COMPUTER ENGINEERING, BACHELOR OF SCIENCE

Mission

The Computer Engineering Program at Johns Hopkins is supported by faculty in the Department of Electrical and Computer Engineering and the Department of Computer Science, who are committed to providing a rigorous educational experience that prepares students for further study and to professionally and ethically practice engineering in a competitive global environment. The mission of the program is to provide students with a broad, integrated education in the fundamentals and advanced topics in computer engineering, basic sciences, mathematics, and humanities in an environment that fosters the development of analytical, computational, and experimental skills, and that involves students in design projects and research experiences; and to provide our computer engineering graduates with the tools, skills and competencies necessary to understand and apply today's technologies and become leaders in developing and deploying tomorrow's technologies.

Educational Objectives

The Program Educational Objectives (PEOs) for computer engineering (CE) at the Johns Hopkins University describe what CE graduates are expected to attain within a few years of graduation. The PEOs are determined in consultation with the Electrical and Computer Engineering External Advisory Committee and approved by the ECE faculty.

The educational objectives of the CE program are:

- Our graduates will become successful practitioners in engineering and other diverse careers.
- Some graduates will pursue advanced degree programs in engineering and other disciplines.

Program Requirements

The Bachelor of Science degree in Computer Engineering requires a minimum of 126 credits, which must include the following:

- *Forty-two (42) credits in Computer Engineering, which must include:*

Code	Title	Credits
Electrical and Computer Engineering Courses		
EN.520.123	Computational Modeling for Electrical and Computer Engineering	3
EN.520.142	Digital Systems Fundamentals	3
EN.520.214	Signals and Systems	4
EN.520.230	Mastering Electronics	2
EN.520.231	Mastering Electronics Laboratory	2
Advanced Laboratory and Design Experience Component		
Select 12 credits of advanced laboratory, design intensive, or senior design project courses [1]		12
"Other" Engineering Courses		
Select six (6) credits of engineering courses (with an E designation) from KSAS or School of Engineering departments other than Computer Science, ECE, Applied Mathematics and Statistics, or General Engineering [2]		6
Mathematics Courses		
Twenty-four (24) required Q credits in mathematics courses taken from the Mathematics Department or the Applied Mathematics and Statistics Department. Must include the following: [3]		4
AS.110.109	Calculus II (For Physical Sciences and Engineering)	4
AS.110.202	Calculus III	4
AS.110.201	Linear Algebra	4
EN.553.171	Discrete Mathematics	4
EN.553.311	Probability and Statistics for the Biological Sciences and Engineering	4
Basic Sciences [4]		
16 required N credits (NS not allowed) and must include the following:		3
AS.171.101	General Physics: Physical Science Major I	4
AS.171.102	General Physics: Physical Science Major II	4
AS.173.111	General Physics Laboratory I	1
AS.173.112	General Physics Laboratory II	1
AS.030.101	Introductory Chemistry I	3
Humanities and Social Sciences [5]		
Select at least five (5), three-credit courses in humanities (H) and social sciences (S) and the following courses:		15
EN.660.400	Practical Ethics for Future Leaders	2
EN.520.404	Engineering solutions in a global, economic, environmental, and societal context	1
Writing Intensive Courses		
Two (2) writing intensive courses are required (at least 3 credits each). [6]		6
Computer Science Courses [7]		
EN.601.220	Intermediate Programming	4
EN.601.226	Data Structures	4
EN.601.229	Computer System Fundamentals [8]	3
or EN.520.225	Advanced Digital Systems	
Select at least 4 more credits of Computer science courses		4
Additional Content Credits		
12 additional credits are needed from ECE or CS.		12
Electives		**3**
Total Credits		126

1 *The program must also contain a substantial advanced laboratory and design experience component, appropriate for the student's interests.* This requirement can be met by taking twelve (12) credits of advanced laboratory, design intensive, or senior design project courses from those given in the degree planning checklist in Section I.C. At least six (6) of these 12 credits must be from ECE or CS courses. A GPA of at least 2.0 must be maintained in Computer Engineering courses. Courses in this category may not be taken Satisfactory/Unsatisfactory.

2 **Note**: Entrepreneurship and Management courses in the Center for Leadership Education CANNOT be counted as "other engineering courses". Students must complete enough of the approved non-CS/ECE advanced design labs so that they have at least twelve (12) credits of advanced laboratory, design intensive, or senior design project courses. Courses in this group may not be taken Satisfactory/Unsatisfactory.

