JOHNS HOPKINS
UNIVERSITY

Department of Electrical and Computer Engineering

Undergraduate Student Advising Manual

Computer Engineering

(Updated 8/20/2024)

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1. INTRODUCTION

The Department of Electrical and Computer Engineering offers two bachelor's degree programs: one in Electrical Engineering and one in Computer Engineering (with close collaboration of the Computer Science Department). Computer Engineering is concerned with the design and application of analog and digital devices and systems, including computer systems. Topics in our program range from the design of integrated circuits to computer communications and networks, and involve specific courses offered by the Department of Electrical and Computer Engineering and the Department of Computer Science. Under the guidance of his or her faculty mentor , each student may select electives in any of the areas of computer engineering according to their interests, talents, backgrounds, and goals to fulfill degree requirements. Students are strongly encouraged to participate in independent research and guided studies with a faculty member at least once during their undergraduate studies and to participate in a summer internship in an industrial setting to broaden their understanding of computer engineering as a field.

The facilities and resources available to students are considerable. The electronics prototyping facility in the Department of Electrical & Computer Engineering utilizes state of the art technology to support the design, fabrication, and other technical aspects of research and academic projects.

The prototyping facility consists of state of the art surface mount technology (SMT) equipment; a printed circuit board (PCB) milling machine to fabricate PCBs; a multilayer press to produce multilayer PCB that can be milled on the milling machine; Stencil Printer to apply solder paste selectively on the milled PCBs; a pick and place machine to accurately place surface mounted devices (SMD) on the finished PCB; reflow oven for lead free soldering; and two sophisticated, ergonomically designed Mantis microscopes for SMD component assembly.

Additional facilities include a Basic Electronics Laboratory, Cadence Computing Laboratory, ECE Undergraduate Design Studio, Biophotonics Teaching Laboratory, a Microprocessor/FPGA Laboratory, and Makerspace in the Pava Center.

The Electrical and Computer Department employs a **Senior Lab Engineer & Lecturer,** Sathappan Ramesh, sramesh@jhu.edu. All students, faculty and staff must complete a specific lab safety training course dependent on which facility access is required or preferred.

Computer Engineering students are entitled to Computer Science server accounts and use of the labs in Malone 122/322. You can get an account request form available in Malone 160 and forward it to Professor Joanne Selinski for signature.

1.1. *Objectives*

Educating students is the main objective of our department. We believe the best way to achieve this is to expose our students to the scholastically and societally important questions being researched by our faculty. We strive to involve students in significant hands-on ECE team projects in which teams, including freshmen to seniors, build complex systems using in-depth engineering principles, modern design and execution tools, and real-life validation and application environments. These projects promote cooperation and team-based problem solving, leadership, and mentoring, while exposing students to engineering best practices that are invaluable for any successful career choice. Furthermore, we value interdisciplinary

research and activities that allow our students to interact and learn from their peers from other departments.

1.2. *Academic Program*

ABET Criteria. The B.S. degree in Computer Engineering is accredited by ABET, http://www.abet.org. As part of the ABET requirements, the Computer Engineering B.S. degree program has established the following:

1.2.1. Computer Engineering Program Educational Objectives

The Program Educational Objectives (PEOs) for the computer engineering (CE) at the Johns Hopkins University describe what CE graduates are expected to attain with 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:

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

Faculty members will assess student performance to ensure that our educational outcomes and objectives are met. Students will also have an opportunity to provide feedback on their educational experience through course evaluations, as well as by meeting with internal (Academic Council) and external review boards (departmental advisory board, ABET review board). Before and after graduation, students will have the opportunity to assess their own educational progress and achievements by means of an exit interview and alumni surveys. The faculty will use the feedback obtained from these various assessment processes to improve the content and delivery of the program.

1.2.2. Computer Engineering Student Outcomes

The program has student outcomes (1) through (7) that prepare graduates to attain the program educational objectives:

(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

1.2.3. Undergraduate Research Opportunities

The faculty welcomes undergraduate student participation in their research, which greatly enhances the educational experience beyond coursework. Opportunities are available during the academic semesters, intersession, and summer through independent study and research courses or through paid research positions.

Undergraduates at all levels are strongly encouraged to contact faculty members directly to participate in the Department's research programs.

1.2.4. "Responsible Conduct of Research Course" May Be Required

Many undergraduate students participating in research will be required to take the "Responsible Conduct of Research" course.

- Students receiving payment for research or who are conducting research used to help complete degree requirements (such as in an Independent Research or Independent Study course) must first complete the online training course (360.624) before conducting research and receiving payment or credit.
- Students receiving payment from NIH Training Grants must take the in-person training course (360.625).

Information is available at https://engineering.jhu.edu/undergraduate-studies/research-opportunities-for-students/. Successful completion of this course must be verified before a student's diploma is issued.

1.3 Advising

1.3.1. Visit Your Advisor Often

There is a change in advising. All students are randomly assigned a faculty mentor their first year (or transfer) and keep the same mentor for the rest of their academic career. A student may change a faculty mentor at any time by contacting Malik Johnson. His office is in Barton Hall 117B, email: malik.johnson@jhu.edu. Both the ECE Chair and the Director of Undergraduate Studies must certify each student's program as having met the requirements for graduation.

