additional information on minors, withdrawal, leaves of absence, concurrent majors, change of major, satisfactory/unsatisfactory credits, and other academic issues, refer to University Faculty Senate Policies for Students. For information on campus and community resources (parking, libraries, museums, etc.; referrals for returning adult students, minority students, veterans, women), refer to Easy Access, available during orientation and published by Student Life.

Any exceptions made in the degree requirements must be approved and documented, usually using a college petition form. Inquiries about exceptions and general degree requirements should be taken to the Computer Science and Engineering Department Office (342E Information Sciences and Technology Building), to your adviser, or to the Engineering Advising Center. (Note that such petitions will NOT be accepted during the semester that 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."

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. You are encouraged to discuss homework assignments. You may discuss what you are supposed to do, the general algorithm and data structures that might be used. The furthest that cooperation is allowed is to assist another student in debugging their code. Do not, for any reason, show another student sections of your code or write sections of code for another student. Any collaboration that exceeds these 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 CSE 121 (Programming Techniques), CSE 122 (Intermediate Programming), CSE 221 (OOP with Web Applications), CSE 311 (Systems Programming), CSE 465 (Data Structures and Algorithms), CSE 428 (Programming Languages), and CSE 411 (Operating Systems). Background in hardware areas is gained through CSE 271 (Introduction to Digital Systems), CSE 331 (Computer Organization and Design), and CSE 431 (Introduction to Computer Architecture). Though taken infrequently by Computer Science majors, the course CSE 472 (Microprocessors and Embedded Systems) examines hardware and software aspects of microcomputer systems.

Specialization is obtained by the students' selection of technical electives. Students must select 12 credits from the Computer Science Electives (6 credits from CSE 421, 457, 418, 481, 451, 455, 456, 460, 467, 468, 458, 486, and EE 456, select 3 credits from any 400-level CSE course, and select 3 credits from CSE 420W or CSE 441W).

Issues related to the integration of hardware and software, and hardware-software tradeoffs are discussed in the required courses CSE 311, CSE 331, CSE 411, and CSE 431, as well as some elective courses such as CSE 472 and CSE 473 (Microcomputer Laboratory).

Students receive an appropriate introduction to various specialized mathematics topics in a sequence of required courses that include: CSE 260 (Discrete Mathematics for Computer Scientists), STAT 318 (Elementary Probability), STAT 319 (Applied Statistics in Science), and MATH 220 (Matrices). A variety of methods for modeling computer processes and systems are introduced in the required courses CSE 465, CSE 331, CSE 411, and CSE 431.

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 CSE 271; a hardware design language and a microprocessor emulation system in CSE 473; a hardware description language simulator in CSE 431; logic design CAD tools in CSE 431 and CSE 471; VLSI CAD tools in CSE 477; and computer vision software tools in CSE/EE 486.

All students learn at least two programming languages, JAVA and C++. Assembly language is studied in CSE 331 and CSE 472. In CSE 428, students are exposed to various language features associated with any programming language. Students make extensive use of both Microsoft and UNIX operating systems.

Program Requirement Summary Chart – On the next pages, you will find a semester-by-semester chart of what courses to take with notes describing any choices to be made or restrictions to be followed. Please realize that although all the courses listed are required for the degree, they need not be taken during the semesters shown in the charts. 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 time frame allowing you to meet entrance to major requirements. A total of 126 credits are required for graduation.
# Suggested Schedule of Courses by Semester

## SEMESTER 1
15 credits

<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
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<tbody>
<tr>
<td>CSE 121 GQ* (Programming Techniques)</td>
<td>3</td>
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<td>MATH 140 GQ* (Calculus I)</td>
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<tr>
<td>PHYS 211 GN* (Mechanics)</td>
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<tr>
<td>ENGL 15 or 30 GWS (Rhetoric &amp; Composition)</td>
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## SEMESTER 2
15.5 credits

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<th>Course</th>
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<tbody>
<tr>
<td>CSE 122* (Intermediate Programming)</td>
<td>3</td>
</tr>
<tr>
<td>MATH 141 GQ* (Calculus II)</td>
<td>4</td>
</tr>
<tr>
<td>PHYS 212 GN (Electricity &amp; Magnetism)</td>
<td>4</td>
</tr>
<tr>
<td>Arts, Human, Soc. Beh. Scivi</td>
<td>3</td>
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<tr>
<td>Health &amp; Physical Activitiyv</td>
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## SEMESTER 3
16-17 credits

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<tbody>
<tr>
<td>CSE 221* (OOP with Web Applications)</td>
<td>3</td>
</tr>
<tr>
<td>CSE 271* (Intro to Digital Systems)</td>
<td>3</td>
</tr>
<tr>
<td>MATH 230 (Calculus III)</td>
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<td>Natural Sciencevi</td>
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<td>Arts, Human, Soc Beh Sci vi</td>
<td>3</td>
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## SEMESTER 4
17 credits