[3] AS.110.109 Calculus II (For Physical Sciences and Engineering), AS.110.202 Calculus III, AS.110.201 Linear Algebra or EN.553.291 Linear Algebra and Differential Equations, EN.553.171 Discrete Mathematics, EN.553.310 Probability & Statistics for the Physical Sciences & Engineering/EN.553.311 Probability and Statistics for the Biological Sciences and Engineering or EN.553.420 Introduction to Probability must be taken. Elementary or precalculus courses such as AS.110.105 Precalculus or EN.553.111 Statistical Analysis I-EN.553.112 Statistical Analysis II are not acceptable. (Calculus I may be waived through an examination taken during freshman orientation. If not waived, it must be taken as a prerequisite to Calculus II.) Courses in this category may not be taken Satisfactory/Unsatisfactory.

[4] Courses in this category may not be taken Satisfactory/Unsatisfactory.

[5] ECE students beginning prior to Fall 2018 will be permitted to fulfill this requirement by six (6), three credit courses, or by the guidelines provided above. The humanities and social sciences courses are one of the strengths of the academic programs at Johns Hopkins. They represent opportunities for students to appreciate some of the global and societal impacts of engineering, to understand contemporary issues, and to exchange ideas with scholars in other fields. Some of the courses will help students to communicate more effectively, to understand economic issues, or to analyze problems in an increasingly international world. The selection of courses should not consist solely of introductory courses, but should have both depth and breadth. Typically, this means that students should take at least three (3) courses in a specific area or theme, with at least one of them at an advanced level (300 level or higher).

[6] These courses may not be taken Satisfactory/Unsatisfactory and require a grade of C- or better. Students may wish to consider a course in Technical Communications to fulfill one of the writing intensive requirements.

[7] If you take EN.500.112 Gateway Computing: JAVA it will count as a CS credit even though it has a general engineering number (EN.500.XXX). Please register for the ECE section of Gateway Computing. If you take a different section, you will be required to take a supplemental summer/intersession course (Java Bootcamp) to count this towards CS/ECE requirements.

[8] NOTE: Students can take either EN.601.229 Computer System Fundamentals or EN.520.225 Advanced Digital Systemsto fulfill this requirement, but shouldn't take both courses.

Please note that all EAC ABET accredited programs require 45 credits of engineering coursework. The credit requirement for this program is met by combining major course work (42 credits) along with "other engineering" course work (3 credits of the additional 6 credits required by ECE). Additional details concerning advising and degree requirements are in the *Computer Engineering Advising Manual.* The B.S. in Computer Engineering degree program is accredited by the Engineering Accreditation Commission of ABET, **http://www.abet.org**.

The sample program shown is very general. Other sample programs with a focus in Microsystems, Computer Integrated Surgery, Software, or Robotics can be found in the advising manual.

First Year

First Semester	Credits	Second Semester	Credits
AS.110.109	4	EN.601.220	4
AS.171.101 or 107	4	AS.171.102 or 108	4
AS.173.111	1	AS.173.112	1
EN.520.137	3	EN.520.142	3
EN.500.112	3	EN.520.123	3
	15		15

Second Year

First Semester	Credits	Second Semester	Credits
AS.110.201	4	AS.110.202 or 211	4
AS.030.101	3	EN.601.226	4
EN.520.230	2	EN.520.216	3
EN.520.231	2	EN.520.214	4
EN.601.229	3	H&S 2	3
H&S 1	3		
	17		18

Third Year

First Semester	Credits	Second Semester	Credits
EN.553.171	4	Select one of the following:	4
EN.520.349	3	EN.553.310	
EN.520.340	3	EN.553.311	
ECE Elective 1	3	EN.553.420	
EN.660.400	2	CS Elective 2	3
EN.520.404	1	H&S 4	3
		Basic Science Elective (N)	3
		ECE Elective	3
	16		16

Fourth Year

First Semester	Credits	Second Semester	Credits
Advanced ECE Lab 1	3	Advanced Lab 3[1]	3
Advanced ECE Lab 2	3	Advanced Lab 4[1]	3
Math Elective	4	Non-ECE Engineering Elective 2	3
Non-ECE Engineering Elective 1	3	H&S 6	3
H&S 5	3	ECE Elective	3
	16		15

Total Credits 128

[1] ECE or non-ECE Engineering Adv. Lab from checklist

Learning Outcomes

Students graduating with a B.S. in computer engineering will have demonstrated:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
3. an ability to communicate effectively with a range of audiences
4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts

5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

Each student and faculty advisor must consider these objectives in planning a set of courses and projects that will satisfy degree requirements. The sample programs and the program checklist included in this advising manual illustrate course selections that will help students meet the program objectives.

Faculty and others will assess student performance to ensure that our educational objectives are met. Students will have opportunities to assess their own educational progress and achievements in several ways, including exit interviews and alumni surveys. Through regular review processes, including Academic Council departmental reviews, visits by the departmental external advisory board, course evaluations, and ABET visits; students will have opportunities to discuss their educational experiences and expectations. The outcomes of these assessment processes will be used by the faculty to improve the content and delivery of the educational program.

The success of each student's program will depend on effective faculty advising. Every undergraduate student in the Computer Engineering Program must follow a program approved by a faculty advisor.