The faculty mentor assists the student in developing an approved program, including assignment of credits to the proper categories and judging the appropriateness of area designators. However, it should be understood that satisfaction of degree requirements is ultimately the responsibility of the student. The student is expected to understand the degree requirements and engage in careful program planning with the faculty mentor . Students should also be familiar with the University's undergraduate policies outlined in the university catalogue https://e-catalogue.jhu.edu/, and WSE advising policies found at https://engineering.jhu.edu/advising/.

Faculty advisors may also help with other aspects of the student's academic career, such as admission to graduate and professional schools or career planning. They may be able to direct students to other advising and counseling resources that provide information on internship opportunities, and direct students to independent research and guided independent studies. Faculty advisors are also a means for undergraduate students to provide valuable feedback on all aspects of their educational experiences to improve the undergraduate education for all students.

The Electrical and Computer Engineering faculty make every effort to be available to their advisees, particularly during the scheduled fall and spring term advising weeks. The student is required to meet with his/her advisor at least once – and preferably more – each semester. It is the responsibility of the student to initiate these meetings with the advisor. It is important that students remain in close contact with their advisors and consult with them before making changes in their program.

1.3.2 Advising Holds on Registration

The faculty mentor must release advising holds on your registration record in SIS before you can register for classes. This is typically done during Advising Week which is the week just before registration begins. Your advising hold will not be released until you have reviewed your course plans with the advisor. The faculty mentor will also sign add/drop forms. Please note that unless prior arrangements have been made, no faculty member other than the student's own advisor can sign the required forms.

Bachelor of Science Degree in the Computer Engineering Major

2. COMPUTER ENGINEERING CURRICULUM

2.1 Mission Statement

The Faculty of the Computer Engineering Program at Johns Hopkins 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 a stimulating and flexible curriculum in fundamental and advanced topics in computer engineering, basic sciences, mathematics, and humanities, in an environment that fosters 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. From this mission statement, the Computer Engineering faculty has established student outcomes and educational objectives for the B.S. in Computer Engineering degree program.

2.2. *Educational Objectives*

The educational objectives of the CE program are:

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

2.3. *Computer Engineering Curriculum*

The B.S. degree in Computer Engineering requires a minimum of one hundred and twenty-six (126) credits that must include:

- Forty-two (42) credits in Computer Engineering, which must include:
    - At least fifteen (15) credits of Electrical and Computer Engineering courses, which must include **First-Year ECE Design (520.137), Digital System Fundamentals (520.142), Signals and Systems (520.214),** and **Mastering Electronics (520.230)** and **Mastering Electronics Lab (520.231)**.
    - At least fifteen (15) credits of Computer Science courses, which must include **Intermediate Programming (601.220)**, **Data Structures (601.226)** and **Computer System Fundamentals* (601.229)**. (***You can count either 601.229, Computer Systems Fundamentals, or 520.222, Computer Architecture as a CE required course).** If you take Gateway Computing: Python (500.113), it will count as a CS credit, even though it has a general engineering number (500.xxx). Please be sure to register for the section of Gateway Computing reserved for ECE students.
    - 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 attached advising checklist in Section III. At least six (6) of these twelve credits must be from ECE and CS.
    - A GPA of at least 2.0 must be maintained in Computer Engineering courses. **Courses in this group must be taken for a grade. In order to count for this requirement, they cannot be taken as Pass/Fail.**

- Six (6) credits of engineering courses from School of Engineering departments other than ECE, Applied Mathematics and Statistics, or General Engineering. Students must complete enough of the approved non-ECE advanced design labs so that they have at least twelve (12) credits of combined ECE and non-ECE advanced laboratory, design intensive, or senior design project courses. Courses in this group must be taken for a grade. In order to count for this requirement, they cannot be taken as Pass/Fail. Entrepreneurship and Management courses in the Center for Leadership Education CANNOT be counted as "other engineering courses".

- Twenty-four (24) credits in mathematics courses taken from the Mathematics Department or the Applied Mathematics and Statistics Department. **Calculus II (110.109), Calculus III (110.202), Linear Algebra (110.201) or Linear Algebra and Differential Equations (553.291), Discrete Mathematics (553.171) or Mathematical Foundations for Computer Science (601.230), Probability and Statistics (553.310/311) or Introduction to Probability (553.420) must be taken**. Elementary or pre-calculus courses, such as 110.105 or 553.111-112, are not acceptable. **Courses in this group must be taken for a grade. In order to count for this requirement they cannot be taken as Pass/Fail.** 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.

- Sixteen (16) credits of natural sciences (physics, astronomy, chemistry, biology, biophysics, earth and planetary sciences) which must include General Physics (171.101-102), General Physics Laboratory (173.111-112), and Introductory Chemistry (030.101). If Physics labs are waived, no credits are awarded, and students must complete additional coursework to reach 16 credits. Other courses with a "N" designation code will be considered on a case by case basis. However, courses coded as "NS" from Psychology, Cognitive Science, and Neuroscience cannot towards this area. **Courses in this group must be taken for a grade. In order to count for this requirement they cannot be taken as Pass/Fail.**

- At least five (5), three-credit courses in humanities and social sciences, and Practical Ethics for Future Leaders (660.400) (2 cr.), and Engineering Solutions in a Global, Economic, Environmental, and Societal Context (520.404) (1 cr.) OR Practical Ethics: Special Topics (EN.660.406) (1 cr.) for a total of 18 credits. 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. This means that students must take at least three (3) courses in a specific area with at least one of them at an advanced level (300 or 400 level). Courses in this group can be taken as Pass/Fail if they are not being used to fulfill the writing intensive requirement.