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<tr>
<th>Course</th>
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<tbody>
<tr>
<td>CSE 331* (Comp. Organization &amp; Design)</td>
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<td>MATH 220 (Matrices)</td>
<td>2</td>
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<td>STAT 318 (Elementary Probability)</td>
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<tr>
<td>CAS 100 A/B (Effective Speech)</td>
<td>3</td>
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<tr>
<td>CSE 260* (Discrete Math for Computer Science)</td>
<td>3</td>
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<tr>
<td>CSE 311* (Systems Programming)</td>
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## SEMESTER 5
16 credits

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<tr>
<td>CSE 431* (Intro Comp Arch)</td>
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<tr>
<td>CSE 465* (Data Structures &amp; Algorithms)</td>
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<tr>
<td>CSE 411* (Operating Systems)</td>
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<tr>
<td>STAT 319 (Applied Statistics in Science)</td>
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<td>Foreign Languageix</td>
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## SEMESTER 6
16 credits

<table>
<thead>
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<tr>
<td>CSE 428* (Programming Lang. Concepts)</td>
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<td>CSE Computer Science Electivei</td>
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<td>ENGL 202C GWS (Technical Writing)</td>
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<td>Department List* (General Elective)</td>
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## SEMESTER 7
15 credits

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<tr>
<td>Supporting Courseviii</td>
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<tr>
<td>Arts, Human, Soc. Beh. Sci.vi</td>
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<tr>
<td>Department List* (General Elective)</td>
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<tr>
<td>CSE Computer Science Electivei</td>
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## SEMESTER 8
16.5 credits

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<tr>
<td>CSE 420W or CSE 441W</td>
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<tr>
<td>Supporting Courseviii</td>
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</tr>
<tr>
<td>Arts, Human, Soc. Beh. Sci.</td>
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</tr>
<tr>
<td>Department List* (General Elective)</td>
<td>3</td>
</tr>
<tr>
<td>Health &amp; Physical Activitiyv</td>
<td>1.5</td>
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</tbody>
</table>

Subscripts in Roman numerals refer to the Graduation Requirements Notes on the following pages.

* A grade of C or better in these courses is required for graduation; (MATH 140, MATH 141, PHYS 211, and CSE 122 require a C or better for entrance to the major). If a course requires a "C" or better and the course is a prerequisite for another course, a "C" is required to meet the prerequisite.

** Select 3 credits from any 400-level CSE course.
GRADUATION REQUIREMENTS NOTES

Many of the courses below have prerequisites; some prerequisites are shown in parentheses; others are given in the Bulletin.

I. Computer Science and Engineering (28 credits):
CSE 121 GQ (3) – Introduction to Programming Techniques
CSE 122 (3) – Intermediate Programming
    (prerequisite: CSE 121; MATH 140)
CSE 221 (3) – Object Oriented Programming with Web-Based Applications
    (prerequisite: CSE 122)
CSE 260 (3) – Discrete Mathematics for Computer Science
    (co-requisite: CSE 122)
CSE 271 (3) – Introduction to Digital Systems
    (concurrent: PHYS 212)
CSE 311 (3) – Systems Programming
    (prerequisite: CSE 221; concurrent: CSE 331)
CSE 331 (3) – Computer Organization and Design
    (prerequisite: CSE 122 and CSE 271)
CSE 431 (3) Introduction to Computer Architecture
    (prerequisite: CSE 331)
CSE 411 (3) – Operating Systems
    (prerequisite: CSE 311; CSE 331)
CSE 428 (3) – Programming Language Concepts
    (prerequisite: CSE 221)
CSE 465 (3) – Data Structures and Algorithms
    (prerequisite: CSE 260)

II. Additional CSE Courses [Computer Science Electives] (12 credits):
One course must be selected from CSE 420W or CSE 441W to satisfy the writing intensive requirement. Some courses are NOT offered every semester or even every year.

Select 12 credits:

Select 6 credits from CSE 421, 457, 418, 481, 451, 455, 456, 460, 467, 468, 458, 486, and EE 456.

Select 3 credits from any 400-level CSE course.

Select 3 credits from CSE 420W or CSE 441W.

*A student may take only one course for credit from CSE (MATH) 451 and 455.

If you are considering graduate school, be sure to talk to your adviser about the best additional courses for you to schedule.