- Two (2) writing intensive (W) courses (at least 3 credits each) are required. **The writing intensive courses cannot be taken Pass/Fail and require a C- or better**

grade. Students may wish to consider a course in Technical Communications to fulfill one of the writing intensive requirements. The course **661.315, The Culture of the Engineering Profession**, is recommended by the ECE Faculty as a writing intensive course.

3.THE COMBINED FIVE-YEAR BACHELOR'S / MASTER'S PROGRAM

The Electrical and Computer Engineering department offers a combined five-year Bachelor's/Master's (B.S. / M.S.E.) program for Electrical Engineering and Computer Engineering majors.

This is an excellent program for individuals who would like to earn the master's degree quickly. The degree will generally increase a student's chances for higher quality employment than would a bachelor's degree.

3.1. *Eligibility and Application Process*

This program is available *only* to Electrical Engineering or Computer Engineering majors at the Johns Hopkins University.

The latest deadline to apply is the end of your first senior semester.

The application process is explained at https://engineering.jhu.edu/ece/undergraduate-studies/concurrent-bachelorsmasters/.

3.2. *Whiting School 50% Tuition Fellowship*

Combined bachelor's/master's students will earn graduate student status and receive a Dean's Master's Fellowship, covering 50 percent of tuition, when they have full-time, resident status in a fall/spring semester, have been admitted to a full-time WSE master's program, and have completed eight full-time semesters of study at JHU. Please visit https://engineering.jhu.edu/education/combined-degrees/deans-masters-fellowship/ for more information.

3.3. *Requirements*

The requirements for the M.S.E. degree in Electrical and Computer Engineering (ECE) are as follows:

1. Satisfactory completion of eight one-semester 3-4 credit graduate courses (xxx.400 -
   a)799) approved by the advisor.
   b)At least five of these courses must come from the full-time ECE department (EN.520.XXX).
   c)Courses that are primarily Independent Study or Dissertation Research may not count as part of these five courses. These courses include 520.800- Independent Study, 520.802- Dissertation Research, and 520.806- Master's Research. Students may count one of these primary research courses as one of the additional 3 courses that make up the (8) 3-4 credit courses required. Students must submit a research report for this course.

c) The ECE Seminar Course (520.895) and Special Studies courses cannot count towards the 5 ECE courses.
d) Students are required to take EN.520.895 ECE Seminar for two semesters.

2. In addition to the eight courses above, students must also fulfill one of the following three requirements:
   a) Satisfactory completion of two additional one-semester 3-4 credit graduate courses (xxx.400 -xxx.799) approved by the advisor. At least one of these courses must come from the full-time ECE department (520.XXX). These can include Independent Study and Dissertation or Master's Research, accompanied by the research report.
   b) Write an M.S.E. essay (the official name of the master's theses at Johns Hopkins) acceptable to a member of the ECE faculty. The M.S.E. essay must be submitted to the library and must follow the guidelines described in http://www.library.jhu.edu/library-services/electronic-theses-dissertations/; or
   c) Completion of a special project acceptable to a member of the ECE faculty and writing a corresponding report. A copy of this report must be submitted to the ECE office and becomes a permanent part of the student's record.

3. Additional Notes

- Engineering for Professionals (EP) courses (525.XXX) do not count as ECE courses.
- No more than two courses may be chosen from the part-time Engineering for Professionals (EP) program.
- A graduate course designated Independent Study, Dissertation Research, or Special Studies that is counted toward the M.S.E. degree must include a written report. A copy of the report will become part of the student's permanent file. Students can only use one of these courses towards MSE degree requirements, if they are completing their degree using option 1 (two additional courses).
- Every graduate course designated Independent Study, Dissertation Research, or Special Studies counted toward the M.S.E. degree must include a written report. A copy of the report will become a part of the student's permanent file.
- To fulfill requirements 1 or 2, a course is satisfactorily completed if a grade from A+ to C- or a "P" is obtained. No more than one C+, C, or C- and/or "P/S" grade can be counted toward the degree requirements.
- The ECE department does not allow Bachelor's/Master's double counting of courses. Students in the combined B.S.E./M.S.E. program can take courses concurrently for the two degrees, but each course may only count for either the B.S.E. or M.S.E. program.
- Every student must be registered in the semester that degree requirements are met; this includes students who have no courses remaining in which to enroll but must resolve coursework for which an "Incomplete" grade was assigned and those who must complete

other academic requirements, such as a language or computing requirement (these students may apply for Nonresident Status).

The Electrical and Computer Engineering Department and the Computer Science Department offer a joint B.S. / M.S.E. program in which candidates may seek a combined B.S. degree in ECE and an M.S.E. degree in Computer Science. Applicants should apply directly to the Computer Science Department for admission to the M.S.E. program. Students in this program will have two (2) advisors: one for the undergraduate degree program and one for the graduate degree program.

4. ACADEMIC AND PROFESSIONAL ETHICS

Students at the Johns Hopkins University are expected to uphold high ethical standards. The Constitution of the Undergraduate Academic Ethics Board of the Krieger School of Arts and Sciences and the GWC Whiting School of Engineering states that:

"Undergraduate students enrolled in the School of Arts and Sciences or the GWC Whiting School of Engineering at the Johns Hopkins University assume a duty to conduct themselves in a manner appropriate to the University's mission as an institution of higher learning. Students are obliged to refrain from acts, which they know, or under the circumstances have reason to know, violate the academic integrity of the University. Violations of academic ethics include, but are not limited to: cheating, plagiarism, altering academic documents or transcripts, submitting the same or substantially similar work to satisfy the requirements of more than one course without permission; submitting as one's own the same or substantially similar work of another; knowingly furnishing false information to any agent of the University for inclusion in academic records; falsification, forgery, alteration, destruction or misuse of official University documents or seal."

The constitution further states in "Responsibilities of Students & Faculty, section B, that "It is the responsibility of each student to report to the professor in charge of the course or to the Ethics Board any suspected violations of academic ethics as outlined in, "Violations of Academic Integrity." Students can find the "Homewood Undergraduate Academic Ethics Policy" at https://studentaffairs.jhu.edu/policies-guidelines/undergrad-ethics/.

Students should also be aware that professional societies, industries, and government agencies all have ethical codes and standards to ensure both good business practices and to maintain the public trust. The Institute of Electrical and Electronics Engineers (IEEE) represents the profession of Electrical Engineering, and students should read that organization's code of ethics published on the web site: http://www.ieee.org/about/corporate/governance/p7-8.html.

5. PROFESSIONAL SOCIETIES, HONOR SOCIETIES, AND AWARDS

5.1. Institute of Electrical and Electronics Engineers

Undergraduates are encouraged to join the student chapter of the Institute of Electrical and Electronics Engineers (IEEE). Go to https://engineering.jhu.edu/ece/ieee-student-chapter/ for more information.

5.2. *Eta Kappa Nu*

The department sponsors a chapter of Eta Kappa Nu, the Electrical Engineering Honor Society. Membership is by invitation only. Juniors must be in the top quarter of their class, and Seniors must be in the top third of their class, based on their cumulative scholastic rank.

5.3. *Awards*

Each year, the ECE Department honors the graduating senior with the highest GPA with the John Boswell Whitehead Award for excellence in academic achievement. One CE and one EE senior is awarded the Charles A Conklin Award and the William H. Huggins Award for outstanding academic achievement. The Huggins Award is also given to one CE and one EE junior with the highest GPA. Additionally, a student is awarded the Electrical and Computer Engineering Student Leadership & Service Award for leadership and service to the department. The Muly Family Undergraduate Research Award is given to an exceptional student for outstanding research contributions made in the department. Occasionally, the Innovative Design Award is given to a team who has created an exceptional product in one of our advanced design lab courses.

6.SENIOR EXIT INTERVIEWS

Several weeks before commencement, seniors are required to complete an online Senior Exit Interview survey and arrange an exit interview with the Department Chair. Seniors CANNOT graduate unless these two things have been completed.

7. GENERAL INFORMATION

7.1. WSE Office of Academic Affairs

The Office of Academic Affairs (Wyman Hall, first floor) has general responsibilities for all engineering majors in the Whiting School of Engineering: https://engineering.jhu.edu/advising/. The Vice Dean and his staff coordinate faculty advising, maintain student records, and handle academic problems that fall outside the scope of the faculty mentor . The office also provides support for non-department student organizations, such as the Society of Women Engineers and the Johns Hopkins Organization for Minority Engineers and Scientists. In addition, the office maintains and distributes undergraduate advising manuals for each of the engineering majors. Additional responsibilities include:

- Informing students regarding leaves of absence and withdrawals.
- Determining advanced standing and acceptance of coursework done at another college/university.
- Advising students on graduation eligibility.
- Informing students regarding proper procedures for taking summer school courses.
- Reporting unsatisfactory course performance to freshmen.
- Placing students on academic probation, monitoring students on probation and identifying students who are required to withdraw from the University.
- Interpreting University academic policy and departmental policy.
- Providing information about internship and study abroad opportunities in engineering.
- Coordinating tutoring for students in engineering courses.

- Informing students regarding the tutoring, study skills and pre-professional counseling services of the Office of Academic Advising.

7.2. *JHU Office of Academic Advising*

The Office of Academic Advising (Wyman Hall, first floor) provides the following services for engineering students: https://engineering.jhu.edu/advising/

- Coordinating premedical, pre-law and public health advising
- Assisting students with disabilities in meeting their academic needs
- Teaching effective study skills
- Offering tutoring in many required courses
- Maintaining a reference library of graduate and professional school publications
- Providing information about national and international scholarships and fellowships, as well as summer internships
- Providing information on study abroad
- Give students approval to overload courses

7.3. *Notice of Nondiscriminatory Policy*

The Johns Hopkins University admits students of any race, color, sex, religion, national or ethnic origin, age, disability or veteran status to all of the rights, privileges, programs, benefits and activities generally accorded or made available to students at the University. It does not discriminate on the basis of race, color, sex, religion, sexual orientation, national or ethnic origin, age, disability or veteran status in any student program or activity, including the administration of its educational policies, admission policies, scholarship and loan payments, and athletic and other University-administrated programs or in employment. Accordingly, the University does not take into consideration personal factors that are irrelevant to the program involved. The Johns Hopkins University admits students of any race, color, gender, religion, age, national or ethnic origin, disability, marital status or veteran status to all of the rights, privileges, programs, benefits, and activities generally accorded or made available to students at the university. It does not discriminate on the basis of race, color, gender, marital status, pregnancy, ethnicity, national origin, age, disability, religion, sexual orientation, gender identity or expression, veteran status, or other legally protected characteristic in any student program or activity administered by the university, including the administration of its educational policies, admission policies, scholarship and loan programs, and athletic and other university administered programs or in employment.