III. Communications (9 credits):
ENGL 15 GWS (3) – Rhetoric and Composition
    (ENGL 30 GWS may be substituted)
ENGL 202C GWS (3) – Technical Writing
CAS 100 A/B (3) – Effective Speech
IV. 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)

V. Health Sciences and Physical Education (3 credits):
The Health Science/Physical Activity (ESACT) requirement can be met by taking one 3-credit course

VI. Natural Sciences (10-11 credits):
Physics (8 credits):
- PHYS 211* GN (4) – General Physics (mechanics)
- PHYS 212* GN (4) – General Physics (electricity, magnetism)
  *Preferred sequence is PHYS 211 and 212, but may not be available at all campuses.
Additional natural science (2-3 credits):
Select 2 credits from PHYS 213 GN(2), 214 GN(2), or 3 credits from any GN except as excluded below.
These GN courses are NOT acceptable:
- ASTRO 1, 10, 11, 120, 140; all BI SC courses; All below CHEM 12;
- PHYS 250, 251, all below PHYS 211
To receive General Education credits, you must take these combinations:
- BIOL 11 and 12
- CHEM 12 (or 17) and 14
- CHEM 13 and 15
- MICRB 106 and 107

VII. Arts, Humanities, Social and Behavioral Sciences, Diversity (18 credits):
Six credits are required in each of the 3 categories: Arts (A), Humanities (H), and Social and Behavioral Sciences (S), as listed under the University's General Education Guidelines [see the University's Baccalaureate Degree Programs Bulletin]. See page 6 [this handbook], General education, for an explanation of the 9-6-3 sequence as it pertains to AHS courses. You may use one of your Arts, Humanities, or Social or Behavioral Sciences sciences selections to fulfill the University’s Diversity requirement (see page 7 [this handbook], Diversity requirement*). A work chart follows.

<table>
<thead>
<tr>
<th>Arts</th>
<th>Humanities</th>
<th>Social Sci.</th>
<th>Diversity Focused Course</th>
</tr>
</thead>
</table>

*For diversity-focused courses, see General Education and Cultural Diversity in the Curriculum on-line and the Semester Course Schedules.
VIII. Supporting courses (6 credits):

- Choose two courses from any one of the following 12 categories. Both courses must be from the same category. A detailed list, including course descriptions and prerequisites, and when the course is likely to be offered, can be found on-line at the Computer Science Supporting Courses website.

- Complete the "Plan for Supporting Courses" form (available in the CSE department office, 342E Information Sciences and Technology Building), showing when you plan to schedule your supporting courses and any prerequisites that might be required. Include a third course from the same category, in the event that one of your preferred courses becomes unavailable. When choosing your supporting courses, be sure to check on their prerequisites, in order to schedule them before your senior year. Have your advisor review and sign the form. Return the completed form to the CSE Undergraduate Secretary at the beginning of your fifth semester.

- On occasion, courses not on the list (for example, certain 497 courses) can be substituted; however, any course not on the list must be approved by Department Petition BEFORE you take the course. Independent Study courses (496s) cannot be substituted.

- Courses with an asterisk are controlled, and you might not be able to schedule them. Before including any of these courses in your plan, you must first check with the department offering the course to see if you fit within the controls. NOTE: Course controls and offerings often change. The Department of Computer Science and Engineering cannot guarantee the availability of any course outside its control.

1. Computer Modeling
   - ERM 412
   - IE 402, 405, 425, 453, 455, 467
   - MATH 484
   - ME 461

2. Electrical Engineering
   - Most 400-level EE courses (excluding those that are cross listed with CSE)
   - IE 464

3. Geographic Information Systems
   - FOR 455
   - GEOG 422, 458*, 480, 481*

   - ARCH 481
   - IE 463
   - MUSIC 458, 459

5. Human Factors
   - FOR 451
   - IE 408W
   - IE 418
   - ME 458
   - PSY 404, 421, 422, 423, 430, 432, 441, 444

6. Instructional Systems
   - INSYS 441, 446, 447

7. Machine Control and Automation
   - IE 450, 456, 463
   - ME 440, 450, 455, 456, 462*
8. Management and Business
   BLOG 421
   ECON 402, 490
   MSIS 402*, 459W*
   OISM 418*
9. Mathematics
   Most 400-level math courses (excluding those that are cross listed with CSE)
10. Quality Engineering
    IE 423, 424, 466
    ME 460
11. Engineering Leadership, Science, Technology, & Society
    ENGR 407, 408, 409
    STS 433, 460, 470
12. Statistics
    EDPSY 450
    STAT 416, 460, 462
*Course is departmentally controlled.

IX. Foreign language proficiency (4 credits)
CMPSC majors are required to demonstrate proficiency equivalent to two semesters of a single foreign language. Since Penn State now requires the equivalent of one semester of a foreign language for admission, 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 (provide the department with a copy of your high school transcripts). You must still make up the four credits, however. In effect, four credits are added to your Department List requirement.

- Complete the 2nd (or higher) semester of one foreign language; e.g. SPAN 2.

- Complete two semesters (8 credits) of a NEW foreign language (other than the one you took in high school). Four of these credits can be applied to Department List electives.