Questions regarding Title VI, Title IX, and Section 504 should be referred to the **Office of Institutional Equity**, Wyman Park Building, Suite 515, Telephone: (410) 516-8075, (TTY): (410) 516-6225.

7.4. *Office of Student Disability Services*

The Office of Student Disability Services (SDS) assists full-time undergraduate and graduate students in the Krieger School of Arts and Sciences and the Whiting School of Engineering with disability concerns, in compliance with the provisions of the Americans with Disabilities Act of 1990 (ADA) and Section 504 of the Rehabilitation Act of 1973.

SDS assists the University community in understanding the effects of disabilities and in

eliminating the physical, technical, attitudinal and programmatic barriers that limit the range of opportunities for students with disabilities, as well as provides individuals with reasonable accommodations. The SDS maintains and protects the confidentiality of individual records as required by law.

For additional information and to access the services of the SDS office, please see their website at https://www.jhu.edu/life/disability-services/ or contact them at 410-516-4720 or studentdisabilityservices@jhu.edu.

If you are a student with a disability or believe you might have a disability that requires accommodations, please contact Dr. Terri Massie - Burrell**,** Director, Student Disability Services, in the Office of Institutional Equity, (410) 516-4720, tmassie1@jhu.edu.

8. GRADUATION PROCESS: B.S. IN COMPUTER ENGINEERING

In the second to last semester your transcripts will be audited to ensure that you are on track to graduate the following semester. You will receive a copy of your degree audit via email along with an email that outlines the completed requirements and the requirements that remain. You will receive a similar e-mail again in your final semester outlining any outstanding requirements and notifying you that you are either eligible or ineligible to graduate.

You will complete an "Application for Graduation" form online in SIS under their Program of Study (Note: any subsequent changes must be done on a hardcopy obtained from the Registrar's Office). This form is then used by the Office of Academic Affairs to generate a list of candidates for B.S. degrees that is then sent to the ECE Department. If you need to apply for graduation after the deadline has passed, you will be required to submit a paper form to the Registrar.

The undergraduate program coordinator will audit your file and ensure that all requirements will be met by the end of the semester. Your degree audit will also be reviewed by the Chair, and then forwarded to WSE Undergraduate Studies for final conferral. Any exceptions and waivers of policy must be noted on your degree audit. If something is missing you should notify the undergraduate program coordinator.

Next, you will receive an e-mail asking you to complete the "Senior Exit Survey for the Computer Engineering Program". You will also receive an invitation to meet with the ECE Chair to discuss your experience at Hopkins. You are required to complete this survey and interview and will not be permitted to graduate unless you have completed these steps.

Notes:

- The deadlines to apply for graduation are posted on the Registrar's website at https://studentaffairs.jhu.edu/registrar/students/graduation/
- Departmental Honors are only given for **first majors**, and only when the GPA is 3.5 or higher in ECE coursework.

9. REQUIRED COURSEWORK

The following courses are required for the B.S. in Computer Engineering and count towards the required 42 (E) credits:

- EN.520.137 First Year ECE Design (spring)
- EN.520.142 Digital System Fundamentals (spring)
- EN.520.214 Signals & Systems (spring)
- EN.520.230/231 Mastering Electronics & Lab (fall & spring)
- EN.601.220 Intermediate Programming
- EN.601.226 Data Structures

- EN.520.225 Advanced Digital Systems *OR*
- EN.520.229 Computer Systems Fundamentals

Computer Engineering majors must complete 24 credits of Q courses including:

- AS.110.109 Calculus II
- AS.110.202 Calculus III
- AS.110.201 Linear Algebra OR Linear Algebra & Differential Equations
  EN.553.291
- EN.553.171 Discrete Mathematics OR Mathematical Foundations for Computer
  EN.601.230 Science
- EN.553.310/311 Probability & Statistics OR Introduction to Probability
  EN.553.420

Computer Engineering majors must complete 16 credits of N courses including:

- AS.171.101 General Physics I
- AS.173.111 General Physics Lab I
- AS.171.102 General Physics II
- AS.173.112 General Physics Lab II
- AS.030.101 Introductory Chemistry

Total of 12 credits of Advanced Labs

A. ECE or CS (minimum of 6 credits from this category)

- Machine Learning for Signal Processing
- FPGA Synthesis Laboratory
- Design of Biomedical Instruments and Systems
- Medical Image Analysis
- Machine Intelligence on Embedded Systems
- Electronics Design Laboratory
- Advanced Microprocessor Laboratory
- Control Systems Design
- ECE Ideation & Design Lab (Third & Fourth Year)
- Bio-Photonics Laboratory
- CAD of Digital VLSI Systems
- Mixed Mode VLSI Systems

- Microfabrication Lab
- Senior Design Project I
- Databases
- Computer Science and Innovation & Entrepreneurship II
- Distributed Systems
- Object Oriented Software Engineering
- Security & Privacy in Computing
- Computational Genomics: Sequences
- Augmented Reality
- Computer Integrated Surgery II
- Computer Vision
- Information Retrieval & Web Agents
- Machine Translation
- Machine Learning: Data to Models
- Machine Learning: Deep Learning
- Computer Integrated Surgery II – Teams

B. Other Engineering

- Senior Design in Materials Science & Engineering I and II
- Robot Sensors and Actuators
- Mechatronics
- Effective & Economical Design for Biomedical Instrumentation
- Microfabrication Laboratory
- Project in Design: Pharmacokinetics
- Project in Design: Pharmacodynamics
- Projects in the Design of a Chemical Car
- Neuro Data Design I and II
- Junior BME Design
- Senior BME Design Team
- Rehabilitation Engineering Design Lab
- Biomedical Instrumentation II
- Precision Care Medicine
- Medical Imaging

Six credits from "Other Engineering" disciplines (coded as E). Up to six credits of "Other Engineering Advanced Labs" can also be used to fulfill the advanced lab requirement (essentially fulfilling two different requirements).

- Senior Design in Materials Science & Engineering I and II
- Robot Sensors and Actuators
- Mechatronics
- Effective & Economical Design for Biomedical Instrumentation
- Microfabrication Laboratory
- Project in Design: Pharmacokinetics
- Project in Design: Pharmacodynamics

- Projects in the Design of a Chemical Car
- Neuro Data Design I and II
- Junior BME Design
- Senior BME Design Team
- Rehabilitation Engineering Design Lab
- Biomedical Instrumentation II
- Precision Care Medicine
- Medical Imaging

EN.520.404 or EN.660.406 and EN.660.400 are required but count towards H/S requirements. These courses are only offered in fall.

Most courses are not offered every semester, so you should be mindful of when they are offered and if they are pre-requisites for other courses.

All programs are subject to the following guidelines:

- All advanced placement credits must be applied to the category of the corresponding Homewood course.

- Transfer students from other institutions must complete at least 21 credits from the Electrical and Computer Engineering Department at Johns Hopkins in order to be eligible for the B.S. degree.

- Courses taken through the School of Professional Studies in Business and Education (either evening or summer session) or the JHU/WSE Engineering Programs for Professionals may be counted only if taken with the advisor's prior written approval.

- Courses taken without the faculty advisor's written approval on the registration or add/drop form may not be counted.

10. FOCUS AREAS

The Department of Electrical and Computer Engineering (ECE) offers classes in many different intellectual areas within ECE's fields. Here, elective classes are organized into overlapping focus areas to help students plan their courses of study. Specializing in a focus area is optional, and students are encouraged to work with their academic advisor to tailor a program to their individual interests. Note that not all courses listed are guaranteed to be taught every year.

10.1 COMPUTING SYSTEMS

Course #	Term	Course Name
520.216	S	Introduction to VLSI
520.344	F	Introduction to Digital Signal Processing
520.349	F	Microprocessor Lab I
520.353	S	Control Systems
520.412	F	Machine Learning for Signal Processing
520.417	S	Computation for Engineers
520.418	F	Modern Convex Optimization
520.424	F	FPGA Synthesis Lab
520.440	S	Machine Intelligence on Embedded Systems
520.447	F	Information Theory
520.448	S	Electronics Design Laboratory
520.450	S	Advanced Micro-Processor Lab
520.485	S	Advanced Semiconductor Devices
601.414	S	Computer Networks
601.415	F	Databases
601.417	F	Distributed Systems
601.418	F	Operating Systems
601.420	F	Parallel Programming
601.421	F/S	Object Oriented Software Engineering
601.428	F	Compilers and Interpreters
601.433	F/S	Introduction to Algorithms
601.476	S	Machine Learning: Data to Models

10.2. INTEGRATED CIRUITS & MICROSYSTEMS

Course #	**Term**	**Course Name**
520.216	S	Introduction to VLSI
520.302	S	Internet of Things Project Lab
520.340	F	Introduction to Mechatronics
520.349	F	Microprocessor Lab I
520.424	F	FPGA Synthesis Lab
520.440	S	Machine Intelligence on Embedded Systems
520.448	S	Electronics Design Laboratory
520.450	S	Advanced Micro-Processor Lab
520.491	F	CAD Design of Digital VLSI
520.492	S	Mixed Signal VLSI Systems
530.495	F	Microfabrication Lab
601.414	S	Computer Networking Fundamentals
601.418F	Operating Systems	

10.3 MACHINE LEARNING AND ARTIFICIAL INTELLIGENCE

Course #	**Term**	**Course Name**
520.302	S	Internet of Things Project Lab
520.315	F	Introduction to Bio-Inspired Processing of Audio-Visual Signals

520.344	F	Introduction to Digital Signal Processing
520.353	S	Control Systems
520.385	S	Signals, Systems & Learning
520.412	F	Machine Learning for Signal Processing
520.414	F	Image Processing & Analysis
520.415	S	Image Processing & Analysis II
520.417	S	Computation for Engineers
520.418	F	Modern Convex for Optimization
520.438	S	Deep Learning
520.440	S	Machine Intelligence on Embedded Systems
520.445	F	Audio Signal Processing
520.447	F	Information Theory
520.454	F	Control Systems Design
520.465	F	Machine Perception
520.471	F/S	Speech Technologies Reading Group
601.454	S	Augmented Reality
601.464	F/S	Artificial Intelligence
601.465F	Natural Language Processing	