If you were admitted to Penn State with a foreign language deficiency, 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.

X. Department List (General Elective) Guidelines (10-14 credits)
Choose enough credits to bring the total number of credits up to at least 126. If your Diversity course was not an Arts, Humanities, or Social and Behavioral Sciences course, it may be counted in this list. These are sometimes called approved free electives or general electives, but the following restrictions apply:

- no courses not satisfying minimum requirements for baccalaureate degree program (see course descriptions in University Bulletin)
- no courses described as intended for non-science or non-technical majors in course descriptions in University Bulletin (You may take non-technical courses, but 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).
- no more than 4 credits of MATH 140A
- not ENGL 4, 5, or any other remedial English
- none of the following:
  - Astronomy (ASTRO) 1, 10, 11, 120, 140
  - Biological Science (BI SC) 1, 2, 3, 4
  - Chemistry (CHEM) 1, 2, 6, 11
  - Computer Science (CMPSC) 100, 203
  - Earth and Mineral Sciences (EM SC) 150
  - English as a Second Language (ESL) 004
  - Language and Literacy Education (LL ED) 5, 10
  - Mathematics (MATH) 200, MATH below 140
  - Philosophy (PHIL) 12
  - Physical Science (PH SC) 7
  - Physics (PHYS) 250, 251, PHYS below211
  - Science, Technology, and Society (STS) 150
  - Speech Communication (CAS) 126, 283
  - Statistics (STAT or MATH) below 318, 401
- only 1 from the following set:
  - STAT (MATH) 318, STAT(MATH) 414, STAT(MATH) 418
- only 1 from the following set:
  - STAT (MATH) 319, STAT(MATH) 415
- no more than 6 credits of ROTC
- no more than 6 credits of music performance courses
- no more than 3 additional credits of physical education
- no more than 6 credits of Cooperative Education
- no more than 2 credits of Engineering Internship
- no more than 3 credits of CHEM 17

- **IST courses are accepted with the following exception:**
  - IST 210 – (if the student has completed CSE 441W)
  - IST 220 – (if the student has completed CSE 458)

**XI. First Year Seminar (1 credit):**
Small interactive classes that allow first-year students to meet faculty and alumni, explore different majors and career opportunities, or focus on hands-on projects and skill development.
Graduation Requirements Checklist for B.S. Degree in Computer Science

format is COURSE (grade,credits,semester): e.g., CSE 121 (A,3,FA06)

Computer Science and Engineering:
CSE 121GQ ( ,3, ) CSE 122 ( ,3, ) CSE 260 ( ,3, )
CSE 221 ( ,3, ) CSE 311 ( ,3, )
CSE 271 ( ,3, ) CSE 331 ( ,3, ) CSE 431 ( ,3, )
CSE 465 ( ,3, ) CSE 428 ( ,3, ) CSE 411 ( ,3, )

Additional CSE Courses (Computer Science Electives): ________ (9)
CSE ________ ( ,3, ) CSE ________ ( ,3, )
CSE ________ ( ,3, )

Writing Intensive Course: ________ (3)
CSE ________ ( ,3, )

Communications: ________ (9)
ENGL 15 GWS ( ,3, ) ENGL 202C GWS ( ,3, )
CAS 100 GWS ( ,3, )

Quantification, Statistics: ________ (20)
MATH 140 GQ ( ,4, ) MATH 141 GQ ( ,4, ) MATH 230 ( ,4, )
MATH 220 GQ ( ,2, ) STAT 318 ( ,3, ) STAT 319 ( ,3, )

Health Sciences and Physical Activities: ________ (3)
______________ ( , , ) _____________ ( , , )
______________ ( , , )

Physics and Natural Sciences: ________ (10-11)
PHYS 211 GN ( ,4, ) PHYS 212 GN ( ,4, )
additional natural science _____________ ( , , )

Arts, Humanities, Social & Behavioral Sciences, Diversity (indicate GA, GH, GS, & DF): ________ (18)
______________ ( , , ) _____________ ( , , )
______________ ( , , ) _____________ ( , , )
______________ ( , , ) _____________ ( , , )

Supporting Courses, Approved by Adviser: ________ (6)
______________ ( , , ) _____________ ( , , )

Foreign Language Proficiency: ________ (4-8)
______________ ( , , ) _____________ ( , , )

Selections from Department List (General Electives): ________ (10-14)
______________ ( , , ) _____________ ( , , )
______________ ( , , ) _____________ ( , , )
______________ ( , , ) _____________ ( , , )

First Year Seminar: ________ (1)
______________ ( , , ) _____________ ( , , )

TOTAL CREDITS ________ (126+)

________________________ (student name) is planning to graduate at the end of
______________ Semester, 20__. This is to confirm approval of the supporting courses listed above:

Academic Adviser’s Signature ____________________________________________