10.4 MEDICAL IMAGING

Course #	Term	Course Name
520.150	S	Light, Image, and Vision
520.220	S	Electromagnetic Waves
520.315	F	Introduction to Bio-Inspired Processing of Audio-Visual Signals
520.344	F	Introduction to Digital Signal Processing
520.385	S	Signals, Systems & Learning
520.403	F	Introduction to Optical Instruments
520.405	S	Advanced Optical and Optoelectronic Instruments and Devices
520.412	F	Machine Learning for Signal Processing
520.414	F	Image Processing and Analysis I
520.415	S	Image Processing and Analysis II
520.417	S	Computation for Engineers
520.418	F	Modern Convex Optimization
520.427	F	Design of Biomedical Instruments and Systems
520.432	F	Medical Imaging Systems
520.433	S	Medical Image Analysis
520.439	S	Machine Learning for Medical Applications
520.465	F	Machine Perception
520.483S	Bio-Photonics Laboratory	

10.5 PHOTONICS & OPTOELECTRONICS

Course #	Term	Course Name
520.150	S	Light, Image, and Vision
520.220	S	Electromagnetic Waves
520.370	F	Introduction to Renewable Energy Engineering
520.403	F	Introduction to Optical Instruments
520.405	S	Advanced Optical and Optoelectronic Instruments and Devices

520.407	F	Introduction to the Physics of Electronic Devices
520.457	F	Quantum Mechanics for Engineering
520.470	F	Infra-Red Sensing and Technologies
520.482	S	Introduction to Lasers
520.483	S	Bio-Photonics Laboratory
520.485	S	Advanced Semiconductor Devices
520.486	S	Physics of Semiconductor Electronic Devices
520.495F	Microfabrication Lab	

10.6 ROBOTICS

Course #	Term	Course Name
520.302	S	Internet of Things Project Lab
520.315	F	Introduction to Bio-Inspired Processing of Audio-Visual Signals
520.340	F	Introduction to Mechatronics
520.344	F	Introduction to Digital Signal Processing
520.349	F	Microprocessor Lab I
520.353	S	Control Systems
520.412	F	Machine Learning for Signal Processing
520.424	F	FPGA Synthesis Lab
520.440	S	Machine Intelligence on Embedded Systems
520.445	F	Audio Signal Processing
520.448	S	Electronics Design Lab
520.450	S	Advanced Microprocessor Lab
520.454	F	Control Systems Design
520.465	F	Machine Perception
520.471	F/S	Speech Technologies Reading Group
530.420	F	Robots, Sensors and Actuators
530.421	S	Mechatronics
601.461	F	Computer Vision
601.463	F/S	Algorithms for Sensor-Based Robotics
601.464	F/S	Artificial Intelligence

10.7 SIGNALS, SYSTEMS, & COMMUNICATION

Course	**Term**	**Course Name**
520.315	F	Introduction to Bio-Inspired Processing of Audio-Visual Signals
520.344	F	Introduction to Digital Signal Processing
520.353	S	Control Systems
520.370	F	Introduction to Renewable Energy Engineering
520.385	S	Signals, Systems, and Learning
520.412	F	Machine Learning for Signal Processing
520.414	F	Image Processing and Analysis I
520.415	S	Image Processing and Analysis II
520.418	F	Modern Convex Optimization
520.427	F	Design of Biomedical Instruments and Systems
520.432	F	Medical Imaging Systems
520.433	S	Medical Image Analysis

520.438	S	Deep Learning
520.445	F	Audio Signal Processing
520.447	F	Information Theory
520.454	F	Control Systems Design
520.465	F	Machine Perception

10.8 Multi-Term Classes

For multiterm courses, enrollment in part I necessitates enrollment in subsequent parts. Students must be enrolled in SIS, the system of record. If a student subsequently drops or fails to register for subsequent parts of a multiterm course, a grade of W (withdrawn) will be assigned for the first part. Students may not register for subsequent parts of the course without having enrolled in part I.

11. FREQUENTLY ASKED QUESTIONS

Q: If this is my second major which requirements do I have to complete for my CE degree?

A: You must complete your ECE, Other Engineering, Programming, Q, N, and Ethics requirements. You do not need to fulfill ECE's writing intensive, H/S, or Breadth and Depth requirements.

Q: How do I count Business courses offered in the Applied Mathematics and Statistics Department?

A: Count these courses as electives. Please note: these courses **CANNOT** be counted as "other engineering" courses.

Q: Can I use an ECE cross-listed course as "Other Engineering"?

A: No, ECE (520) courses cross-listed in other departments cannot be counted as "other engineering".

Q: How do I get a senior design project? And is it necessary that the project be done in the ECE department and/or under the guidance of an ECE faculty member?

A: All seniors must take both sections of Senior Design (520.498/499) with Professor Lucas Buccafusca

Q: How can I get Gateway Computing waived?

A: You must earn a 5 on the AP exam or a 6 & 7 on the IB Computer Science exam. ECE students are required to complete Intermediate Programming, so this will only waive the pre-req., not the programming requirement.

Q: I am majoring in CE. Can I take an ECE or CS course pass/fail?

A: A student is allowed to (but not encouraged) to take an ECE or CS course pass/fail. In this case, the course **CANNOT** be counted toward the 45-credit ECE requirement. It can only be counted as an **ELECTIVE** (area VI).

Q: Am I allowed to take humanities courses pass/fail?

A: In general, humanities courses can be taken pass/fail. The only exceptions are the two courses that count toward the writing intensive (W) course requirement. These may not be taken pass/fail. You must also earn a grade of C- or higher in order to count.

Q: Can I have a grade "uncovered" after I take it as an S/U?

A: You can only have an "uncovered" grade switch from S/U to a letter grade if you have changed to a major where a grade is required in the course.

Q: If I take a class as a S/U, can I improve my grade in a course by taking it again?

A: If you retake a S/U graded course, the same grading method will apply if you re-take it.

Q: Do add/drops show on my transcript?

A: No, but withdrawals (W) do. However, they do not affect your GPA.

C

Q: Do I need permission to retake a class?

A: You do not need permission to retake one class. However, if you have more than one class to retake, you will need to get permission from your WSE professional advisor.

Q: How should I handle requirement changes in the program?

A: You are bound to the requirements of the catalog under which you entered. If you are unsure about your requirements, check with the academic program coordinator or your faculty mentor .

Q: For my humanity/social sciences requirement, can I take courses coded NS or must they be only H or S?

A: Courses coded NS can be counted as Social Science (S), but not as natural science courses (N).

Q: Why is there an advisor hold alert on my account?

A: All WSE students have a hold placed on their accounts after the second week of classes. Students are required to get permission from their advisors to drop courses and to register for the following semester.

Q: Can I count writing intensive courses (W) that do not carry an (H) or (S) descriptor as humanities and social science electives?

A: No.

Q: Can I count the first two courses in a foreign language as (H) credits if I am an engineering major?

A: Yes.

Q: How many credit hours of 520.xxx Independent Study can I count towards the 45 required EE credits or 42 required EE/CS credits for the BS/CE?

A: No more than 6**.**

Q: What are the prerequisites for Mastering Electronics/Lab (520.230/231)?

A: Physics II(171.102) and Physics II Lab (173.112) and Calculus II.

Q: Can BME Systems and Controls count toward my EE credit requirement as a substitute for Control Systems?

A: No.

Q: I have a score of 3 on the AP Calculus BC exam, which gives me 4 credits and exempts me from Calculus I (110.108). May I count my 4 credits from the AP Calculus exam towards fulfilling the mathematical requirements for my degree?

A: Yes, you may count the 4 credits from AP Calculus as part of the Mathematics and Mathematical Science Requirements provided that they show up on your transcript.

Q: Can I double-count graduate courses for both my B.S. and M.S.E. degrees?

A: No, you may count the course for either the B.S. or the M.S.E. degree, but not both.

Q: Calculus II and III were waived, but do not appear on my transcript. Can I use these courses to fulfill the Mathematics and Mathematical Science requirements?

A: If a course is waived, but does not appear on your transcript, it cannot be used to fulfill courses requirements. The only advantage of a course being waived is that you may be able to take more advanced courses.

Q: Is there a particular computer I should have to complete my ECE work?

A: 8GB RAM minimum, 16GB RAM preferable; Intel i5 or AMD Ryzen3 minimum, Intel i7 or AMD Ryzen 5 preferable; 256Gb SSD minimum, 512 GB SSD preferable; 13.3 inch minimum, 14-15 inch preferable; Windows 10 Home minimum, Windows 10 Pro 64 preferable or Mac OSX; Chromebooks are not recommended.

Q: Which Gateway Computing class should I register for?

A: EN.520.112 Gateway/Java. Be sure to look for the sections reserved for ECE students.

Q: Is it possible for a freshman to take more than 18 credits a semester in the first semester?

A: No, Academic Advising will not permit you to take more than 18 credits in the first semester.

Q: As an entering freshman with advanced placement in Physics, do I have to take Physics Lab I and Physics Lab II?

A: As of March 10, 2005, students who earned credit for Physics I and/or Physics II through their scores on acceptable exams (Advanced Placement, GCE A-levels, or IB exams) are eligible to have Physics labs 173.111 and/or 173.112 waived. If you have credit for Physics I through one of the exams listed above and you have not already taken 173.111 at JHU, a notation will be added to your transcript "Physics Lab I waived." If you have credit for Physics II through one of the exams listed above and you have not already taken 173.112 at JHU, a notation will be added to your transcript "Physics lab II waived." You may take just the Physics Lab Courses 173.111, 173.112 if you have received AP credit for Physics I and/or Physics II.

Q: If Physics Lab was waived, do I still need (A) one year of a lab in a natural science and/or (B) only 15 credits of (N) courses rather than 16?

A: No, if Physics Lab was waived, you DO NOT need one year of a lab in a natural science, but you still need 16 credits of (N) courses.

Useful Web Sites

https://engineering.jhu.edu/ece/

https://engineering.jhu.edu/undergraduate-studies/

https://engineering.jhu.edu/advising/

https://e-catalogue.jhu.edu/engineering/

https://studentaffairs.jhu.edu/registrar/students/course-schedule/